INCUBATING TECHNOLOGIES 2021

STARTUP READY TECHNOLOGY FROM THE OHIO STATE UNIVERSITY
Leading Innovation, Generating Solutions

The breadth, scope and excellence of our research programs make Ohio State a leading force of innovation and change – locally, nationally and globally. Ohio State is one of only a few universities in the U.S. that, in a single location, houses 15 different colleges, including seven health sciences colleges and a college of agriculture.

At Ohio State we have all of the tools that are needed—the creative minds, the expertise, the experience and the world-class facilities—to discover innovative solutions to complex problems.

Ohio State Startups

University technologies are usually early-stage and require significant additional development and investment prior to generating revenue. To help accelerate these innovations, Ohio State’s Keenan Center for Entrepreneurship brings the robust Ohio State ecosystem together, providing support and resources to grow and foster talent, capital and venture creation at the university across disciplines.

Ohio State’s Incubating Technologies are innovations with high start-up company potential in various stages. These technologies need qualified entrepreneurs to lead them to the market. There are more than 150 technologies in Ohio State’s pipeline that have the potential for a startup company – where they can be further developed to impact lives.

For more information about forming a startup company based on Ohio State technology, visit go.osu.edu/incubatingtech.

Ohio State Innovation Foundation

The Ohio State Innovation Foundation (OSIF) is a not-for-profit Ohio corporation formed in 2013 to hold, manage and facilitate commercialization of the university’s intellectual property.

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Agriculture, Food Science & Nutrition

Black Opal | T2018-119
Technology Lead: Ahmed Yousef
College of Food, Agricultural and Environmental Sciences

A typical fermentor or bioreactor is designed to run batch processes, with the resulting product information gathered only at the end of the process run. In such a system, many intermediate metabolites or reaction products are not detected and/or are difficult to monitor or control in real-time. To address these problems, Dr. Ahmed Yousef and Research Engineer David Kasler have developed a bioreactor that automates and controls lengthy fermentation runs, while also monitoring and capturing valuable metabolic intermediates. For example, the system allows for monitoring and separation of novel antimicrobial agents produced during a short stage of the growth cycle of the producing microorganism before it is destroyed at the later stages of growth. Similarly, the system is capable of monitoring and measuring other short-lived rare biological and metabolic events. Use of this technology is expected to help the researchers discover new biological phenomenon for many potential applications.

Coloroxi | T2008-012, T2012-228
Technology Lead: Monica Giusti
College of Food, Agricultural and Environmental Sciences

Anthocyanins are natural compounds that give most fruits and vegetables their orange, red, blue and purple colors. These pigments are powerful antioxidants, believed to play an important role in the health-enhancing properties of produce—including the prevention of cancer and other diseases. Despite their wide availability in nature, anthocyanins are difficult and expensive to isolate into pure forms and any remaining impurities are likely to interfere with downstream applications, such as commercial food applications. Coloroxi is a novel technique to fractionate highly purified anthocyanin mixtures at low costs and high efficiency.

CropSpy | T2017-325
Technology Lead: Scott Shearer
College of Food, Agricultural and Environmental Sciences

The agricultural industry is rapidly adopting the use of unmanned aerial systems (UAS) to generate high-resolution crop health data over large areas. UAS generate this data by imaging the upper canopy while flying above row crops; however, most crop health problems originate below the upper portion of the canopy. This means that when UAS identify diseased crops, it is often too late to take corrective action. CropSpy is a camera and sampling probe-equipped UAS and image-processing technology that improves crop disease surveillance. The camera and probe are fastened to an arm that extends down from the UAS body, extending the reach of UAS observation to the crop’s lower canopy. Following data collection, CropSpy employs AI-guided image-processing algorithms that accurately identify biotic and abiotic stressors in real time. These processing algorithms are able to quickly diagnose diseases and describe the affected areas. In turn, this facilitates targeted action plans to treat crop malnutrition and disease at unprecedented levels of both speed and precision.
Green Insecticide | T2015-271; T2019-167
Technology Lead: Peter Piermarini
College of Food, Agricultural and Environmental Sciences

Mosquito-borne diseases, including Zika virus, West Nile virus, malaria, encephalitis, dengue and yellow fever, are among the world’s leading causes of illness and death today. Control of mosquito-borne diseases relies on insecticide-based interventions and consumers are actively looking for organic intervention option. Green Insecticide is a novel use of naturally-derived compounds from Madagascan plants that exhibits insecticidal activity on agricultural pests and importantly, mosquitos. This technology is an environmentally safe, non-toxic insecticide that can be employed as a novel tool for combatting mosquitos and other pests. Additional work has begun developing semi-synthetic derivatives of the naturally-derived compounds which show greater efficacy.
Animal Health

AR Pro | T2017-147
Technology Lead: Hua Wang
College of Food, Agricultural and Environmental Sciences

Antibiotic resistance (AR) is a major challenge to human health worldwide. Research efforts have demonstrated AR bacteria even in newborn animals, passed along through gut microbiota of the mother. AR Pro is a series of probiotic strains and derivatives that has been demonstrated to reduce AR in poultry. Being part of the natural microbiota, the probiotic strain has good colonization in the chicken gastrointestinal tract, especially during the early establishment of GI microbiota. AR Pro is expected to have both human and animal applications.

Small Molecules for Control of Bacteria | T2016-058, T2018-157, T2018-162, T2018-175
Technology Lead: Gireesh Rajashekara
College of Food, Agricultural and Environmental Sciences

New therapeutics are needed to overcome the increase in antibiotic- and antimicrobial-resistant strains of bacteria. New treatments for both humans and animals that are efficacious, stable, and scalable for mass production are needed. Dr. Gireesh Rajashekerera and colleagues have identified small molecule compounds for treatment of a variety of common bacteria.

- Twelve Campylobacter-specific small molecules have been identified candidates for combination therapy and provide an effective way to prevent the evolution of drug-resistant strains. These drugs are good candidates for treatment in both humans and livestock.
- Four Salmonella-specific small molecules have been identified. These compounds are effective on biofilm-protected Salmonella and can be fed directly to livestock or incorporated into food packaging. They can be combined with other treatments and exhibit low toxicity.
- Seven small molecules have been identified for effective bactericidal activity against Avian pathogenic Escherichia coli (APEC). They work against both the standard pathogen and pathogens with developed anti-biotic immunity. They can be used in large-scale operations, as they exhibit low toxicity and can be delivered through food or water.

Virus-like Particles for Non-Cultivable Porcine Rotavirus C | T2019-154
Technology Leads: Anastasia Vlasova and Linda Saif
College of Veterinary Medicine

The increasing prevalence of porcine rotavirus C (RVC) infection and disease in neonatal suckling piglets necessitates further research to understand the role of RVC infections in the diarrheal disease complex of neonatal piglets. Currently, few RVC strains have been adapted to grow in cell culture, which raises difficulty in vaccine and immune assay development. Dr. Anastasia Vlasova has developed virus-like particles for non-cultivable porcine RVC strains, which allows for the development of RVC-VLP based antibody ELISA assays to evaluate the immune status of sows and piglets. Currently the RVC-VLPs are being evaluated as vaccine candidate.
100% Solar-Driven AC | T2018-392
Technology Lead: Jordan Clark
College of Engineering

Air conditioning accounts for 5 percent of all energy use in the United States and places a large load on electrical grids during peak times of day. A team of researchers led by Dr. Jordan Clark has developed an air-conditioning technology that can rely entirely on solar energy. By integrating metal-organic frameworks sorbents into polymer membranes and creating a spiral-wound membrane module, the air conditioner is completely driven by solar thermal heating and a few small fans and pumps. This innovation could eliminate non-renewable energy use associated with air conditioning.

AeroFlow | T2018-006; T2019-010
Technology Leads: Kaushik Krishna and Shaurya Prakash
College of Engineering

Tractor-trailers are essential to the United States economy and consume 29 billion gallons of fuel annually – 17 percent of the total U.S. highway fuel consumption. The high fuel consumption by tractor-trailers can be largely attributed to their poor fuel economy (5.8 miles per gallon), which yields higher fuel costs and significant greenhouse gas emissions. Outside of engine losses, aerodynamic losses account for the largest fraction of fuel consumption for tractor-trailers. AeroFlow is an innovative and systematically engineered geometric pattern that can be retrofitted over the planar sidewalls of the tractor-trailer to alter the airflow resulting in reduced aerodynamic drag. Any tractor-trailer utilizing the invention can save 6-12 percent in fuel due to reduction in aerodynamic drag, translating to 780 million gallons of fuel saved annually in the U.S.

CO2Ethanols | T2015-059
Technology Lead: Anne Co
College of Arts and Sciences

Production of ethanol from corn is not energy efficient and requires massive amounts of water for corn cultivation and processing. Therefore, more sustainable and energy efficient methods to manufacture ethanol are needed that use feedstocks that do not compete with food supply. CO2Ethanols is a method to produce alcohol from the direct conversion of carbon dioxide. It utilizes electrochemical processes on a metal catalyst resulting in over 50 percent selectivity for hydrocarbon formation. Carbon dioxide for this process can be scrubbed from the air or various highly concentrated sources, such as waste streams from chemical plants or coal power plants.
FastCharge Battery | T2018-184
Technology Lead: Anne Co
College of Arts and Sciences

Current recharging technologies use lithium ion batteries with graphite anodes that have a tendency to deteriorate due to the lithium electrolyte. FastCharge Battery’s unique structure and composition enables it to charge without the usual associated drawbacks of fast charge on a graphite anode. The anode improves heat dissipation capabilities, maintains graphite’s low voltage capability, and does not observe lithium dendrite growth. By maintaining stable temperatures, the anode retains its structure during fast charge cycles, highlighting a marked improvement over state-of-the-art fast charge graphite anodes.

Floating Aquatic Habitats | T2018-032
Technology Lead: Jake Boswell
College of Engineering

Functional wetlands and floodplains that contribute to robust aquatic ecosystems have largely been replaced by human development, resulting in numerous water bodies that experience high growth of toxic algae during summer months. This affects critical habitat, drinking water resources, recreation, and tourism. Ohio State researchers led by Jacob Boswell have developed a perforated conical vessel made of buoyant concrete for the use of floating aquatic plant species. The concrete mixture allows water to permeate the vessel while remaining afloat and the vessel supports a soil volume sufficient to grow water-loving plants like willow and cypress along with a large range of other edge and emergent wetland species.

LiveLong Battery | T2017-348
Technology Lead: Giorgio Rizzoni
College of Engineering

The fuel economy of Hybrid Electric Vehicles (HEVs) is dependent on the capacity of the on-board energy storage system to store energy. However, energy storage systems typically experience degradation in both storage capacity and internal resistance due to several irreversible degradation processes that occur over the life of the vehicle. Batteries designed to last for the life of a vehicle while still satisfying the energy and power requirements is currently prohibitively expensive. LiveLong Battery resolves the life/power issue by automatically recognizing conditions that could result in accelerated battery aging, and reducing the power output of the battery to minimize damage – in essence systematically optimizing the trade-off between fuel usage and battery life extension as dictated by severity conditions imposed by environmental and operating conditions.
O-Catalyst | T2013-137
Technology Lead: Anne Co
College of Arts and Sciences

Fuel cells offer a cleaner, more efficient alternative to gasoline and other fossil fuels and have the potential to revolutionize the way the nation is powered. Fuel cells operate in a similar fashion to conventional batteries, but fuel cells can be continually supplied with a fresh feed of fuel, much like a conventional internal combustion engine. Fuel cells have the potential to leverage the benefits of both engines and batteries in a single powerful technology. However, high production costs have limited proliferation of fuel cell use. In order to reduce or offset fuel cell production costs, solutions that either increase system efficiency or lower materials costs are required. O-Catalyst is a high surface area catalyst for use in fuel cells and lithium-ion batteries. Lab scale testing demonstrates that O-Catalyst consistently outperforms the Department of Energy targets for fuel cell specifications. In addition, O-Catalyst is easily manufactured through a relatively inexpensive chemical etching process, thus offering cheaper materials without compromising on the performance of the fuel cell.

Poly Drag Reducer | T2018-284
Technology Lead: Andy Maxson
College of Engineering

One of the operational costs in recirculating heating and cooling systems is the cost of pumping. Using a drag reducing solution can significantly lower the pumping costs of such systems. Turbulent drag reducing additives have been introduced in many heating and cooling systems around the world, but they are not yet commonplace due to their negative impact on heat transfer operations. Dr. Andy Maxson and his colleagues have created a mixed surfactant solution that is able to reduce drag in recirculating systems. Additionally, the drag reduction capability can be turned on and off by modifying flow rate, or changing temperature, allowing current heat transfer equipment to be unaffected. Pump energy requirements could be reduced by up to 80 percent.
Engineering & Physical Sciences – Manufacturing & Instrumentation

aBioBot | T2019-063
Technology Lead: Raghu Machiraju
College of Medicine

Biotechnology experiments often require the execution of mundane but exacting actions, such as filling dozens of test tubes with exact quantities of various liquids. aBioBot is a robotic device that automates certain functions of the laboratory workbench, such as drawing liquid from one or more reservoirs, depositing the liquid in one or more wells, discarding a used pipette tip, and adding on a new pipette tip. aBioBot can receive natural language instructions from a user which can be compiled into specific control instructions.

Next-Generation Mass Spectrometer | T2019-008
Technology Lead: Abraham Badu-Tawiah
College of Arts and Sciences

Mass spectrometry is one of the most powerful analytical instruments at a scientist’s disposal, due to its ability to identify unknown compounds, characterize a chemical mixture, and ease of use. Ionization of chemical species is an essential part of the measurement process. But, ionization, and especially ambient ionization, of non-volatile organic compounds is difficult and commonly achieved by conversion into vapor phase by high-energy particles or high electric fields. Another drawback of current mass spectrometry technique is the long time period required for analysis of biological samples and difficulty of analysis of very small samples. Advancements in mass spectrometry technology would greatly advance the capabilities of research in chemistry and biology. Next-Generation Mass Spectrometer technology showcases a new contained mass spectrometry approach that serves as a significant improvement to current techniques. Samples of serum with 1 ng/mL cocaine and samples of raw urine with caffeine concentration of 200 pg/mL can be detected. Additionally, samples on the scale of a few picoliters can be detected and biological samples are able to be analyzed 20 times faster than HPLC MS. This new method analyzes samples at ambient conditions.

Ocel8 | T2018-041; T2018-051; T2019-054; T2019-309
Lead Inventors: Mehmet Tomac, Jim Gregory
College of Engineering

Ocel8 is a phase-synchronized fluidic oscillator array and method. Traditional uses of multiple oscillators create random vortices, diminishing the efficiency of the flow control. Ocel8 uses a shared feedback channel to synchronize a fluidic oscillator pair increasing pressure in a 3D spray design. This passive system can be used in flow control applications such as flow over wings and bluff bodies, cooling applications such as turbine blade cooling, spraying applications, such as dishwashers and showerheads, and many others.
Paper Chip | T2018-060; T2018-366  
Technology Lead: Abraham Badu-Tawiah  
College of Arts and Sciences  

T2018-060: Dried blood spots on paper substrates offer a facile sample collection, storage, and transportation approach for biofluids. However, variable diffusion, volcanic effects, possible analyte instability, and difficulty in recovering sample from paper plague this method, lowering confidence in analyte quantification. Dr. Abraham Badu-Tawiah and his colleagues developed a novel 3-dimensional dried blood spheroids as a versatile new approach for the collection of biofluid samples. Blood spheroids form on hydrophobic paper and prevent interaction between sample and paper substrate, eliminating all chromatographic/volcanic effects. This increases the stability of labile analytes through the formation of protective mold, with lifetime of analyte increased from days to several weeks. On-surface detection of the dried blood spheroids was achieved using paper spray mass spectrometry, resulting in sub-ng/mL limits of detection for all illicit drugs tested. Through manipulation of the surface tension of the spray solvent, differential extraction of benzoylecgonine was achieved, which enabled correct estimation of the surface energy of the hydrophobic paper strips.

T2018-366: A current method in immunoassay often uses magnetic beads to simplify the approach and to ease signal amplification. Traditionally, this technique employs colorimetric detection based on enzymatic reactions which raises stability concerns. There have been some efforts toward analyte quantification using mass spectrometric-based platforms, but lasers are still vital for the ionization process which is not ideal for field analysis. To circumvent these disadvantages, Dr. Abraham Badu-Tawiah and his colleagues developed a thread as:

(i) medium for sample collection, including immuno-extraction of disease biomarker capture, and  
(ii) substrate for ionization of collected analytes for subsequent characterization and detection by mass spectrometry.

It is expected that the porous thread will offer the following advantages:

(i) large surface area for antibody immobilization compared with solid magnetic particles,  
(ii) easy separation of captured biomarkers from complex mixtures without applied magnetic fields, and  
(iii) direct detection and quantification of captured analytes.

Optimized conditions should enable two unique ionization mechanisms: electrospray ionization and atmospheric pressure chemical ionization. This technology creates an analogous user-friendly technique to paper-based platform. With thread as a substrate, a solid-phase extraction cartridge can be easily developed for effective sample collection and detection. With its simple setup, only needing a single thread and glass capillary, thread spray mass spectrometry would be compatible for analysis with a portable mass spectrometer and in clinical settings.
QC-EYE | T2019-051
Technology Lead: Heather Allen
College of Arts and Sciences

QC EYE is a novel solution for addressing the global challenge of keeping the medicine and food supplies safe with a low-cost and simple-to-use tool that analyzes images with a deep learning algorithm to rapidly and reliably identify a chemical or compound. By utilizing machine learning, no library spectra are required. In addition, no technical training will be required. The handheld unit is currently being developed for use with a smartphone camera and interface. The device is based on inelastic scatter imaging via spontaneous Raman processes arising from the unique molecular content of the material being evaluated. A small amount of Rayleigh scattering contributes to the imaging content, adding to the unique signatures. Training of the neural networks is completed for the desired question to be answered. The material can be analyzed directly or through a clear plastic envelope/bag. Testing is showing accuracies better than 95 percent - in some cases, 98 percent - with little training.

Welding Process for Shape Memory Alloys | T2019-121
Technology Lead: Boyd Panton
College of Engineering

Shape memory alloys currently cannot be joined to other alloys using conventional welding processes, limiting their use. Current state-of-the-art methods such as fusion welding for the joining of shape memory alloys in medical devices are limited by configuration options which increase manufacturing time and complexity. Ohio State’s new vaporizing foil actuator joining technology produces defect-free joints that are stronger than the base material and 50 percent stronger than the state-of-the-art fusion welding techniques. This technology provides design flexibility and maintains cyclic SMA properties to base metal values after 100 cycles. This use in surgical tools and medical devices will provide physicians new and greater control for patient care. While the current focus is on the medical industry, solving this problem applies to a wide range of other industries including aerospace, automotive, and electronics where shape memory alloys are prevalent or envisioned.
E-Fibers | T2015-042
Technology Lead: Asimina Kiourti
College of Engineering

Current antennas on e-fibers are not suitable for applications that require high flexibility and are subject to continuous mechanical deformation. E-Fibers is a fabrication process for stretchable and flexible wire antennas with conductive fibers. During this process, the wire antenna is embroidered using e-fibers and embedding into a flexible polymer with a printed geometrical accuracy of 0.3 mm. The resulting e-fiber antenna can endure repetitive deformations and corrosion. Initial tests in truck tires to transmit their history, temperature, pressure, and stress have shown comparable performance to that of their copper foil and copper wire counterparts. Other potential fields of use include: medical devices; defense and security; infrastructure; fitness apparel and accessories; and smart fabrics for home/hospital.

MODAR | T2016-132
Technology Lead: Joel Johnson
College of Engineering

Technology for environmental and ship motion forecasting (ESMF) requires measurement of both the power and velocity of sea waves and is useful for many offshore applications, including naval operations, cargo/personnel transfer, and aircraft landing. Existing state-of-the-art wave motion radar systems used in marine research are unable to measure velocity, while traditional lower-power pulse-Doppler radar systems are prohibitively expensive. MODAR is an innovative coherent-on-receive radar system that adds the ability to measure velocity to low-cost and high-power magnetron radars.
Health & Wellness

Claiming Resilience | T2019-221
Technology Lead: Amy Rettig
Wexner Medical Center

Physicians and other medical professionals often experience burnout due to long hours and strenuous workdays. If this burnout is not addressed, patient care can falter. Amy Rettig has developed a program and method to develop resilience in these at-risk groups to diminish the incidence and impact of burnout. The current program consists of an in-person event with the potential to expand into online forums, social media presence, and mobile apps.

Family HealthLink | T2017-449
Technology Lead: Kevin Sweet
College of Medicine; Wexner Medical Center

Family HealthLink was launched online in 2008 and has been incorporated into patient registration procedures at Ohio State’s James Cancer Hospital and Solove Research Institute since 2012. Following patient consent, data is actively used in treatment decisions as well as in research projects conducted in the Department of Health Genetics at Ohio State. Family HealthLink is the only family history risk assessment web-based interactive tool that evaluates risk for more than 100 common and rare hereditary cancer syndromes and heart diseases. More than 25,000 online users and approximately 4,000 patient-users have provided information through the interactive tool.

ImmerseMe | T2018-367
Technology Lead: Vitalya “Vita” Berezina-Blackburn
College of Arts and Sciences

Learning how to empathize with those diagnosed with cognitive disorders can help the emotional health of all parties. Virtual reality is increasingly used for employment training and therapy to increase empathy in a low-stakes environment. ImmerseMe utilizes a collaborative team of artists to create virtual reality simulations that allow a user to experience challenges of a cognitive disorder, such as a year in the life of a dementia patient. The user reacts to multiple scenarios and interacts with a live person acting as the user’s caregiver. The experience can be projected onto a screen for audience engagement and caregiver training, or it can be completed individually for family and friends.
Rhythm Rehab | T2019-217
Technology Lead: Yune Lee
College of Arts and Sciences

Aphasia is a devastating communication disorder resulting from dysfunctional language systems from acquired brain injuries, such as stroke. Intriguingly, many aphasic patients with difficulty speaking are often able to sing lyrics. Rhythm Rehab is a solution for aphasia treatment based upon a rhythm gaming therapy that is accessible and affordable to the patient community. This rhythmic video game will provide a platform for rhythm therapy regimens to be implemented, as well as a means to track performance moment to moment, allowing an assessment of therapeutic outcomes. This novel aphasia treatment will not only reduce patients’ financial and commuting burdens, but acquired data will also as a basis for future music-based rehabilitation.

Screen U | T2016-131
Technology Lead: John Clapp
College of Social Work

College campuses face a growing problem of alcohol and prescription drug abuse. Available screening options are costly, require several hours-long programs, and do not differentiate between students at-risk and the general population. Targeted programs that are efficient and can be used readily around campus will improve early intervention methods and guide future strategies to tackling this public health problem. Screen U is a prevention and intervention-screening program for colleges to use with their students. This web-based program is quick for students to complete, is cost-effective, and can be utilized multiple times throughout the year. It does not require a physician to administer the test and can be completed by students on their own time. The screening takes 5 minutes and uses an evidence-based screening tool with real-time reporting features to assess a large number of students quickly and effectively.
Healthcare IT

Acne Imager for Telemedicine | T2018-031
Technology Leads: Metin Gurcan and Benjamin Kaffenberger
College of Medicine

Acne and rosacea are skin diseases that affect around 85 percent of individuals. There is no gold standard for evaluation of these skin diseases and their treatment efficacy is generally determined according to a poorly validated counting process by the physician and patient. This process is prone to poor reliability between different observers and can be highly time consuming, making the assessment challenging and inefficient. Researchers at Ohio State have created novel image analysis software for the recognition and stratification of various skin lesion morphologies and redness in skin disease. This software is ideal for monitoring patient progression during dermatological clinical trials where this technology could decrease cost, investigator time, and inter-rater variability between investigators. The novel software uses a series of time-stamped digital photographs captured with plain white light and readily accessible smart phone cameras to automate lesion identification and quantification. The software automatically adjusts for variance in lighting and generates a map of the lesions. Using proprietary algorithms and methodologies, the skin lesions are scored and classified into six different lesion morphologies for an accurate patient assessment. A summative global score is then calculated for each patient’s time-stamped entry to quantify efficacy of clinical treatments.

Balanse | T2016-017
Technology Lead: Ajit Chaudhari
College of Medicine

Chemotherapy-induced peripheral neuropathy (CIPN) is the dose-limiting toxicity for many commonly used classes of anti-cancer agents. Currently, the measurements used to diagnose and evaluate chemotherapy-induced peripheral neuropathy are patient-reported questionnaires and a series of tests that have limited reliability and sensitivity. Ohio State researchers, led by Dr. Chaudhari, have created a standalone application that can be combined with commercially available balance platforms to establish normal and abnormal balance measures for early diagnosis of chemotherapy-induced peripheral neuropathy.

DocUMenter | T2016-007
Technology Lead: Jeffrey Sneddon
College of Medicine

DocUMenter is a system to improve the timeline and accuracy of medical documentation that automates and optimizes manual entry of discrete data. Results from diagnostic tests run by third party centers can be classified by type and entered into patient records. This software application automates the process of documentation management and works alongside electronic health records to ensure accuracy and efficiency of patient health information. The system has been validated and is in use in the Transplant Surgery Unit at Ohio State’s Wexner Medical Center.
MyRx | T2018-332  
Technology Lead: Rajiv Chandawarkar  
College of Medicine

The opioid epidemic has devastated American cities and kills 91 Americans a day. Eighty percent of these addicts start with prescription pain killers. Over the last fifteen years, the number of opioid prescriptions written has quadrupled, with many patients unaware of the possibility of getting addicted. Effective and direct patient-physician communication for postoperative pain control does not exist, and physicians are currently not equipped with adequate tools to help prevent this disaster. MyRx provides information to patients about what medications to take during the acute post-operative phase of recovery and includes information on non-prescription alternatives/adjuncts to manage pain. In addition, it provides the physician the ability to track the efficiency of therapy by tracking patient pain scores, allowing health care providers to better understand the needs of their patients. Though initially focused on pain-management, the app could be expanded for use in various medical settings where physicians would like to track therapeutic outcomes.

Surgical Simulator | T2017-346  
Technology Lead: Greg Wiet  
College of Medicine

This computer-based virtual reality (VR) simulator for temporal bone (ear) surgery provides a means for pre-surgical rehearsal such that operating surgeons can load patient image data and practice the patient specific procedure in VR before operating on the real patient. The advantage of this approach is that an operating surgeon can become familiar with the nuances of the anatomy and pathology for a specific patient prior to performing the actual surgery and make surgical decisions regarding best approach a priori. This should enable the surgeon to operate more efficiently, with greater confidence and less chance of an unexpected variance in the surgical field. Applications include use by less experienced surgeons for routine cases and use by experienced surgeons for more complex procedures with unusual anatomy or pathology.

The APP App | T2018-081  
Technology Leads: Robin Rosselet and Scott Cackler  
Wexner Medical Center

Physician assistants and nurse practitioners are referred to as advanced practice providers (APPs). They are certified health care professionals who provide care and treatment to patients under a doctor’s supervision. Although they are an integral part of many clinics and hospitals, traditional measures of APP productivity are volume-driven. Less focus is placed on complex care goals, and the impact of their care is not accurately represented in these figures. The Advanced Practice Providers Productivity App includes work that volume-based reports fail to measure, such as quality, service, and patient outcomes. The system is operational at Ohio State’s James Cancer Hospital. The technology has broader applications beyond APPs and is useful for measuring impact of any group of medical professionals.
VECTOR | T2019-081
Technology Leads: Amanda Haney and Daniel Vazquez
Wexner Medical Center

With medical errors being characterized as the third leading cause of death in the United States, healthcare providers are in high demand for harmless training scenarios for increasingly complex patients and scenarios. Currently, this market mainly consists of simulation mannequins and two-dimensional simulations. VECTOR is a virtual reality interactive software used for a clinical training environment that can be simulated for increasingly complex medical procedures to help better prepare healthcare providers.
Methacrylate adhesives are structural adhesives that are exceptionally strong and can be used to bond most plastics, metals, and composite materials. Methacrylate adhesives are used in a wide range of dental and medical applications, as well as in industrial applications such as the construction of furniture, automobiles, and boats. However, their two-part curing mechanism initiated by an external stimulus, such as heat, light, or mixing a redox system, has so far limited the feasibility of widespread adoption of use to consumer applications. Minx Adhesive is a new single-component methacrylate/polyurethane hybrid adhesive that eliminates the need for an external stimulus to initiate the curing reaction allowing for widespread adoption of use. Though the use of Accelerator Award funding the inventors have finalized the minimum viable product formulation.
Medical Devices, Diagnostics & Imaging

Cerenetics | T2017-039
Technology Leads: Skyler Cranmer and Zhong-Lin Lu
College of Arts and Sciences

Cerenetics is a platform software technology using structural and functional connectivity networks from brain imaging to provide physicians with the first quantitative, objective, and direct measure of the cognitive and socio-emotional disruption that can result from brain disease or injury. These include autism, Alzheimer’s Disease, depression (MDD), ADHD, anxiety, schizophrenia, brain injury, PTSD, and cardiac arrest. This software system securely uploads existing MRI data to the cloud and returns medical reports to physicians based on automated, scalable analyses. Initial proof of concept was achieved in the laboratory with two datasets, one on healthy individuals performing a variety of tasks and the other comprising a population of schizophrenia patients and healthy controls.

Digital Pathology Portfolio | T2018-153/T2018-122
Technology Lead: Metin Gurcan
College of Medicine

A clinician/researcher group led by Dr. Metin Gurcan has developed a portfolio of digital pathology tools, including:

- Associated with higher tumor stages, lymph node metastasis and decreased disease-free survival, tumor budding has emerged as an important adverse prognostic factor in a multitude of cancer types, including colorectal cancer. The Ohio State team has developed an automated system for identifying tumor buds in a digitized, whole slide image of an H&E stained section of a tumor using a machine learning classifier. The reliability of the automated system was initially demonstrated using cases from the Ohio Colorectal Cancer Prevention Initiative cohort. This system is intended to relieve the current high cost burden and subjectivity of manual analysis.

- The group has also developed a virtual image generator technology for creating realistic, synthetic digital slide images of immunohistochemistry A&E stained tissues with known, fully-controlled ground truth. This tool employs Generative Adversarial Networks in an effort to make the “phantom” output indistinguishable from reality. The phantom digital histopathology tissue sections have background imaging that supports the realism of the sample, correcting a significant shortcoming of other approaches. These in silico standards enable testing of the ability of clinicians, research pathologists, and trainees to analyze IHC slides in a systematic, consistent manner.
Field-of-View Loss Monitor | T2017-125
Technology Lead: Teng Leng Ooi
College of Optometry

This field-of-view loss monitor can be used by a patient or healthcare practitioner to assess visual field defects quickly and accurately at home or in clinic. The monitoring system is quick and easy to use, without expensive instrumentation, enabling self-monitoring of disease progression. The testing kit consists of a software program that can be readily downloaded to a laptop, tablet or other mobile device along with inexpensive eyewear providing either colorized or polarizing lenses for each eye. The system concurrently presents dissimilar visual scenes to each eye and areas of visual field loss or defects are immediately recognizable on the display. Proof of concept for this technology in human subjects has been achieved.

Health Mat | T2018-274
Technology Lead: Asimina Kiourti
College of Engineering, College of Nursing

Currently, anthropometric and biological measurements in the healthcare setting are made with individual devices that require both specialized equipment and time on the part of the patient and healthcare provider. Ohio State researchers have developed an antenna-impregnated fabric that can monitor anatomical measurements, such as height, weight, heart rate, respiratory rate, sleep quality, and other biofeedback measures. This technology has application in monitoring pets, children, and patients in sustained recumbent positions.

Junctional Tourniquet | T2018-372
Technology Leads: Tanya Nocera, James McElroy and Nadi Graham
College of Medicine, College of Engineering

Tourniquets are most frequently applied to the extremities but are difficult to apply to wounds on the torso. The junctional tourniquet uses a ratcheting lock to keep pressure on wounds of the torso, such as the shoulder and groin regions. Hemostasis can be achieved while the patient is still in the field. The novel design of this tourniquet allows direct pressure to be transferred to the wound and remain in place during transit.
Malaria Detection Portfolio | T2019-076; T2019-267; T2016-068
Technology Lead: Vishwanath Subramaniam
College of Engineering

Malaria, caused by a parasite, is one of the most lethal infectious diseases in tropical regions. Treatment options exist, but current diagnostic methods are limited by various factors, including poor sensitivity and lack of quantitative results, as well as the need for a highly trained practitioner in the field. Yet, detection of malaria in the early stages is important to mitigating its effects. The blood sample drawn to test for malaria is typically sent to a laboratory for analysis, creating delays in diagnosis and, particularly in developing countries, treatment. The MalFind device is able to detect malaria in a blood sample in minutes at the point of care—dramatically improving the diagnosis for patients and expanding their treatment options. In addition, Ohio State faculty have developed a time-domain reflectometer (TDR) for malaria detection which capitalizes on the properties of remnant food vacuoles with respect to the malaria parasite. The remnant food vacuoles show an impedance discontinuity in solution. The TDR for malaria detection detects the malaria parasite via impedance discontinuity.

Percutaneous Pericardial Shunt | T2017-434
Technology Lead: Scott Lilly, M.D.
College of Medicine

A pericardiocentesis is the percutaneous removal of fluid from the pericardial space. It is performed when excessive fluid accumulates due to various co-morbidities. After the fluid is removed in a proportion of patients, it re-accumulates, necessitating an additional pericardiocentesis. In these situations, patients are often referred for surgery for a "pericardial window." A pericardial window is a procedure in which the pericardial sac is incised and a "window" is created by suturing flaps of pericardium open. This creates a continuous connection between the pericardial space and the mediastinum and prevents fluid re-accumulation. This invention comprises a permanent, percutaneous pericardial window device. It can be deployed at the time of pericardiocentesis, obviating the need for a subsequent surgical pericardial window. This is valuable in that many of the patients with recurrent effusions are poor surgical candidates.

Perforator Vessel Imager | T2016-098
Technology Leads: Michael Knopp, Xiangyu Yang
College of Medicine

Successful perforator flap surgery often requires pre-operative imaging of the vasculature in order to optimize the choice of perforator vessel, ensuring sufficient blood flow to the flap tissue. This innovative perforator angiography technique fuses phase contrast angiography images with an anatomic MRI data set to create a high-resolution, flow-sensitive, pre-operative perforator imaging tool without exposing patients to ionizing radiation or any exogenous contrast media. The developed technique is a safe, robust, and effective perforator imaging methodology that provides an alternative to computed tomography angiography (CTA) for pre-operative imaging of deep inferior epigastric perforators for plastic and reconstructive surgery.
Pathologists and pathologist assistants rely on visual and tactile cues to identify and locate tumors and lymph nodes in resected tissue specimens. This “grossing” of a tissue specimen can be time consuming and a standard 2D image of a large specimen does not accurately reflect the number of tumors, their orientation, or their relationship to the nearest surgical margin of resection. The Smart Surgical Eyewear technology provides a real-time, 3D view of the tumor(s) being targeted, enabling accurate identification and precise sampling of the tissue, including evaluation of the surgical margin of resection. One embodiment of the system comprises a stereo electro-optical camera pair, an imaging device such as a gamma camera, a pathology locator wand and a wearable Google glass (or other) augmented reality generator.
Tissue Stiffness Measurement (Elastography) Portfolio  
T2012-069; T2013-386; T2014-262; T2016-059; T2018-307  
Technology Lead: Arunark Kolipaka  
College of Engineering  

Magnetic resonance elastography (MRE) combines MRI imaging with sound waves, creating a visual map showing and quantitating the stiffness of body tissue. The numerous advantages of MRE include the ability to assess the entire organ, unlike the limited number of points of a biopsy. Because of its accuracy, MRE has become the preferred modality over ultrasound for assessing liver stiffness/fibrosis. The growing clinical interest in MRE has created a demand for improvements in sound wave generation, more accurate data analysis techniques, and technologies to expand the use of MRE to other organs. Ohio State researchers, led by Arun Kolipaka have developed a series of inventions for creating more robust MRE 3D stiffness maps and enabling translation of MRE procedures beyond liver to smaller target organs including spleen, heart, aorta, pancreas, and kidneys. Other advances in the field include combining MRE stiffness estimation with current MRI blood flow measurement techniques for more accurate diagnosis and treatment planning of aneurysms, such as an abdominal aortic aneurysm. The invention allows this assessment to be done, for the first time, in a single MRI session. The invention portfolio includes processing algorithms enabling elastography on CT systems, which to date has been considered a technical impossibility.

Veno-Sure  
T2018-380  
Technology Leads: Emile Daoud and John Hummel  
College of Medicine  

Multiple medical procedures access the vascular system by using veno-puncture to place sheaths in the venous system, with some common procedures requiring multiple sheaths. Current clinical challenges include delays in achieving hemostasis quickly after sheath removal resulting in a lengthy recovery period, as well as material being deployed in the vein that can result in significant complications. The device of this invention, Veno-Sure, uses subcutaneous suture coupled with mechanical focal pressure to achieve hemostasis. In contrast to other vein closure products that use suture, this product will only deploy suture in the subcutaneous tissue (not through the vein) and will not require manual pressure, but rather focal pressure will be achieved by the device. The novelty of this product is the hybrid approach of subcutaneous suture with focal external pressure for hemostasis without the use of ancillary nursing staff. Another important aspect of this design is that the expected cost will be quite low, which is critical for a high-volume disposable of this type.

Versatile Cancer-Targeting Peptides  
T2015-068  
Technology Lead: Mike Tweedle  
College of Medicine  

Oncologic surgeons use images (PET, MRI, etc.) to plan surgery but have only vision and touch to guide resections intraoperatively. After surgery, oncologists deliver billions of dollars’ worth of chemotherapeutics that are effective, but cause dose-limiting side effects in a quarter of the patients. The peptide of this invention, HN17, is designed to solve both of these problems. HN17 is a hybrid of small molecule and cell penetrating peptide (CPP) technologies in preclinical development stage. It facilitates entry of exogenous chemotherapeutic agents into living cells’ cytoplasm. HN17 works synergistically without chemical conjugation of the exogenous agent, and also as a chemical conjugate with fluorescent dyes for optical surgical navigation applications, where it is brightly visible in real time.
Semiconductors, Sensors & Controls

High Efficiency LEDs | T2018-128
Technology Lead: Hongping Zhao
College of Engineering

This invention is a novel material-based LED semiconductor designed to increase the external small plug efficiency of red, green, and amber LEDs. ZnSnN2 belongs to II-IV-N2 group materials, which is an expanded nitride material system that has not been well studied. In this invention, the novel design is of InGaN/ZnSnN2 heterostructures for high efficiency light emitters application. The unique advantages from this design are summarized as following: 1) a large valence band offset between InGaN and ZnSnN2, which allows a strong hole confinement; 2) a small conduction band offset between InGaN and ZnSnN2, which allows the electron wavefunction spread in the conduction band; 3) the combination of 1 and 2 results in a significantly enhanced electron-hole wavefunction overlap; 4) closely lattice-matching between ZnSnN2 and InGaN with In-content close to 25-35 percent; 5) lower In-content InGaN is needed in the novel QW design as compared to that of the conventional InGaN QW targeting the same emission wavelength.

Nanodize | T2016-130
Technology Lead: Roberto Myers
College of Engineering

Nanodize allows the production of nanowire devices on a planar surface at a relatively lower cost, opening up a variety of applications for nanowire devices that were not before economically feasible. Nanowires can accommodate large physical strains, which are otherwise impossible in conventional planar films. However, nanowire devices are primarily grown on expensive single crystalline substrates so there is a need to develop nanowires and related materials on low-cost, scalable metal substrates. Ohio State researchers led by Dr. Roberto Myers have developed a method that utilizes molecular beam epitaxy (MBE) to deposit epitaxial semiconductor nanowire heterostructures directly on metal foil. Nanowire heterostructures form by selecting the appropriate III/V flux ratio, substrate temperature, and shutter protocol to realize the desired composition variation and grow in regular arrays along the metal foil surface. The method could be applied to other families of semiconductors.
EasyOrder | T2018-369
Technology Lead: David Ogle
College of Engineering

EasyOrder is a purchasing platform for commercial users that order from multiple vendors. The current process of online purchase tracking requires multiple emails to the customer who must visit multiple websites – creating a cumbersome and time-consuming tracking process. EasyOrder technology enhances the process of tracking ordering and shipping information by compiling information and emails from multiple online orders into a single ledger dynamic updates on shipping status from the third-party shipper’s tracking information. The ledger can also be shared with the vendor so they can update information on their associated order, eliminating the need for email updates.

GeoGames | T2017-002
Technology Lead: Karl “Ola” Ahlqvist
College of Arts and Sciences

GeoGames is a web-based, multiplayer platform that combines satellite images, geographic information and gameplay to provide real-world simulations that give users a micro-experience of any place in the world. The fundamental innovation of the GeoGames platform is the ability to provide a modifiable, interactive game board that integrates a full range of GIS supported map and processing services with online multiplayer gaming affordances into an online map game/simulation environment. Web implementation makes the game easily disseminated and helps to maintain and update the game on a continual basis.

ICARUS | T2017-331
Technology Lead: Arnab Nandi
College of Engineering

Manual data cleaning and validation is time-consuming and tedious when performed manually. These tasks also scale up with the size of the dataset. ICARUS solves these issues by working with a user to create a system of rules to automate the data validation process and reveal potentially problematic data. After the user makes a change, ICARUS proposes a rule for the user to approve, which is then applied to the entire data and can be stored for future use by other users. This software will lead to less time being spent on preparing data and less time analyzing, freeing up resources for higher needs.
Machine-Learning Algorithm for Improved Speech Intelligibility in Noise
T2018-008
Technology Lead: Eric Healy
College of Arts and Sciences

A primary complaint of hearing-impaired listeners is poor speech recognition in background noise. Despite considerable effort, monaural (single-microphone) algorithms capable of increasing the intelligibility of speech in noise have remained elusive. Ohio State researchers led by Dr. Eric Healy have developed a novel form of time-frequency (T-F) masking that combines the computational simplicity of the Ideal Binary Mask (IBM) with the superior sound quality of the Ideal Ratio Mask (IRM). The result is intelligibility results equal to or superior to the IRM at computational loads only marginally larger than the IBM. The algorithm is trained using techniques of deep learning to analyze and classify T-F units. Once trained, the algorithm estimates the Ideal Quantized Mask (IQM) for the speech-plus-noise mixture. Importantly, the algorithm can be trained using any input signal, meaning it can be used to identify any desired marker in a noisy signal, making the IQM valuable for a wide range of applications, including voice communication, speech recognition, and noise cancellation.

NavigAR | T2017-151
Technology Leads: Matthew McCrink and Jim Gregory
College of Engineering

Loss-of-control incidents are the primary contributor to fatal general aviation (GA) accidents. The availability of low-cost in-flight augmented reality devices for GA pilots provides an opportunity to develop a system using the lessons learned from the military in a cost-effective package designed for wide adoption by the GA fleet. NavigAR utilizes augmented reality to aid pilots in identifying and preventing loss of control incidents. It builds on inertial navigation systems designed for unmanned aerial systems and improves situational awareness for the pilot. NavigAR can be integrated into existing avionics systems.

PointPrognostics | T2019-029
Technology Lead: Mrinal Kumar
College of Engineering

Particle (or Monte Carlo) methods are a class of computational algorithms used to estimate potential outcomes of a system or process. Although popular for their simplicity and scalability, the use of fixed sized "particle ensembles" renders the simulations unable to provide performance guarantees in quantifying system uncertainty. Thus, there is no way of knowing the degree of accuracy of the generated forecast. PointPrognostics provides system forecasts with guaranteed performance, while also providing the flexibility of using the smallest possible ensemble to achieve the user's desired accuracy. It delivers system forecasts with a guaranteed estimation accuracy of quantities of interest over the entire duration of the forecast, thereby enabling more robust decision-making and system prognostics. Some applications for this technology include performance and failure analysis of systems, prognostics and reliability assessment, decision making support and predictive maintenance analysis and scheduling. A report by IOT Analytics evaluated the predictive maintenance (PdM) market at $1.5-billion in 2016 and anticipated a growth of 39 percent annually to $10.96-billion by 2022.
Skillset Solver | T2016-278
Technology Lead: Gretchen Goffe
Fisher College of Business

Skillset Solver is a means for employers to optimize the continuing education experience of their workforce. Conferences and degree programs are the most frequent means of enriching an employee's skillset. Yet, often, these activities simply make the employee more "marketable" to another employer, while not providing the targeted skill-based learning required of the employer. SkillSet Solver matches targeted coursework and training to the requisite skillset of specific positions, amplifying the benefit of the employer’s continuing education budget.
**Therapeutics, Drug Delivery & Biotechnology**

**Adipose-Targeting AAV Vectors | T2017-118**  
Technology Leads: Lei Cao and Wei Huang  
College of Medicine

Recombinant adeno-associated viruses (rAAVs) are effective tools for delivering gene therapy treatment and for manipulation of acquired diseases. Unfortunately, there is no effective method to target adipose tissue and transduction efficiency is low in naturally occurring AAV serotypes. In addition, current methods of gene therapy can result in off-target transgene expression. Ohio State researchers have developed a unique approach using novel rAAV expression plasmids to efficiently deliver genes to adipose tissue while restricting off-target expression in the liver, which is known to sequester a large fraction of injected viral particles. This technology provides a vehicle to genetically manipulate adipose for research purposes, as well as treating genetic and acquired diseases, such as obesity, metabolic syndromes, and cancer.

**BactoBan | T2017-308**  
Technology Lead: Mark Mitton-Fry  
College of Pharmacy

Bacterial infections such as sexually transmitted diseases, meningitis, pneumonia, tuberculosis, and tetanus are some of the most common infectious diseases. However, there are few drugs that can be used against all of these diseases, and several bacteria have developed resistance to many commercial antibiotics. New drugs that can fight against multiple bacterial infections are drastically needed to improve treatment capabilities globally. Ohio State researchers led by Dr. Mark Mitton-Fry have developed novel bacterial type II topoisomerase inhibitors for treatment of bacterial infections. These inhibitors incorporate a novel linker that has reduced lipophilicity and reduced amine basicity. This novel linker could be easier to synthesize and create beneficial solubility/pharmacokinetic properties and enhanced safety. Examples of bacterial infections these inhibitors could treat are those cause by S. aureus, S. pyogenes, S. pneumonia, P. aeruginosa, E. coli, N. gonorrhoeae, and Myc. tuberculosis; it could also be used against parasites, including the malarial organism, Plasmodium falciparum.
Chagas Vaccine | T2019-096
Technology Lead: Bradford McGwire
College of Medicine

Trypanosoma cruzi is a protozoan parasite that causes Chagas disease, a PRV-eligible disease that is the leading cause of heart failure in Latin America. Chagas disease is also a growing public health concern in the USA and other destinations. No vaccine is available for Chagas disease, and current treatments are only successful if therapy begins soon after infection. These drugs alleviate symptoms of disease, but are less effective during the chronic phase, require a longer course of treatment, and have side effects associated with long-term use. A strain of T. cruzi containing a double knock-out mutation at the gene that encodes the enzyme has been developed. This strain fails to cause disease when introduced to a mouse model, but results in the accumulation of anti-T. cruzi antibodies. These antibodies provide immunity when hosts are re-inoculated weeks later with the wild-type strain. In a study between control and immunized mice, only immunized mice were alive and showed no signs of disease at 4 weeks. This indication qualifies as an orphan indication and Chagas interventions are eligible for FDA priority review voucher program.

Doganzomib | T2016-115
Technology Lead: Ozlem Dogan Ekici
College of Arts and Sciences

The FDA-approved multiple myeloma therapeutic drugs are associated with dose-limiting side effects, including peripheral neuropathy, inflammatory toxicity in lungs and muscles, and adverse cardiovascular effects. This is largely due to the non-selective binding to off-target biomolecules and mechanism of action. Doganzomib is a novel proteasome inhibitor made up of a novel class of aldehydes and ketones that utilizes a strategic approach to proteasome inhibition to increase potency and target selectivity. Doganzomib is in the lead optimization stage of the drug discovery process and has the potential to become the next generation anticancer drug to treat multiple myeloma patients.

DRV Vaccine for RSV | T2011-146
Technology Lead: Jianrong Li
College of Veterinary Medicine

Among the paramyxoviruses, human metapneumovirus (hMPV), human respiratory syncytial virus (hRSV), and human parainfluenza virus type 3 (hPIV3) account for more than 70 percent of acute viral respiratory diseases. Despite the enormous economic losses and emotional burdens these viruses cause, vaccines and anti-viral drugs are currently not available. Dr. Jianrong Li and colleagues have developed methyltransferase (MTase) defective recombinant viruses as live vaccine candidates for hMPV, RSV, and hPIV3. This technology has currently been attenuated in cell cultures and mice while maintaining excellent immunogenicity.
EAAT2 Activators for Alzheimer's and Other Neuro Disease Therapies | T2018-353; 2018-064; T2018-063
Technology Leads: Chien-Liang “Glenn” Lin and Kevin Hodgetts
College of Medicine

Glutamate is a major neurotransmitter in the mammalian central nervous system and essential for normal brain function including cognition, memory, and learning. However, the extracellular concentration of glutamate must remain below excitotoxic levels (~1 μM) to avoid overstimulation of glutamate receptors, leading to neuronal damage or death. Excitotoxicity has been associated with multiple acute neurological conditions such as ischemic stroke, epilepsy, trauma, chronic adult-onset neurodegenerative disorders such as Alzheimer’s disease and amyotrophic lateral sclerosis (ALS), and depression. One potential approach to preventing excitotoxicity is to enhance glutamate reuptake. EAAT2 is the major glutamate transporter and functions to remove glutamate from synapses. An increase in EAAT2 protein expression and function can provide a means to prevent insufficient glutamate reuptake and consequently reduce neuronal damage. Drs. Chien-Liang (Glenn) Lin and Kevin Hodgetts have developed a series of compounds that increase EAAT2 protein expression and their lead compound, LH-2, shows great promise as an Alzheimer’s therapeutic. In vivo mouse data demonstrates that treatment with LH-2 results in increased EAAT2 expression in the brains of wild type mice. Administering a daily dose LH-2 at a 10mg/kg to a neurodegenerative mouse model, Tau mouse, resulted in a statistically significant restoration in cognitive function. In vivo PK and bioavailability data has been generated in dog, rat, mouse and monkey. The inventors recently received tranche funding from the Alzheimer’s Drug Discovery Foundation. The first tranche will support the project through IND submission while the second tranche will support development through a first in man Phase I study.

EGFL7 | T2017-126
Technology Leads: Adrienne Dorrance, Ramiro Garzon and Changxian Shen
College of Medicine

Epithelial Growth Factor-Like 7 (EGFL7) is a secreted protein that plays an important role in angiogenesis, survival, migration, and differentiation of endothelial cells. Aberrant expression of EGFL7 has been indicated in tumor growth and progression for solid tumors, but Ohio State researchers have also discovered a novel role of EGFL7 in the leukemic microenvironment. Data demonstrates that targeting primary AML blasts with an anti-EGFL7 antibody (Parsatuzumab) leads to decreased blast cell growth and increases in NOTCH target gene expression. It was also shown that Parsatuzumab synergizes with the FLT3 inhibitor (Gilteritinib) in primary AML cell lines from patients. Remarkably, treatment of healthy mice with the highest reportable dose of Parsatuzumab did not display any significant hematopoietic defects, which is consistent with in vitro data showing no effect in CB CD34+ cells treated with Parsatuzumab. There have not been any reports of significant hematopoietic side effects in patients with solid tumors treated with Parsatuzumab in combination with chemotherapy. Thus, the data indicate that Parsatuzumab exhibits anti-leukemic effects without affecting normal hematopoiesis.
**Listeriosis Vaccine | T2019-384**
Technology Lead: Stephanie Seveau  
College of Medicine

Although the average number of cases is moderate in the United States (1600-2500/year), listeriosis infection is a significant health concern due to its exceptionally high fatality rate. Listeriosis is the 3rd deadliest foodborne illness and costs $2.8 billion/year. The infection leads to more than 90 percent hospitalization rate, often involving intensive care. The risk and severity of the disease are significantly increased among the elderly (about 80 percent of cases) and pregnant women and their newborns (about 20 percent of cases). Clinical manifestations include septicemia, meningoencephalitis, miscarriage, stillbirth, and severe infection of neonates with a fatality rate of 16-25 percent and 13 percent long-term neurologic deficits, despite treatment. Researchers at Ohio State, led by Dr. Stephanie Seveau, have developed an experimental listeriosis vaccine. The technology strategically implements a safer approach to listeriosis vaccination by utilizing a subunit vaccine, rather than a live-attenuated vaccine. The vaccine comprises a novel, non-toxic listeriolysin O polypeptide (LLOT) and an experimental adjuvant cholera toxin (CT). The adjuvant β subunit of CT is approved for human use in the US. When tested in vivo, the vaccine was efficient in protecting mice against L. monocytogenes infection. Because all virulent Listeria strains produce listeriolysin O, the vaccine is expected to be protective of all Listeria strains.

**Multi-Functional Cancer Drug Delivery Nanodevice for Precision Medicine | T2018-305**
Technology Leads: Carlos Castro, John Byrd, Christopher Lucas and Patrick Halley  
College of Engineering

This novel therapeutic approach leverages structural nanotechnology to create a DNA nanostructure that acts as a customizable delivery vehicle for therapeutic molecules. The technology allows for a highly tunable and customizable multi-functional drug delivery platform that incorporates interchangeable:

i) small molecule therapeutics  
ii) therapeutic oligonucleotides, and  
iii) targeting moieties on a single DNA-based nanostructure to specifically target and destroy tumor cells, while leaving healthy tissue unharmed.

The folded DNA nanoparticle was shown to deliver clinically relevant dosages of daunorubicin in a human Acute Myeloid Leukemia multi-drug resistant cell line and refined drug release profiles. Combined with its fast self-assembly and stability in physiological conditions, this DNA nanostructure could be implemented to deliver a wide range of therapeutic agents and/or nucleic acids in a targetable manner.
**Multiple Sclerosis Treatment** (small molecule IL-6/STAT3 inhibitors) | T2018-057  
Technology Leads: Chenglong Li, Yuhong Yang and Michael Racke  
College of Medicine

Multiple Sclerosis (MS) is an unpredictable and disabling autoimmune disease affecting the central nervous system and the leading cause of non-traumatic neurological disability in young adults. There have been important advances in MS therapy, including drugs that slow the disease progression and reduce attacks, but current treatments are only partially effective. MS has an array of symptoms and unique characteristics that make traditional drug therapy difficult. New and innovative therapies that target a common element to multiple pathways of MS pathogenesis would provide a significant improvement over current strategies that target a single pathway. One potential pathway of interest is IL-6/STAT3, as dysregulation of IL-6 signaling plays a significant role in the pathogenesis of MS and other autoimmune diseases. Ohio State researchers led by Drs. Chenglong Li and Yuhong Yang have developed small-molecule prodrugs that target the IL-6/STAT3 pathway, which is common to multiple pathogenic pathways in MS. They have developed several inhibitor analogs and have shown that these analogs suppress production of inflammatory cytokines in vitro and in vivo. The compounds have been shown to suppress pSTAT3 expression and IL-17 production in myelin-specific CD4 T cells in a dose-dependent manner. When tested in vivo, the analogs were able to suppress disease development in a chronic EAE model of MS in vivo.

**Nanomaterials for Therapeutic Applications**  
Technology Lead: Yizhou Dong  
College of Pharmacy

Messenger RNA (mRNA)-based therapeutics have been evaluated as a potential therapeutic avenue, however, the efficient delivery of mRNA remains a key challenge in mRNA-based therapy due to the instability and insufficient translatability of mRNA. Dr. Yizhou Dong has created an extensive library of encapsulated anti-cancer drugs using his nanomaterials for therapeutic applications. In pre-clinical models, Dr. Dong and colleagues have shown that several of these compounds provide high delivery efficiency of mRNA to target cells. The creation of this extensive lipid-based nanoparticle library has the potential to greatly improve mRNA-based therapeutic applications.

**Nerve and Sarcopenia SMN Treatment** | T2015-163  
College of Medicine

Sarcopenia is the loss of muscle strength that accompanies aging. Researchers led by Drs. Burghes and Arnold have developed minimally invasive in vivo techniques for treatment of nerve injury and sarcopenia that utilize survival motor neuron (SMN) proteins. In brief, nerve damage is identified in the patient and a SMN protein-increasing substance is administered, reducing nerve damage and improving functional strength for the patient.
**NerveGas Neutralizer | T2016-115**

Technology Lead: Christopher Hadad  
College of Arts and Sciences

Organophosphorus (OP) poisons including sarin, VX, and novichoks are lethal agents of chemical warfare. Their toxicity is due to their direct inhibition of acetylcholinesterase (AChE), an enzyme that is vital to the nervous system via regulation of the neurotransmitter acetylcholine (ACh). AChE inhibition by OPs leads to death from respiratory failure due to overstimulation of ACh receptors at neuromuscular junctions. Current treatments to OP exposure rely on oxime-based therapeutics, which cleave the OP molecule from AChE. However, oxime therapy is only successful if treatment occurs within a brief and limited time frame following exposure to the toxin. Ohio State researchers led by Dr. Christopher Hadad have developed a family of novel pyridine- and pyridinium-based compounds that indefinitely extend the window for therapeutic intervention following OP exposure.

**Norovirus Vaccine | T2011-065**

Technology Lead: Jianrong Li  
College of Veterinary Medicine

Human norovirus (HuNoV) is a major causative agent of foodborne gastroenteritis worldwide. It is estimated that more than 90 percent of outbreaks of acute nonbacterial gastroenteritis are caused by noroviruses. Healthcare facilities, including nursing homes and hospitals, are the most commonly reported place for HuNoV outbreaks in the United States and other industrialized countries. For these reasons, HuNoV is classified as a NIAID Category B priority biodefense pathogen. Each year in the U.S., HuNoV causes about 21 million illnesses and contributes to about 70,000 hospitalizations and 800 deaths (CDC). There is only one known clinical-stage norovirus vaccine under investigation at the present time. Ohio State researchers led by Dr. Jianrong Li have developed a novel vectored vaccine for human norovirus. Development of an attenuated vaccine for HuNoV has not been possible previously due to an inability to replicate the virus in a cell culture. A vectored vaccine is able to overcome this obstacle. The vectored human norovirus vaccine is able to produce virus-like particles (VLPs) that are morphologically and antigenically identical to native virions and triggered significantly higher immune responses compared to traditional non-replicating VLPs based vaccine candidates.

**Ocular Drug Delivery | T2019-061**

Technology Lead: Pengfei Jiang  
College of Engineering

According to the National Institutes of Health National Eye Institute, age-related macular degeneration (AMD) is the leading cause of vision loss in the United States. It requires monthly injections to manage its effects and prevent permanent blindness. Receiving recurrent injections can potentially cause additional problems, such as infections of the eye and retinal detachment. Current procedures require frequent visits and increased medical costs. The expense and severity of retinal diseases make it challenging for patients to receive treatment at an affordable rate. The invention is a biodegradable device that prolongs drug release to the eye via intravitreal injection with a 22-gauge needle. There are multiple layers for the device; an inner layer that controls the diffusion of the drug [anti-VEGF (vascular endothelium growth factor)] and an outer layer that slows down the release of the drug during device biodegradation. The drug can be contained, and bioactivity is maintained for at least six months after injection, much longer than the monthly control of current procedures.
Peptide-based Cancer Imaging and Therapeutic Agents  | T2015-068 and T2020-071
Technology Lead: Mike Tweedle
College of Medicine

Oncologic surgeons use PET/CT and MRI to plan surgery but have only their vision and touch to guide them in real time, resulting in missed tumors and frequent recurrence of cancer. Oncologists then treat half of all cancer patients with a platinum chemotherapy, one characterized by dose-limiting side effects in 25% of patients. Novel pharmaceuticals developed by Prof. Mike Tweedle and his research team, HN17 peptides, transiently permeabilize tumor cell membranes and offer a potential solution to both problems. HN17-based compounds can produce real time intraoperative tumor images allowing surgeons to clear margins more accurately. In addition, other HN17-based compounds potentiate platinum chemotherapy, lowering the dose required, while avoiding platinum off-target organs.

HN17 offers additional advantages for commercial development: 1) It can potentially target any tumor. 2) As a peptide small molecule, it does not have the high protein-related development costs of antibody approaches. 3) It has the rapid development speed, approximately five years, that accrues to small molecule imaging agents. A relevant credential of Prof. Tweedle and his research group is Tweedle’s work in the pharma industry prior to joining OSU. He invented and developed the gadolinium-based MRI contrast agent Prohance that has been used in over 50 million patients.

Regional Organ Assessment and Repair Centers  | T2020-036, T2020-037, T2020-038, T2020-039
Technology Leads: Sylvester Black, Bryan Whitson and Brenda Cuson
College of Medicine

Solid organ transplantation is one of the most impactful medical therapies available to patients with critical illness and end-organ failure. Measuring >90% at one year, survival rates for organ transplantation are exceptional. However, the success of organ transplantation has created a supply and demand problem as the number of waitlisted patients far outstrips the suitable donor organ supply. While 112,683 patients were on the UNOS organ waiting list as of February 1, 2020, likely only ~1/3 of these patients will receive a transplant this year. In CY2019, only 39,720 solid organ transplants were performed with 19,251 donors. This low rate of organ recovery is due, in part, to the aging donor population whose donor organs, because of chronic diseases, are often deemed marginal, i.e., organs that tend to function less well and tolerate the transplant process poorly. These potentially transplantable organs confer substantial risk of death to the recipient, and so are often discarded.

Normothermic ex vivo organ perfusion (NEVOP) technology is a platform to assess, repair, and modify donor organs. During NEVOP, an organ is removed from the donor body (ex vivo) and supported with a machine at conditions similar to normal physiology. Because NEVOP allows for the organ to be at normal body temperature, organ function and suitability for transplantation can be evaluated. The current standard of care, cold storage, lowers the metabolic rate to allow for increased preservation times, but does not allow for the assessment of organs nor the opportunity for therapeutic administration, both of which are possible with NEVOP.
rVSV Vaccine for RSV | T2017-299
Technology Lead: Stefan Niewiesk
College of Veterinary Medicine, College of Medicine

Respiratory syncytial virus (RSV) infections are one of the most common causes of infant hospitalization and cause up to 200,000 deaths each year. Currently, several RSV vaccine candidates are under development, but live attenuated and killed vaccines have not been successful. This recombinant vesicular stomatitis virus (rVSV) vector expressing RSV proteins induces protective immunity against RSV and is a more powerful approach that could be used to limit RSV infections.

Synthetic Apratoxins and Novel Analogs | T2018-101
Technology Leads: Craig Forsyth, Matthew Jackel and Xiao Li
College of Arts and Sciences

Apratoxins are potent cytotoxic biosynthetic products that are naturally produced by specific marine microorganisms. When isolated from organisms, the compounds display very potent anti-cancer activities. They have also been implicated in immunosuppressive activity. In their natural form, apratoxins have a narrow therapeutic window, are poorly tolerated in animal studies, and are too toxic for direct use as chemotherapeutics. Additionally, due to a limitation on accessibility, isolation for use on a large scale is not feasible for commercial use. There remains a need for analogs of these natural apratoxins that have improved physiological properties, such as reduced toxicity, while still being useful for targeted treatment of tumors. Ohio State researchers led by Dr. Craig Forsyth have developed laboratory syntheses of natural apratoxins and non-natural apratoxin analogs. Some of these analogs are designed to be used to elucidate cellular binding partners in efforts to determine their anti-cancer mechanisms, and others for the empirical identification of therapeutic candidates with enhanced selectivities for cancerous cells versus non-cancer cells. These synthetic variants could also be used to develop treatments for solid tumors, without a need to extract material from natural sources.

Tissue Factor Targeting Therapeutics | T2017-143
Technology Lead: Zhiwei Hu
College of Medicine

Cell-based immunotherapy utilizing specific chimeric antigen receptor (CAR) expressing T and NK cells have shown promising efficacy for a host of diseases that express tissue factor (TF). Dr. Zhiwei Hu has developed a therapeutic method utilizing genetically modified T and NK cells with a TF binding domain. These cells can be infused into patients to treat diseases such as solid tumors, lymphoma, endometriosis, rheumatoid arthritis, and macular degeneration.
Oncolytic viruses (OVs) have emerged as a promising means of treating cancer due to their potential to selectively target and effectively kill cancer cells. Numerous ongoing OV clinical trials have demonstrated efficacy, and the first ever viral cancer treatment received FDA approval in 2015. The goals of oncolytic virus therapy include both tumor cell death and immune system engagement. The latter of these has only recently become a priority as tumor evasion of the immune system is a limiting factor in treatment. Ohio State researchers have created a novel means of employing oncolytic viruses in conjunction with bacterial toxins to create a widely applicable strategy for cancer cell targeting. The scientists have demonstrated in vitro a strategy for reversible inactivation of bacterial toxins with their subsequent reactivation with the help of oncolytic viruses and the ability to regain activity upon controlled reconstitution within a cancer cell. The team is further validating the approach through conducting in vivo experiments in human xenograft mouse models. This technology expands the range of human cancers susceptible to oncolytic virus therapy while improving upon the specificity of existing approaches and reducing off-target toxicity. Additionally, this proposed strategy will also improve the efficacy of the therapy by combining the oncolytic power of viruses with killing power of bacterial toxins.