U of T Celebrates Innovation

Inventors of the Year
Connaught Innovation Awards
UTEST companies
The University of Toronto (U of T) has a proud history of bringing new ideas and inventions to the world. Just as the groundbreaking discovery of insulin in 1921 changed the face of healthcare and saved countless lives, our researchers continue to challenge, explore, invent and improve the world around us.

Today, U of T fosters a vibrant entrepreneurial community with numerous initiatives and support programs to encourage innovation, cultivate new ideas and create new companies. U of T has become a global leader in transforming research for entrepreneurship and prosperity, and in turning ideas and innovation into products, services, companies and jobs.

This celebration of innovation has become a wonderful annual event to recognize the ingenuity and imagination of the U of T community. This year we are celebrating new ideas and technologies in disciplines ranging from aerospace control systems, human-computer interfaces, imaging technologies for surgical guidance, advanced manufacturing and 3D modeling, and a platform for protein and drug-discovery. We congratulate them all!

In addition to recognizing some extraordinary research achievements, we also acknowledge the immense support of our partners in innovation. In partnership with MaRS Innovation, U of T launched the UTEST program in 2012 to provide seed-funding and entrepreneurship support to our inventors. To date, UTEST has helped 16 companies come to life. This success was made possible with financial support from The Connaught Fund, which also supports the Connaught Innovation Awards, and the Ontario Centres of Excellence. We applaud OCE for their financial assistance and leadership through the newly formed Campus-Linked Accelerator program. Thank you to all of our partners.

Today we reflect upon and celebrate some of our inventors and entrepreneurs and look forward to another exciting year!

Vivek Goel
Professor Vivek Goel
Vice President, Research & Innovation

Peter Lewis
Professor Peter Lewis
Associate Vice President, Research & Innovation,
Global Research Partnerships

D. Newton
Dr. Derek Newton
Executive Director,
Innovations & Partnerships Office
Extended Touch User Interface
Parham Aarabi

**Professor Parham Aarabi** is a Professor in U of T’s Department of Electrical and Computer Engineering. He received his Ph.D. in Electrical Engineering from Stanford University, and his M.A.Sc. and B.A.Sc. from the University of Toronto. He is author/inventor of over 100 scientific publications and two books including “The Art of Lecturing”, and was twice selected as a Canada Research Chair in Multi-Sensor Information Systems. He is the founding director of the Mobile Applications Lab. In 2005, Parham was selected by MIT as “one of the world’s top young innovators” and in 2006 received the Premier’s Catalyst Award for Innovation. Professor Aarabi is also the founder of ModiFace Inc., which in the past decade has emerged as the world’s leading beauty technology company.

Professor Aarabi’s invention, called **Extended Touch User Interface**, enables any flat surface to become tap sensitive by placing a mobile device on it. The unique acoustic signatures generated from taps are classified and associated with a unique tap location, enabling a virtual tap interface to be used on any surface. This is significant as it is the only commercially available technology that can instantly transfer a surface to become tap sensitive without any hardware add-ons. This can be done without any additional hardware requirements other than an iPhone/iPad.

The invention has the potential to lead to the age of tap-sensitive tables/walls/furniture using only the devices and technology that is available today.
Dr. Hugh H.T. Liu is a full Professor at UTIAS and currently serves as the Associate Director, Graduate Studies. Dr. Liu is an internationally leading researcher in the area of aircraft systems and control, and leads the “Flight Systems and Control” (FSC) Research Laboratory. He has published over 100 technical papers in peer reviewed journals and conference proceedings, and has received one patent (US and Canada) on his work on motion synchronization. He has significant research contributions in autonomous unmanned systems development, cooperative control, and integrated modeling and simulation. He also serves on editorial boards and technical committees of international professional societies. Dr. Liu is a Fellow of CSME, Associate Fellow of AIAA, and an active member of IEEE, CASI.

Motion synchronization refers to a dynamic pattern where each agent of a system(s) moves in a timekeeping coordination fashion such that the overall system behaves as one entity to perform a coordinated task. The invention provides a generic synchronized motion control system for multiple dynamic systems. It enables the system to autonomously engage and maintain in a synchronized configuration. The technology developed in the present invention improves dynamic performance in a coordinated motion profile. As well it has the potential for a wide range of applications involving autonomous vehicles. For instance, a group of unmanned aerial vehicles (UAVs) may fly autonomously in formation and multiple autonomous ground vehicles may move in a certain cooperative strategy.

Since the invention was disclosed, Professor Liu and his research team have secured several commercialization oriented grants to develop prototypes. A project under CSA’s space technologies development program supported a Canada-Japan small satellite formation flying mission. A project under FedDev ARC program made a successful field flight demonstration of using UAVs for wildfire monitoring. Subsequently, an OCE technical problem solving program allowed development of the technology and a prototype, a UAV onboard integrated data collection and analysis package. A spin-off company, Arrowonics Technologies Ltd. was founded by Professor Liu and run by his former graduate students (Dr Mingfeng Zhang, Henry Zhu and Everett Findlay). The company recently received an investment of $500,000 CDN to develop a consumer UAV product.
Professor Emeritus Richard Cobbold received his B.Sc. degree in physics from Imperial College in 1956, and obtained the M.Sc. and Ph.D. degrees from the University of Saskatchewan, in 1961 and 1965, respectively. Since 1966 he has been a Professor in the Institute of Biomedical Engineering at the University of Toronto, where he was Director from 1974 through to 1983. He is currently Professor Emeritus in the Institute of Biomaterials and Biomedical Engineering (IBBME) and in the Department of Electrical and Computer Engineering.

Dr. Amir Manbachi obtained his Ph.D. at the University of Toronto in 2015 under the supervision of Richard Cobbold and Howard Ginsberg. He carries the experience of international research and industrial internships. While an undergraduate at U of T, he interned at Harvard Medical School, which resulted in a number of scientific publications. During 2012, he also interned with Stryker’s R&D headquarters in Germany. Stryker is one of the top five global corporations specializing in surgical navigation products. Amir is also an entrepreneur, who founded his own start-up company, called “Spinesonic Medical Inc.”, while a Ph.D. student. He is the primary inventor of two International patent applications and one design application that were filed in collaboration with the University. These inventions are devoted to providing a solution to the traditionally blind process of inserting screw implants during spinal surgeries.

Spinesonics Medical Inc. is a spin-off company from IBBME, focused on developing the PedicProbe™, consisting of an imaging array at the end of a surgical drill kit. The device uses ultrasound technology to give surgeons a clearer picture during operations where screws are inserted into the spine. The technology could prevent navigational errors and significantly reduce the rate of revision surgeries. The technology is portable, affordable and will provide advantages over X-ray technologies from a safety and cost standpoint. It is estimated that through a reduction in the rate of revision surgeries, this imaging device could result in up to $600M of annual savings to the North-American healthcare system. In addition, it could be used for reducing training time for surgical residents and could be used in battlefield clinics, where no portable imaging system is available.
Karan Singh is a Full Professor of Computer Science at the University of Toronto. He is co-director of the graphics and HCI laboratory, DGP (Dynamic Graphics Project. He received his B.S. in Computer Science from the Indian Institute of Technology, Madras in 1991, and both an MS and Ph.D. from the Ohio State University in 1992 and 1995. He was the Software R+D Director for the award-winning animated short film Ryan in 2004. His research interests include geometric design, character animation, artistic perception of shape and motion, 3D interaction, and virtual reality. James McCrae is a post doctoral fellow working with Professor Singh. He is company founder and co-creator of the software flatfab and True2Form.

flatfab is a software aimed at subtractive manufacturing, in natural materials like wood to complement the trendy new area of additive manufacturing (3D printing). flatfab is also aimed at non-professionals allowing hobbyists and even children create compelling physical 3D objects, using devices ranging in sophistication from laser cutters to a pair of scissors. It has been tested and used as a design tool by Canadian high school students at John Paul II Catholic Secondary School in London, Ontario.

True2Form radically impacts the productivity of design professionals allowing them to sketch in 2D freely and have their creations be automatically transformed into 3D digital models. True2Form is a sketch-based modeling system that reconstructs 3D curves from typical design sketches. A novel mathematical framework of insights derived from perception and design literature, enables the inference of 3D form from 2D drawings.

Both inventions have been demonstrated at entrepreneur-focused events including SmartWeek, Small Business Forum and the Tata Consultancy Services co-innovation network.
Membrane Protein Interactions Detection - MaMTH
Julia Petschnigg and Igor Stagljar

Igor Stagljar is a Professor of Molecular Genetics and Biochemistry in the Donnelley Centre for Cellular and Biomolecular Research at the University of Toronto. Julia Petschnigg was a post doctoral fellow working with Professor Stagljar. Dr. Petschnigg received her Ph.D. from the University of Graz in Austria. She was first author on the recent Nature Methods publication describing MaMTH.

Membrane protein interactions are crucial in many cellular processes, and due to their association with a variety of diseases are major therapeutic targets. Membrane proteins are hugely complex, and despite intensive research, little is known about their interaction partners. Consequently, new technology is needed to investigate how the malfunction of integral membrane proteins and their interactions leads to various human diseases. Mammalian membrane two-hybrid (MaMTH), the invention, enables context-dependent detection of full-length membrane protein interactions in human cells. In the next few years, MaMTH is expected to uncover considerable information about protein interactions for the majority of “druggable” human membrane proteins, enhancing research into diseases like cancer, cystic fibrosis and Parkinson’s disease. As a proof of principle, the Stagljar group recently showed that MaMTH can detect subtle changes in protein interactions in response to stimuli such as hormones or inhibitory drugs, and identified interactions of potential clinical relevance to lung cancer.

MaMTH technology has the potential to impact Canada’s economy and society in several ways. First, MaMTH is an innovative new tool for the scientific community and will be incredibly useful for discovering new information about membrane proteins. This technology has already catalyzed numerous international collaborations, which raises the global profile of Canadian research. Second, MaMTH technology fills a gap in the drug discovery market, with the potential to greatly facilitate the discovery of new drugs for diseases such as lung cancer, cystic fibrosis and various neurodegenerative disorders, and it is believed that this will have a direct impact on the health and pharmaceutical sectors of Canadian society. Last, Dr. Stagljar is currently establishing a new start-up company based on the MaMTH technology called Protein Network Sciences Inc that will contribute to the growth of Ontario’s biotech sector and hence have an overall positive effect on the Canadian economy.
flatfab is software that helps individuals design and fabricate 3D objects. Users imagine in 3D but ideate and draw in 2D. flatfab seamlessly does both. flatfab marries digital modeling and traditional craftsmanship. 3D printing in new-age materials is great for small complex objects, but prohibitive in time and money. flatfab enables designers and hobbyists to use their own skills working with common tools and materials, anything that is reasonably flat and can be cut: paper, plastic, wood, steel, even stone. www.flatfab.com

ICE3 (Ice Cube) is developing new technologies to introduce light-weight, compact, cool and universal ac–dc power supplies that will consolidate all of the chargers for one’s electronic devices into one. Currently state-of-the-art power adapters are often bulky, expensive and/or hot-to-the-touch solutions, which burden the user, the environment and diminish the devices portable experience. The ICE3 technologies will improve the portability of the electronic devices and the users overall experience.

Stock investors pay increasing attention to stock advice before their investment decision. Popular websites reinforce this behavior because they don’t keep track users’ past performances. Nvest is an investment platform with real accountability where recommendations are evaluated in real time. The most important feature is delivering credibility and permanent visibility. Nvest keeps track of every recommendation to build investors’ performance history and offers advanced analytical models to assist users with in–depth reasoning. Helping people better evaluate the legitimacy and certainty of stock recommendations. www.nvest.me

Syncadian Inc. is continuing to develop software in the fatigue modelling and management space. They are continuing to develop applications for shift workers, military, cancer patients and others to monitor sleep quality and quantity to manage fatigue in a variety of forms. www.syncadian.com

Onyx Motion is building digital coaches to help individuals play like an experienced athlete. Using smartwatches to show the user how they play and how to improve at the moment they need it most. It’s a digital coach that fits right in the pocket. It is ready to play always. www.onyxmotion.com
In partnership with MaRS Innovation and with financial support from the Connaught Fund, UTEST provides nascent software companies with start-up funding, mentoring, business strategy and office space in the MaRS Discovery District facility. A part of U of T’s growing ecosystem of incubators and commercialization support services, UTEST is currently selecting the 2015 class. www.utest.to

“UTEST is a successful joint initiative between U of T and MaRS Innovation that deepens our working relationship while encouraging student entrepreneurship linked to the research programs of the university.”

Dr. Raphael Hofstein, President and CEO, MaRS Innovation
The annual Connaught Innovation Awards accelerate the development of promising technologies and promote commercialization and/or knowledge transfer of innovations arising from the University of Toronto. Projects should have societal impacts and outcomes that improve the quality of life for society. The program supports projects with recognized technology transfer potential by providing crucial assistance in the early stages of technology validation, product development and market connection. The Innovation Awards provide one-time, early-stage, seed funding for research and development activities leading to technology transfer to a new or established Canadian company, or knowledge transfer to society. Talent development and opportunities for trainees are expected within the project.

**2014–15 Awardees**

**Ridha Ben Mrad**  
A cell phone camera module incorporating a micro-electrostatic actuator enabling autofocus (AF) and optical image stabilization (OIS) capabilities. ($56,500)

**Mo Mojahedi**  
Multimode Spectroscopy with Plasmonics and Hybrid Plasmonics Sensors ($60,000)

**Constantin Christopoulos**  
Implementation of the GIB system for the seismic upgrade of a real soft-storey building retrofit ($75,000)

**David Steinman**  
A Disruptive, Physics-Based Ultrasound Simulation Platform for Accelerating Sonographer Training ($76,500)

**Edgar Acosta**  
Microencapsulated Self- Microemulsifying Drug Delivery System ($76,800)

**Edward Sargent**  
Commercialization of a highly efficient hybrid quantum dot/silicon solar cell ($91,500)

**Geoffrey Ozin**  
Energy Transition Engineering Solar Enabled CO2 Conversion Technology ($97,500)

**Ofer Levi**  
Miniature, implantable multimodality optical imaging systems for drug screening in awake rodents ($100,000)

**Radhakrishnan Mahadevan**  
Production of bio-based 1,3-butanediol ($100,000)
The Connaught Innovation Awards program provides funding for proof-of-principle/development projects with strong commercialization potential, including projects that test discoveries to mitigate the risk for further research investment (e.g., feasibility studies, prototype development, etc.).

Projects must be based on inventions or research discoveries that are already disclosed to the University. Where ownership is assigned to the University, the Innovation Award application should be developed in partnership with the Innovations and Partnerships Office, which assists applicants in evaluating and protecting the new technology, service or process; developing proposals; preparing a technology transfer approach; making business contacts; and negotiating licensing or other such arrangements with potential partners.

2013–14 Awardees

**Baher Abdulhai**
Field Operation Testing and Commercialization of MARLIN Traffic Signal Control Technology ($100,000)

**Richard Cobbold**
PedicProbe: Ultrasound Navigation for Spinal Fusion Surgery ($35,000)

**Richard Hegele**
Repurposing of anti-cancer drug for respiratory syncytial virus therapy and prophylaxis ($97,557)

**Shana Kelley**
A microchip for the sorting and analysis of circulating tumour cells ($100,000)

**Joyce Poon**
Three dimensionally integrated electro-optic transmitters and receivers ($90,000)

**Li Qian**
High-speed On-demand Quantum Random Number Generator ($100,000)

**Yu Sun**
Automated probing of nanoelectronic structures inside scanning electron microscope ($78,000)

**Michael Thompson**
A true theranostic approach to medicine: Tandem sensor detection and removal of endotoxin in blood ($92,000)

**Xiao Yu (Shirley) Wu**
Development of nanoparticle formulations for targeted delivery of proteins to the brain ($90,000)
ACCELERATING INNOVATION AT U of T

The University of Toronto’s Innovations & Partnerships Office (IPO) manages U of T’s intellectual property—turning ideas and innovations into products, services, companies and jobs—and helps to build successful partnerships between industry, business, government, and the U of T research community.

Industry Partnerships

University of Toronto researchers forge numerous connections with external partners to expand their research activities and impact.

The Innovations & Partnerships Office (IPO) Business Development team connects private-sector companies with U of T researchers in many areas of study, both through direct communication and indirectly through our online Funding Opportunities Database available on research.utoronto.ca.

IPO also offers professional support services to help formalize sponsored research and collaboration agreements, non-disclosure agreements, material transfer agreements, and other partnership agreements.

IPO can also help to identify sources of supplementary research dollars—such as NSERC, OCE, FedDev, Mitacs, and federal and provincial tax incentives—that can magnify the resources available to your project. Our Business Development team can help identify the program most appropriate for your needs.

Commercialization

The University of Toronto is a global leader in transforming research for entrepreneurship and prosperity. U of T has a vibrant entrepreneurial community with numerous initiatives and support programs that create, encourage, foster and grow new companies. Since 2000, 170 start-up companies have been created.

IPO’s team of Commercialization and Entrepreneurship Managers offer a variety of services to help members of the U of T community bring their ideas and innovations to the world.

The University of Toronto also has a strategic alliance with MaRS Innovation (marsinnovation.com), one of Canada’s pre-eminent commercialization engines.

IPO manages U of T’s inventions portfolio and has an ever changing and expanding number of market-ready innovations, ideas and technologies available for licensing by private-sector companies. Current opportunities may be viewed at www.research.utoronto.ca.

Contact the Business Development team at innovations.partnerships@utoronto.ca.

Contact IPO’s Commercialization and Entrepreneurship Managers at commercialization@utoronto.ca.