Acorn Innovation Fund Report (FY21 and FY22 Cohorts)

The Innovation Commercialization Seed Fund, also known as the Acorn Innovation Fund, is enabled by the Legislature: "shall be used to advance the goals of job growth creation, innovation and economic development which may include, but shall not be limited to, the construction of prototypes, testing, market research and other steps necessary to bring the invention or concept to market in the commonwealth".

The Acorn Innovation Fund supports principal investigators (faculty, graduate students and post-doctoral students) at Massachusetts research institutions (universities and medical centers) who seek to demonstrate the viability of their technology and advance them towards commercial use. Awards can be used to: 1) further develop a prototype, 2) gather additional data to demonstrate proof of concept, or 3) obtain data to compare the technology to existing technologies and show its competitive advantages. Several past Acorn Innovation grant winners have gone on to spinning out startups based on their inventions and have raised outside capital.

Here is the program summary re applications, reviewers and results for the past 5 years. MassVentures ran the Acorn program on behalf of the Massachusetts Technology Transfer Center (MTTC) housed at University of Massachusetts for both the FY21 and FY22 Cohorts during 2021.

Year	Total Applications	UMass Applications	MA Applications	Winners	Proposal Reviewers
FY22*	37	8	29	12	54
FY21*	35	14	21	13	69
FY20	24	12	12	13	23
FY19	53	18	35	14	16
FY18	49	29	20	10	20

*2 wk. application window is the shortest solicitation period versus normal cycles (~4 wks.) for past years.

FY21 Details:

Thirteen grants of $15,000 each were awarded to faculty researchers from Boston University Medical Center, Northeastern University, Brandeis University, the University of Massachusetts and Worcester Polytechnic Institute to assist them in testing the viability of their technologies and potentially bringing their research to market.

Acorn Innovation Fund Report (FY21 and FY22 Cohorts)

Projects selected spanned from medical technologies that help treat breast cancer and kidney disease, to novel moisture sensors to reduce food waste, to technologies and products that benefit the environment, including new methods for detecting PFAS, the "forever chemicals" in water, biolubricants created from yeast, and closed loop processes for recovering metals from Lithium-Ion batteries.

FY21 recipients of the MassVentures Acorn Innovation Fund awards are as follows:

Steven Borkan, MD
Boston University/Boston Medical Center
"NPM-Based Peptide Therapeutic for Acute Kidney Injury (AKI)"
Grantee has discovered a renal targeted prototype peptide that shows promise for treating kidney disease in laboratory animals and may eventually be applied to humans. The peptide therapeutic prevents & treats acute kidney injury (AKI), reduces renal death in vitro, preserves kidney function, and prevents animal death in vivo after acute ischemia.

Jennifer Broderick, PhD, **University of Massachusetts Medical School**: **"Cell Type-specific Gene Silencing Tethers"**
This innovation advances the ability to target cell type with a systemically delivered therapeutic agent to better hone disease treatment. MicroRNA (miRNA) tethers silence genes (that is, turns off their expression) in one or a small number of tissues because silencing occurs only in those cells that produce a specific miRNA. miRNA tethering is the only therapeutic strategy that limits gene silencing to the intended cell type even when the therapeutic agent is delivered systemically.

Karen Dunphy, PhD, **University of Massachusetts Amherst**: **"Personalized Breast Cancer Treatment Decisions with E2-Path Diagnostic"**
E2-Path Diagnostic is a pathology tool that will help oncologists personalize medicine and treatment options for breast cancer patients. This diagnostic directly tests an individual's functional estrogen response to guide selection of therapeutics. The Acorn Innovation award will fund experiments to standardize the diagnostic.

Acorn Innovation Fund Report (FY21 and FY22 Cohorts)

Yuxiang Liu, PhD, Worcester Polytechnic Institute: "Fiber Optical Moisture Sensors in the Agriculture Industries: System Development and On-site Demonstrations"
Grantee proposes to develop and test fiber optical moisture sensors for the agriculture industry. These hair-sized sensors are capable of real-time, accurate monitoring of product moisture during processing, which helps enhance the process control and reduce food waste.

Sanjeev Manohar, PhD, **University of Massachusetts Lowell**: **"Smart and Economic Multifunctional Coatings"**
Grantee has developed an extremely simple, safe, and cost-effective coating technology that has excellent antibacterial properties and can also dramatically decrease indoor air pollution. The technology enhances the ability of titanium dioxide nanoparticles to destroy bacteria and viruses while simultaneously mitigating potential safety issues related to nanoparticles.

Yousof Naderi, PhD and Dr. Kaushik Chowdhury, PhD, Northeastern University:
"iSurface: Programmable Intelligent Surfaces with AI-enabled Autonomous Sensing, Computing, and Networking"
Grantees propose iSurface, an "intelligent surface platform," that is the first-ever programmable and AI-driven plug-and-play solution that transforms ordinary surfaces into intelligent contactless sensing, computing, and networked surfaces.

Suzanne Paradis, PhD and Vernon Clarke, PhD, **Brandeis University**: **"Sema4D represents a new and exciting disease-modifying therapeutic strategy for the treatment of intractable seizures"**
Sema4D reduces ongoing seizure activity in laboratory animals by rapidly driving new inhibitory connections in the brain. Sema4D seeks to address the problem of drug resistance and acquired tolerance, offering hope for the long-term management of chronic epilepsy and the acute treatment of "intractable status epilepticus," or continuous seizures.

Michael Ross, PhD, **University of Massachusetts Lowell**: **"Nanostructured SERS Architectures for Handheld Detection of PFAS in Water"**
This handheld approach to detecting per- and polyfluoroalkyl substances (PFAS) in water, offers a rapid assessment for detection of these persistent, toxic chemicals. The technology uses novel nanofiber materials to capture PFAS and handheld Raman (spectroscopy or light scattering)

technology to identify their unique chemical footprints. This technology is useful for water utilities, environmental testing, and for assessing workplace hazards.

Sukalyan Sengupta, PhD and Chen-Lu Yang, PhD, **University of Massachusetts Dartmouth "Resource Recovery from Spent Lithium-Ion Batteries (LIBs)"**
This sustainable, closed loop process recovers high-purity metal precipitates (Lithium, Cobalt, Nickel, and Manganese) from spent Lithium-Ion Batteries (LIBs) that can be reused as a raw material in the manufacture of new LIBs. Recovery is achieved by sequentially and selectively applying organic ligands (molecules or atoms) to the complex metals. The organic ligands are reused over multiple cycles in a zero waste process.

Aatmesh Shrivastava, PhD, Northeastern University, **"Ultra-low Power Wake-up Radio"**
This project aims to advance an ultra-low-power, wake-up radio solution for Internet of Thing (IoT) applications with up to six orders of magnitude reduction in power consumption when compared to existing solutions. IoT technologies, such as for managing energy use in homes, are kept in the sleep mode most of the time to keep power consumption low, and wake-up solutions are needed to trigger the sensors to carry out a task. This new technology will enable continuous network connections, allowing for applications otherwise not possible.

Benjamin Woolston, PhD, Northeastern University: "A Co-Culture Method for Enhanced Biofuel and Biochemical Production from Untreated Waste Gases"
Fermentation of waste industrial gas streams is a promising method for producing renewable biofuels and biochemicals from the waste streams. The process requires microorganisms and is limited by the sensitivity of the anaerobic microorganisms involved to oxygen. This grantee is developing a symbiotic co-culture approach that overcomes these issues.

Dongming Xie, PhD, University of Massachusetts Lowell: "Biolubricants from Yeast"
Worldwide, nearly 40 million tons of lubricants were produced from petrochemical processes in 2018 for use in machinery and tools. As much as 40-50 percent leaks into the environment, such as from chain saws in forestry operations, polluting soil, air and groundwater. This project uses a

novel yeast biomanufacturing technology to directly convert waste cooking oils into non-toxic, biodegradable wax esters to replace the petroleum-based lubricants.

Mingdi Yan, PhD and Olof Ramstrom, PhD, University of Massachusetts Lowell: "Preclinical Studies on a New Class of Antimicrobial Agents against multidrug-resistant Pseudomonas aeruginosa"

Grantees' products are a new class of antimicrobial agents to fight multidrug-resistant Pseudomonas aeruginosa, a leading Gram-negative pathogen that is highly resistant to antibiotics and carries high mortality rate. Their products have unique mechanisms of action, low toxicity, and broad-spectrum activities, and thus the potential to treat future super-infections.

FY22 Details:

Twelve grants of $16,250 each were awarded to faculty researchers from Boston VA Healthcare, Boston University; Northeastern University; MIT; the University of Massachusetts at Amherst, Boston, Dartmouth and Lowell; Tufts University and Western New England University to assist them in testing the viability of their technologies and potentially bringing their research to market.

The majority of projects selected were life science or medical innovations and spanned from novel therapeutics to treat lung cancer, to AI applications that facilitate outpatient rehabilitation via telemedicine, to modular bioreactors that allow for distributed and affordable production of medications. Several projects were also chosen that focus on novel surveillance technology, such as for remote monitoring of civil infrastructure integrity (roads and bridges) and real-time surveillance of roadways for traffic incidents.

Acorn Innovation Fund Report (FY21 and FY22 Cohorts)

FY22 recipients of the MassVentures Acorn Innovation Fund awards are as follows:

Chengbo Ai, PhD and Qing Hou, University of Massachusetts Amherst:
"Low-Cost Crowdsourcing-Based Infrastructure Mapping for Pedestrian Accessibility"
Grantees are developing and validating an efficient and cost-effective pedestrian infrastructure inventory method, using low-cost LiDAR sensors, also known as 3D scanning. The technology would enable transportation agencies to maintain pedestrian walkways in compliance with the Americans with Disabilities Act in a timely and comprehensive manner. If proven feasible, the principal investigator will further integrate the low-cost LiDAR sensors into motorized wheelchairs to achieve a fully automated, crowdsourced inventory of pedestrian infrastructure.

Mark Grinstaff, PhD, Boston University and Yolonda Colson, MD, PhD, Mass General Hospital:
"Novel Antibody-Drug Conjugates for Squamous Cell Carcinoma Treatment"
Grantees are developing a novel, emerging class of anti-cancer therapeutics, called antibody-drug conjugates (ADCs), for the treatment of non-small cell lung cancer, which accounts for 85 percent of lung cancer and has low 5-year survival rates. ADCs are designed to kill tumor cells with minimal effect on healthy tissue. While ten ADCs have been approved for treatment of other cancers, none have yet been approved for lung cancer.

Dr. Raymond Fu, Northeastern University: "Pathfind: AI Driven Remote Motion Tracking by Light-Weight Deep Learning"
This award-winning, artificial intelligence framework was developed to facilitate and improve outpatient rehabilitation via telemedicine. It uses novel light weight, deep learning techniques to quantitatively sense, analyze, understand, and modulate human behaviors through low-cost and portable devices including smartphones. The framework enables human pose tracking,

behavioral recognition, and motion capturing and runs on platforms constrained by limited hardware. Acorn funds will help the researchers commercialize their technology.

Carlos Gradil, PhD, MSc, LMV, DAC, University of Massachusetts Amherst: "Revolutionary Contraceptive Intrauterine Device for Women"

Grantees are developing a 'frameless' long-acting contraceptive intrauterine device (IUD) composed of three independent elliptically shaped rods. This device will offer the same efficacy as current IUDs, but with greater safety and lower risk of pain, expulsion and perforation, and it will not require strings. The researchers launched a women's healthcare company, 3Daughters, to commercialize the IUD and will use Acorn funds to hone the prototype design and development, and develop a clinical trial strategy.

Kimberly Hamad-Schifferli, PhD and Jose Gomez-Marquez, PhD, University of Massachusetts Boston: "Paper Powered Pharmaceutical Manufacturing"

Grantees created a modular biochemical manufacturing platform that enables distributed, affordable, and scalable production of medications. The innovation includes a membrane-to-membrane continuous flow reactor system that can operate without pumps or advanced instrumentation and uses minimal power. This "paper reaction vessel" system can be reconfigured to store, transport, and mix reagents on-demand. It requires far less capital investment and complex instrumentation than both centralized pharmaceutical manufacturing and alternative methods, such as those using robotics or small-scale reactors.

June Horowitz, PhD, RN, PMHCNS-BC, FAAN, University of Massachusetts, Dartmouth: "Momma Connect mHealth Application for Women with Postpartum Depression and their Infants"

Researchers are developing and evaluating the feasibility of MommaConnect, a mobile health (mHealth) application, to reduce postpartum depression (PPD) and improve mother-infant interaction. An accessible, convenient, cost-effective mHealth app for clinicians and women with

Acorn Innovation Fund Report (FY21 and FY22 Cohorts)

PPD can bridge the current gap between PPD screening and availability of customized perinatal mental health care.

Dr. Devina Jaiswal, Western New England University: "Designing and Testing of Add-on Features for Do-it-Yourself Bioreactor: A Product-Market Fit Approach"

Researchers are developing a customizable bioreactor that allows for dynamic tissue culture of tissue-engineered products as alternatives to allografts and autografts (bone tissue derived from humans). The device will accommodate multiple test conditions and samples to yield statistically sound data for a variety of tissues, a critical feature not currently available in commercial bioreactors. The device is geared for researchers in biomedical engineering and science who are designing and developing tissue-engineered products or studying disease, repair, and regeneration of soft tissues.

Dr. Karen Panetta, Tessera Intelligence, Tufts University: "Tessera Intelligence-Traffic Incident Detection and Analysis System"

Tessera Intelligence is an artificial intelligence (AI) based framework that automatically triages and alerts traffic control agents in real time for rapid intervention. The system leverages available large-scale camera infrastructures to detect highway and roads incidents (e.g., wrong-way driving, traffic congestion, bicyclists or pedestrians in tunnels, and crashes) while providing a visual intelligence solution to remove weather and environmental anomalies that can interfere with detection, such as rain, haze, snow, and smoke. Its potential benefits include reduced time for first responder arrival, increased survival rates, and the cost-effective deployment of incident response resources.

Ravi Rasalingam, MD, TeamOSA/Boston Veterans Affairs Healthcare and Ellen Roche, PhD, MIT: "A Novel Device to Treat Obstructive Sleep Apnea"

The team is developing a custom fit mouthguard to prevent airway obstructions by transmitting low level suction that stabilizes the throat muscles of obstructive sleep apnea patients. It is

created from a CAD modified digital scan of the mouth that is then 3D printed in biocompatible resins. It connects to a miniature suction pump.

Drs. Sloan Siegrist and Emily Mezler, Latde Diagnostics/University of Massachusetts Amherst: "A Novel Tool to Detect Bacterial Growth and Antibiotic Susceptibility"

Latde Diagnostics is developing a platform technology using universal cell surface labelling to rapidly detect bacterial growth and antibiotic susceptibility. The technology will shorten the time to an antibiotic susceptibility profile at relatively low cost, saving lives and reducing costs in clinical and industrial settings. The first application is detection and antibiotic susceptibility profiling of bloodstream bacterial infections, but it could be readily adapted to speed pathogen and contaminant detection in a variety of settings such as food and biomedical manufacturing facilities.

John Wixted, MD, Beth Israel Deaconess Medical Center: "Metal Injection Molded External Fixators"

Grantees developed a low-cost external fixator, which is a widely used technology for fracture repair, especially of the knee or ankle. External fixators hold and prevent a broken bone from moving around, for a period of days to weeks. The grantees developed a fixator from metal injection molded parts which will save hospitals two-thirds of the costs of temporary external fixation. Acorn funds will help researchers mechanically test their device using ASTM International standards.

Tzuyang Yu, PhD, University of Massachusetts Lowell:
"Compact Portable Microwave Sensor for Inspecting Critical Civil Infrastructure"

Grantee is developing a versatile, efficient, and cost-effective microwave remote sensing technology for inspecting the subsurface conditions of critical civil infrastructure (e.g., concrete buildings, bridges, tunnels, roadways, airports) and energy infrastructure (e.g., wind turbine blades). The technology is compact and lightweight and can be mounted on a drone. It can

monitor concrete cover (protecting layer for steel reinforcing bars and tendons) and locate steel rebars from the surface of bridges. It allows for prognostic inspection and early repair to avoid expensive repair and/or sudden failures of structures from happening.