



#### Innovation Grant (Up to \$250,000 Development Grant)

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**1.ING09007 Water Purification for Remote Location:** A portable water purification device to convert seawater/brackish water/contaminated water into potable water, in an energy efficient process that allows low power operation. A new separation technology known as ion depletion separates ions or other charged particles at a nano junction (PI: Jongyoon Han, SMART-MIT).

**2.ING09008 Humanized Mouse Models for Drug Development:** Humanized mice model for pharmaceutical industry and applied research of human immunity and hematological diseases (PI: Chen Jianzhu, SMART-MIT).

**3.ING09009 A Three-dimensional Microfluidic Assays for Cancer Drug Screening:** The first in vitro quantitative assessment of molecular and cellular level behaviour of metastatic cancer (PI: Roger Kamm, SMART-MIT).

**4.ING09010 High Performance Protein Microarrays:** A protein array using a novel random placement of beads containing antibodies on a chip and a method for decoding the placement of such antibodies. The microarrays allow for the performance of vast numbers of experiments at the same time thereby increasing data density and accuracy, speeding up discovery and saving time and money (PI: Dieter Trau, NUS).

**5.ING10012-ICT An Integrated Wireless Sensing Platform for Water Distribution System:** An end-to-end system for continuous remote monitoring of a water distribution system, including wireless sensing hardware (for hydraulic, acoustic and water quality parameters), a data collection and visualization infrastructure, modeling and analysis tools (PI: Ami Preis, SMART).

**6.ING10013-BIO Gastro-Duodenal Sleeves:** To perform the requisite bench testing, prototyping, and animal studies to prove the concept of a gastro-duodenal sleeve as a substitute for Bariatric surgery for weight reduction in obese patients (PI: Jimmy Soh, NUS).

**7.ING11023-BIO 3D compass navigational tool to augment laparoendoscopy:** To develop a standalone three dimensional compass system that provides real time spatial orientation of the endoscope to aid surgeons in advancing and manoeuvring during an endoscopic procedure (PI: Victor Lee, NUS).

**8.ING11027-ENG Silicon-Nanocrystal-Based Anti-Reflection Coating for full-spectrum harvest silicon solar cells:** Enhance silicon solar cell efficiency by making use of the leftover solar energy based on the Si nanocrystal (nc-Si) anti-reflective coating (ARC) developed in lab. The low-cost nc-Si ARC effectively converts UV light of the solar spectrum to useful visible light, and at the same time it greatly reduces the reflectance in the near IR-IR regions while the performance in the visible region is not affected (PI: Chen Tupei, NTU).

**9.ING11028-ENG Oxide nanoparticles doped hollow carbon spheres - An anode material of Lithium-ION Battery:** Achieving high energy density LIBs (lithium-ion batteries) by doping various metal-oxide nanostructures into a hollow core-shell carbon sphere structure (PI: Yang Hui Ying, SUTD).

**10.ING11031-ICT High Speed Optical Access Networks:** A fiber-optic access network which is capable of upgrading the transmission system for internet data traffic on as-needed basis in a cost-effective manner (PI: Hoon KIM, NUS).

**11.ING11032-ICT Mobile Intelligent Travel Agent:** To develop a mobile game application and design an open mobile cloud server platform for introducing travelling services from the real world. A variety of terminals including iPhone/iPad and Android will be supported (PI: Miao Chunyan, NTU).

**12.ING11033-ENG A membrane-Based Power Management and Storage Device for Hybrid Vehicles:** As a ground-breaking achievement and a continued advancement of the ignition project ING10022-ENG(IGN), the team recently invented the world's first piece of energy-storage membrane for the power management and storage system of hybrid vehicles. The light weight and long cycle life of the membrane help reduce the load and maintenance of vehicles (PI: Xie Xian Ning, NUS).



**13.ING11034-ENG High efficiency, low consumption solar-powered street light:** To develop a high-efficient, low-consumption solar-powered street light. The energy is produced directly only when it is needed (PI: Thomas Reindl, NUS).

**14.ING11035-BIO Isolation and purification of Trastuzumab using a MIP (molecularly imprinted particles) system:** A low cost system for purifying antibodies with a semi-continuous and a continuous approach (PI: Tong Yen Wah, NUS).

**15.ING11036-BIO Development of an endovascular implant for the treatment of aortic aneurysms:** Advancement from ignition grant project no. ING10017-BIO(IGN), the team has developed a novel endovascular implant that seek to overcome the shortcomings of commercially available stent grafts in the treatment of aortic aneurysms (PI: Benjamin Chua, NUS).

**16.ING11037-BIO Multi-channel FTIR for high speed spectrometry:** A Multi-Channel FT spectrometer which overcomes known limitations of conventional FT spectrometers through two groundbreaking innovations. Firstly, movable mirror elements are replaced by an arrangement of stepped, micro-fabricated mirror surfaces. Secondly, amplitude beam-splitters are removed (PI: Sascha Pierre Heussler, NUS).

**17.ING12042-BIO A Novel Biodegradable ventilation tube with Sustained Drug-Eluting Property for Treatment of Middle Ear Effusion :** A biodegradable ventilation tube for middle ear effusion treatment will reduce the need for topical antibiotic ear drops, and reduce infection or biofilm afflictions of the ventilation tube. (PI : Lim Hsueh Yee Lynne, NUS)

**18.ING12043-BIO Integrated Droplet-Based Microfluidic Platform for High-Throughput Personal Medicine Analysis :** A droplet-based microfluidic technology enables the high-throughput screening of a large number of biochemical reactions while using a small amount of patient or other biological sample to facilitate the monitoring of biomolecule activity for diagnostic and drug discovery. Hundreds of enzyme activity bioassays can be used to test clinical samples directly and efficiently. (PI : Chen Chia-Hung, NUS)

**19.ING12044-BIO Light-up Fluorescent Probes for Continuous Monitoring of Live Cell Apoptosis and Drug Screening:** New light-up probes have been developed using organic fluorogens with aggregation induced emission characteristics. These probes have no background fluorescence and as a result can provide continuous monitoring of live cell apoptosis and day screening. (PI : Liu Bin, NUS)

**20.ING12045-ENG Development of Robust High-Performance Nanofiltration Membranes for Textile Wastewater Treatment :** A hollow fiber nanofiltration membranes is specifically designed for the textile industry. A unique double-repulsive bi-layer can remove > 99% of dye from textile wastewater. The technology is a tailored solution for the textile industry in wastewater treatment. (PI : Chung Tai-Shung, NUS)

**21.ING12046-BIO An automated physio-neuro rehabilitation platform for recovery of hand function after stroke :** A rehabilitation platform which targets the recovery of hand function after stroke. It stores brain and muscle data during therapy to automatically personalize therapy. The product is wearable and easy to use at hospital and home for training actions, tasks and cognition. It provides support in acute , sub-acute and chronic stages of recovery.(PI : John Heng, NTU)

**22.ING12052-BIO Generation of autologous pericyte progenitors from peripheral blood for therapeutic angiogenesis-Phase II :** A novel cell type called "blood derived angiogenic cells (BDAC)" is derived from the patients peripheral blood. The BDAC cells migrate to the site of injury and facilitate small blood vessel restoration. The BDAC cells can be used to treat diabetic wounds and limb ischemia, stroke and MI. (PI : Michael Raghunath, NUS)

**23.ING13053-BIO The Illumelute Affinity Purification System – A Radical New Way of Purifying Recombinant Proteins :** Using an affinity tag that binds to a light-sensitive chromatography column, a completely new method of purifying proteins was developed. This technology has the potential to significantly impact best-practices in biopurification. (PI : Chester Drum, NUS)

**24.ING13054-BIO Stapled Peptides: Next Generation Biological Reagents with improved Specificity and Potency :** Utilizing a patented process of producing stapled peptides, reagents (antibodies, small peptides, siRNA, etc) of great specificity and low toxicity will be developed for the reagent market. These next-generation reagents will be of immense value to the biological research community. (PI : David Lane , P53Lab)



**25.ING13055-BIO Partially Biodegradable Percutaneous Caval Valve Implantation for Severe Tricuspid Regurgitation :** A novel unidirectional valve is implanted in the superior and inferior vena caval using a minimally invasive interventional approach. The caval valve prevents high systolic pressures from being transmitted distally to the end organs and permits improved forward flow, which translates into reduced tricuspid regurgitation symptoms. (PI : Edgar Tay, NUHS)

**26.ING13056-ENG High-Tensile Organic Fiber Reinforcement for Structural Concrete :** The project describes the development of novel organic composite materials as a reinforcement system in structural concrete to replace steel rods and to revolutionize the concrete building sectors. (PI : Dirk Hebel, ETHZ)

**27.ING13057-ICT TaxiSG : Optimizing Taxi Operations in Singapore :** Big Data from historic and real time information and novel analytics are used to monitor the taxi system in Singapore and optimize its efficiency in terms of passenger waiting time and other parameters needed to provide optimal services. The system and analytics are scalable to other cities globally. (PI : Daniela Rus, MIT)

**28.ING137068-BIO Portable Magnetic Resonance Imaging (MRI) System for Human Brain/Extremities Using Electrical Property As A New Contrast Mechanism:** To develop an affordable and portable MR imaging system for human brain/extremities using electrical property of human tissues as a new contrast mechanism. (PI : Huang Shaoying, SUTD)

**29.ING137069-BIO Development Of An Industrial Viable Workflow for Carotenoids Production:** Continuing from the 1st grant, we will extend the work further to optimize synthetic biology tools and develop an industrially viable process to produce lycopene as a sustainable commercial source for natural colorant. (PI : Too Heng Phon, NUHS)

**30.ING137070-BIO Targeting the Ribonucleome for Antibiotic Development:** Identifying enzymes for tRNA modifications critical to cell survival , determination of high-resolution structures of these enzymes and identification of candidate lead compounds as enzyme inhibitors. Thereby developing a new class of antibiotics. (PI : Peter Dedon, MIT)

**31.ING137074-ENG Fault Tolerant Capacitorless Three-Phase Inverter for Electric and Hybrid Electric Vehicles with Reduced Magnetic & Electrolyte Volume and Device Count:** This project proposes a novel three-phase inverter for electric vehicles using a capacitorless topology with a single phase transformer to solve reliability issues and overcome the shortcoming of existing products and solutions. (PI : Akshay Rathore, NUS)

**32.ING148076-ICT Datacollider:** A tool that transform large amounts of unstructured data into meaningful information and eventually into striking visualizations within a matter of minutes. (PI:Carlo Ratti, SMART/FM)

**33.ING148077-ICT iClonecast: Cloud-based service engine for multi-screen applications:** The iClonecast solution leverages cloud-based distributed service architecture and advanced virtual machine migration algorithm to provide scalable and economical multi-screen services for application and development. (PI: Wen Yonggang, NTU)

**34.ING148078-ENG On-site robotic tilling:** A robot that can deliver high accuracy tiling at more than double the speed of conventional work. This can also be applied as a robotic co-worker that can safely work alongside humans without employing additional security measures. (PI:Fabio Gramazio, ETH)

**35.ING148079-ENG Biomimetic micro-sensors for flow sensing on UUVs, pipeline leakage monitoring and slosh detection in oil tanks:** This product embraces the structural design and the sensing principles of the ingenious neuromasts sensors found in biology and attains ultrahigh sensitivity and accuracy (PI:Ajay Kottapali, SMART/CENSAM)

**36.ING148080-BIO A new form of recombinant protein expression:** This technology uses nanometer sized individual folding incubators to promote successful folding of proteins in E.coli. (PI: Chester Drum, NUS)



- 37.ING149086-ICT Ultra low-power embedded machine learner for image/video processing in robotics and portable/wearable devices :** This special co-processor provides machine learning for image/video processing. It consumes 100X less energy in recognition and classification tasks compared to state of the art GPP and about 5X less energy than custom digital co-processors. Its application will be in robotics and portable/wearable devices. (PI: Arindam Basu, NTU)
- 38.ING149087-ICT HuGGler – A robot companion with intelligent sensors & internet connectivity:** HuGGler is an interactive pet robot equipped with intelligent sensors and internet connectivity to provide social companionship and monitoring capabilities to the user. With intelligent sensors, and smart signal-processing algorithms, HuGGler is able to infer the emotional state of the user. The application is primarily for elder care. (PI: Alvin Wong, I2R)
- 39.ING149088-ENG High speed motion & imaging sensor – Bringing high speed to low cost wide application:** An image sensor architecture was developed that allows on-chip pixel-parallel image processing and event-driven readout. The device provides a new way to perform high speed motion capture. (PI: Chen Shoushun, NTU)
- 40.ING149089-ENG A low cost, high performance multi-channel LED driver for universal lighting applications:** An innovative and disruptive LED (light-emitting diode) driver has been developed for commercial lighting applications, providing energy savings, monitoring, and ease of installation. (PI: Pritam Das, NUS)
- 41.ING149090-BIO Adventitial drug delivery using nanoparticles for treatment of critical limb ischemia:** A novel therapeutic device provides sustained release of sirolimus, using a dedicated oval drug delivery nanoparticle. The adventitial infusion is used to treat critical limb ischemia. (PI: Subbu Venkatraman, NTU)
- 42.ING149091-BIO Electrolateral-Flow bioscience enabling dengue infection detection and differentiation between primary and secondary infection to help indicate a putative severe case:** An electrochemical lateral flow biosensor, named BIOSTRIPCHECK, is designed for point-of-care dengue antibody detection. This is to demonstrate and validate a quantitative and rapid test to anti-dengue immunoglobulins IgM and IgG as well as dengue glycoprotein (NS1) in whole blood, enabling the user to differentiate between primary and secondary infections (increased risk of haemorrhagic fever), thus helping him determine earlier putative cases of severe dengue cases. It also has other applications such as quantitative analysis of HIV infection. (PI: Robert Marks, BGU)
- 43.ING1510100-BIO Development of a small molecule that expands SCID repopulating hematopoietic stem and progenitor (HSPC) cells from non-enriched umbilical cord blood:** To develop the small molecule, IM-29, as an exogenous cell culture additive for HSPC ex vivo expansion. (PI: William Hwang, Duke-NUS)
- 44.ING1510101-BIO A novel cell retention device for suspended-cell perfusion cultures. :** To develop the first clog-less microfiltration platform, with unique advantages over the conventional filtration devices, for perfusion culture of suspended cells to showcase the long-term (up to 3 months) culture of mammalian cells using our novel separation system, and demonstrate its unique advantages over existing methods. (PI: Han Jong Yoon, SMART BioSym)
- 45.ING1510102-BIO A cloud based automatic EEG data interpretation system :** A low cost validated neural network system to automatically screen and select EEG data of clinical significance for further review by the clinician. This product will reduce expenses associated with EEG tests and allow physicians to devote quality time for their patients. (PI: Justin Dauwels, NTU)
- 46.ING1510103-BIO New stabilizing agents for blood collection devices :** A new blood collection tube using a blood stabilizing agent is being built and tested. This technology will apply to a broad range of blood tests such as platelet function test, clinical chemistry analysis, haematology analysis and immunohaematology test. (PI: Kini Manjunatha, NUS)
- 47.ING1510104-BIO Innovation Grant Proposal for Biophysically Derived Mesenchymal Stromal Cells (MSCs) for Human Therapy:** To support production and early clinical testing of a potent therapeutic based on a patented subset of MSCs (PI: Krystyn Van Vliet, SMART BioSym)
- 48.ING1510105-ENG Towards commercialization of large, high quality (Ge, III-V)-on-Si engineered substrates:** To demonstrate functional devices on these substrates in order to understand their performance and address the feasibility of large high quality fabrication using the substrates. (PI: Lee Kwang Hong, SMART LEES)





- 49.ING1510106-ENG Planar structure designer (PS-Designer) A design tool for the maritime industry:** A new software algorithm provides a means to layout and cut complex shapes efficiently from a single sheet of material. (PI: Chen Lujie, SUTD)
- 50.ING1510107-ICT UbiQIoT : Ubiquitous intelligent platforms for the internet of things:** To further develop a ubiquitous platform called UbiQIoT; a chip platform that solves the urgent need of developing user-defined devices for the Internet of Things (IoT) with typically tight miniaturization/cost/lifetime/security requirements, while making their design process as simple as the popular Arduino prototyping boards. (PI: Massimo Alioto, NUS)
- 51.ING15108-ICT zSense: A novel technology to allow shallow depth gesture recognition on smart wearables:** : a novel close-proximity gesture recognition technology that consumes significantly low energy and computational power that allows it to be a practical solution for smart wearables. (PI: Suranga Nanayakkara , SUTD)
- 52.ING1611115-ENG Silicon Nano Solid Oxide Fuel Cells (Si-nSOFCs):** A lightweight, ultra-portable, and easily scalable fuel cell power source has been developed that can replace existing battery and conventional fuel cells as a longer lasting portable power source. (PI: Su Pei-Chen , NTU)
- 53.ING1611116-ENG Invisible Earphones/Headphones -A new generation of personal audio devices:** A new-generation of 'personalized' audio-devices for ubiquitous smartphone/tablets. This will provide the first-ever private listening-zone in free-field without wires and without the need for earphones or headphones. (PI: Ge Tong , NTU)
- 54.ING1611117-ICT A fully automated cloud based testing solution for mobile apps:** A testing solution that systematically explores a given app to find various types of defects such as app-crashes, sluggish performance, energy-inefficient behavior. Since the testing solution is fully automated, it can be simultaneously run on multiple devices at the same time, thereby reducing required cost and time. (PI: Abhik Roychoudhury ,NUS)
- 55.ING1611118-ICT An audio content based semantic music search system:** An algorithm can help users select music by identifying the arousal, valence and tempo of a music piece from its audio content . (PI:Simon Lui , SUTD)
- 56.ING11611119-BIO Enzyme-Nanoencapsulator Technology based Prodrug Therapy:** A tumor targeting particle is designed for cellular uptake in tumor cells and for releasing a prodrug therapy within the cell. (PI: Chester Drum ,NUS)
- 57.ING1611120-BIO An integrated platform for non-invasive continuous blood glucose monitoring :** A cloud based diabetes management platform technology combines novel noninvasive glucose monitoring technology and deep learning algorithms, which can achieve ISO15197 standards (PI: Sunny Sharma , NTU)
- 58.ING1611121-BIO Child Fever Palette – an innovative stack pad test for low-cost, rapid detection of most common causes of fever in children:** A Child Fever Palette multiplex assay, based on the proprietary StackPad technology, is able to diagnose the six most common causes of child (pediatric) fever in under 5 minutes at a price of a few dollars (PI: Robert Marks , ETPL DxD Hub)
- 59. ING-000061 BIO Antibody-based expansion of  $\gamma\delta$ T cells for cancer immunotherapy:** Monoclonal antibodies specific to human V $\delta$  chains have been identified that can expand  $\gamma\delta$ T cell subsets ex vivo. The ultimate goal is to develop  $\gamma\delta$ T cell-based cancer therapy.(PI : Liu Haiyan, NUS)
- 60. ING-000066 BIO Rapid in vivo identification of corneal pathogens using a non-invasive scanner:** A device for the rapid, non-invasive, all-optical in vivo identification of corneal pathogens including bacterial and fungal microorganisms. The novel device will be able to establish a confirmed diagnosis in less than 5 minutes. (PI : Roger Beueerman, SERI)
- 61.ING-000074 ENG Robotic precision drilling system for unstructured environments** An automatic robotic drilling system. This task has been identified by Airbus as highly laborintensive, yet extremely difficult to automate, precisely because of contacts and unstructured environments. This robotic system can also be used by many other high precision industries in Singapore and worldwide. (PI : Pham Quang Cuong, NTU)



**62. ING-000099 ENG 3U Cubesat with an image payload for global food security** A Singaporean CubeSat to cater to the growing commercial needs in agricultural imaging. A collaborative partner, OpalCrest already uses images and artificial intelligence to process the data from satellites, however this step will provide an integrated solution and will make Singapore the only “satellite as a service” center for agriculture commodity analysis in the world. (PI : Luo Sha, NUS)

**63. ING-000101 BIONatriuretic peptide analogues with vasodilatory or renal activities for personalized care of heart failure patients** Novel natriuretic peptides have been discovered for developing personalized therapies for the treatment of heart failure. (PI : Kini Manjunatha , NUS)

**64. ING-000112 ENG Waste-to-value: An Integrated, Economical System for Waste Shell Fractionation:** A new, advanced technology is proposed to fractionate and recover all the three major components in the seashell including chitin, proteins and CaCO<sub>3</sub>, by using green and simple processes comprising 1) employment of CO<sub>2</sub> to remove CaCO<sub>3</sub> and 2) extraction of protein by urea. (PI : Yan Ning , NUS)

**65. ING-000139 BIO Next Generation Neurotechnology Device Platform:** A series of devices and collaborators to explore commercial opportunities in peripheral nerve stimulation to treat disease.(PI : Percy Luu , NUS)

#### Ignition Grant (Proof of Principal Grant)

**66.ING09005(IGN) Terahertz Swept Source Optical Coherence Tomography:** A laser imaging system for the thicknesses measurement of polymer layers using terahertz frequency light (PI: Qing Hu, MIT).

**67.ING09006(IGN) A Platform to Prime Peripheral Blood Monocytes for Induction into Multi-and Pluripotency:** A new break-through technology to convert autologous somatic cells (i.e. peripheral blood monocytes) into induced pluripotent stem cells (IPS) (PI: Michael Raghunath, NUS).

**68.ING09011(IGN) Vector Control of Dengue Mosquito Larvae/Pupae Using Ultrasound:** Using portable ultrasound to destroy mosquito breeding (PI: Alfred Tan, SMART-MIT).

**69.ING10015-BIO(IGN) Modeling Human Liver Cancer in Humice:** Construct a human Hepatocellular carcinoma (HCC) mouse model with oncogene-modified human hepatocyte progenitors and use it as a platform for studying anti-HCC modeling therapy. The same approach will be applicable to other non-hematopoietic stem cells to construct different tissue-specific cancer models. It is anticipated that such humanized mouse models will greatly facilitate the development of anti-tumor drugs and other therapeutic strategies (PI: Chen Jianzhu, SMART-MIT).

**70.ING10016-BIO(IGN) Isolation and Purification of Heparin:** Heparin is one of the oldest drugs in the market and it is commonly used as an anticoagulant. The aim of our project is to simultaneously isolate heparin from porcine tissue and cleanse it of infectious prions and viruses using molecularly imprinted polymers (MIPs) (PI: Tong Yen Wah, NUS).

**71.ING10017-BIO(IGN) An Endovascular Implant for the Treatment of Aortic Aneurysms:** To develop and evaluate the feasibility of a novel endovascular implant that will overcome the shortcomings of commercially available stent grafts in the treatment of aortic aneurysms (PI: Benjamin Chua, NUS).

**72.ING10018-BIO(IGN) Platform Technology to Enhance Affinities of Antibodies:** Propose to strategically incorporate proline residues in the flanking segments of complementarity determining regions (CDRs) to enhance binding efficiency of single-chain variable antibody (scFv6) (PI: R Manjunatha Kini, NUS).

**73.ING10019-BIO(IGN) Adaptable Optical Microscopy Technology:** Employ a large illumination aperture and incoherent source to perform label-free live cell imaging thereby providing a tool for quantitative high-resolution and label-free analysis of cellular morphology (PI: Colin J.R. Sheppard, NUS).

**74.ING10020-ENG(IGN) Integrated Micro Fuel Cells on Porous Silicon:** To provide a novel design and fabrication of monolithically integrated micro fuel cells on silicon with stable and high energy density (PI: Seyed Ali Mousavi Shaegh, NTU).



**75.ING10021-ICT(IGN) WiFi Solution for High Data Rate Requirements:** A wireless network solution for enterprise and community networks that has been primarily designed to cater to the exploding growth in Wi-Fi technology use (PI: Mehul Motani, NUS).

**76.ING10022-ENG(IGN) Applications for Nanosegregant-Engineered Resins/Membranes:** Newly invented nanomaterial, to engineer high performance capacitors for energy storage as well as other applications using unique properties of the material (PI: Xie Xian Ning, NUS).

**77.ING11024-BIO(IGN) Generation of autologous pericyte progenitors from peripheral blood for therapeutic angiogenesis:** Pericytes are specialized cells that facilitate blood vessel formation, maintenance and function. The team has developed a proprietary process to grow potential pericyte progenitors from peripheral blood in therapeutically relevant amounts. These cells represent a potential breakthrough in cell-based therapy. Project will seek to fully characterize these cells functionally *in vitro*, establish a patentable marker profile, and to confirm their homing behavior in animal models (PI: Michael Raghunath, NUS).

**78.ING11025-BIO(IGN)  $\mu$ Magnetic Resonance Relaxometry for label-free, rapid malaria diagnosis:** new system for sensitive, quantitative and rapid detection of parasitemia level in malaria parasites infected red blood cells (iRBCs) by means of based Magnetic Resonance Relaxometry (MRR) (PI: Peng Weng Kung, SMART).

**79.ING11026-BIO(IGN) Partially biodegradable percutaneous caval valve implantation for severe tricuspid regurgitation:** Aims to create a competent unidirectional valve in the superior and inferior vena cava. This serves to prevent high systolic pressures to be transmitted distally to the end organs, permit improved forward flow and translate into improved symptoms (PI: Edgar Tay, NUS).

**80.ING11029-ENG(IGN) A Hybrid Composite Desiccant/Nano-Woven Membrane Air Dehumidifier for Warm and Humid Climates:** To dehumidify moist air using a novel hybrid system integrating composite desiccant/nano-woven membrane. The hybrid system promotes energy efficiency in high latent load removal and allows greater capacity for air dehumidification particularly when low humidity is desired. Focus on developing the state-of-the-art dehumidification technology for cooling in buildings to dramatically improve energy efficiency. A commercial turn-key product is expected soon and will enable new levels of filtration performance in diverse applications with a broad range of environments and contaminants (PI: Ernest Chua, NUS).

**81.ING11030-ENG(IGN) Solution-Processed Conducting Polymers for Transparent Electrode of Optoelectronic Devices:** Develop novel approaches to prepare solution-processed conducting polymer films with conductivity and transparency comparable to Indium tin oxide (ITO) (PI: Ouyang Jianyong, NUS).

**82.ING11039-BIO(IGN) Novel Glaucoma Drainage Device:** Glaucoma Drainage Devices (GDD) design contains novel features for the drainage tube and plate that not only reduce failure and post-operative complications, but are also easier to deploy (PI: Paul Chew, NUS).

**83.ING11040-BIO(IGN) Targeted liver cancer drug delivery through sugar-functionalized nanoparticles:** To perform proof-of-concept test of a novel sugar-targeted nanoparticles drug delivery method to liver cancer using existing drug Nexavar (sorafenib) (PI: Ge Ruowen, NUS).

**84.ING12041-BIO(IGN) Development of a novel integrated workflow for the production of dihydroartemisinic acid, a metabolite of the anti-malarial and antitumor prodrug, artemisinin:** A metabolic pathway in a microbe is engineered using synthetic biology techniques to produce isoprenoids (PI: Too Heng-Phon, NUS)

**85.ING12047-BIO(IGN) Adapting (Niche Biology for the ex vivo Expansion of (Mesenchymal Stem Cells (MSCs) Towards Off-The-Shelf Therapeutics) :** The system will produce therapeutically relevant quantities of mesenchymal stem cells in ex vivo culture without the loss of their biological potency. This will result in more potent therapeutics using MSCs. (PI :Krystyn Van Vliet, SMART)

**86.ING12048-BIO(IGN) A Field-Friendly Immune Surveillance System :** Development of a point-of-care field-friendly system to assess exposure to infectious agents or the effectiveness of their vaccines. The vaccines uses a microarray-based technology and can be customized according to the range of pathogens/vaccine panels to be screened. (PI : Megan McBee, SMART)



- 87.ING12049-BIO(IGN) “Photopette” – Reinventing the Photometer for the Modern Life-Scientist :** An entire spectrophotometer has been incorporated into a handheld pipette to serve the modern researcher in life-science/molecular biology/microbiology/pharma labs. It provides spectrophotometric measurements with an ultra convenient handling and a simple and fast work flow. ( PI : Dieter Trau, NUS)
- 88.ING12050-ENG(IGN) Super UV Luminescence from Hydrogen-doped Single ZnO Nanorod: Property Evaluation and Optimization at Nanoscale :** An improvement in the UV emission of solution-grown ZnO nanorods through hydrogen doping has been developed. This makes possible nanoscale UV Luminescence sources and lasers. The use of solution grown ZnO nanorods can also impact solid state lighting and solar cells. (PI : Chua Soo Jin, NUS)
- 89.ING12051-ENG(IGN) Development of Green and Recyclable Supported Metal Nanoparticles-Based Catalysts for Oxidation Reactions of Biomass-derived Alcohols :** Heterogeneous nanoparticle based catalysts have been developed which can be removed by filtration or centrifugation at the end of the reaction. The application will be for selective oxidation of alcohols to their corresponding aldehydes on ketones for industrial application. ( PI : Zhu Yinghui, A\*Star)
- 90.ING13058-BIO(IGN) Synthetic Surface Coating for Xeno-free Stem Cell Culture :** Regulatory requirements are pushing stem cell markets towards the usage of animal free (xeno-free) culture media. In this project, cell culture ware is coated with a synthetic polymer that can solve this problem completely by replacing protein coatings and costly surface treatments. (PI : Michael Raghunath, NUS)
- 91.ING13059-BIO(IGN) Real-Time Continuous Organ Perfusion Monitoring for Organ Viability :** A device monitors graft perfusion, potentially reducing the morbidity and mortality associated with liver transplant and allowing early graft salvage from vascular thrombosis. (PI : Victor Lee Tswen Wen, SGH)
- 92.ING13060-ENG(IGN) Waste-Heat Driven Dehumidification Systems for Energy Efficient Air Conditioners in Electric Vehicles in Tropical Regions :** A novel solid state desiccant is developed to dehumidify air before it is cooled. Regeneration of the desiccant uses waste heat. Target market will be in electrical vehicles where it will have a significant impact on vehicle range. (PI : Ulrich Stimming , TUM-CREATE)
- 93.ING13061-ENG(IGN) A New Energy Efficient Method to Fractionate and Process Waste Oils for Biodiesel Production :** A novel 2-step process has been developed to convert non-edible vegetable oil feed-stocks with high free fatty acid (FFA) content into biodiesel , which cannot be converted using conventional biodiesel plants. (PI : Song Sin Nee, Republic Poly)
- 94.ING13062-ENG(IGN) CuDDler -Interactive Pet Companion for Elderly :** An interactive pet companion for the elderly (called “CuDDler”) uses unique patent pending technology to recognize verbal and non verbal acts that are tied to the emotional state of a person. CuDDler can provide 24x7 around the clock, always on and unconditional companionship to the elderly. (PI: Tan Yeow Kee, I2R)
- 95.ING137063-BIO(IGN) Production of Low Cost Xylooligosaccharides (XO) from Xylan by Using Xylanase Enzyme:** A newly isolated strain of Clostridium together with membrane-based technology is used to facilitate simultaneous synthesis and recovery of XO. By using this technology, we estimate that XO can be produced in a larger quantity and high purity (>95%) with a lower cost. (PI: Yang Kun Lin, NUS)
- 96.ING137064-BIO(IGN) Micro-Needles for Keloid Management Based on the Contact Inhibition Effect:** To provide a cost-effective modality for management of keloids, specifically based on the contact inhibition effect. We will design and utilize a microneedle device to reduce and prevent the proliferation of keloid fibroblasts which play a key in the formation of keloids. (PI: Xu Chenjie, NTU)
- 97.ING137065-BIO(IGN) Nano-Advantaged Surfaces for Biosensing : Development of Cutting-Edge Diagnostics:** To develop a target specific carbohydrate diagnostic for blood or tissue samples to screen sugar-galectin binding pairs, and quantify galectin expression level for specific diagnostic purposes. (PI: Liu Xuewei, NTU)
- 98.ING137066(IGN) Biophysically Derived Mesenchymal Stromal Cells (MSCs) for Human Therapy:** Support production and early clinical testing of a potent therapeutic based on a patented subset of MSCs.(PI:Krsytyn Van Vliet, SMART)
- 99.ING137067-BIO(IGN) Photopette Phase 2 – Manufacturing a Novel Photometer Device for the Modern-Life-Scientist : To**



# SMART Innovation Centre

## Current Project List

12<sup>th</sup> Grant Cycle



build 20 devices and 2000 disposable measurement tips. The devices will be distributed to partner labs and early adaptors for testing. (PI: Dieter Trau, NUS)

**100.ING137071-ENG(IGN) Design of Next Generation Membrane for Fuel Cell Applications:** To develop a new type of membrane technology that addresses the cost issues that currently hinder fuel cell systems by replacing the Nafion membrane in a traditional PEMFC with a far more cost effective technology. (PI: Chad Mason, TUM)

**101.ING137072-ENG(IGN) Development of High Yield Automated Marine Rearing System:** A novel design that allows the system to be deployed in existing open pond and tank systems enabling eggs, larvae and fries to be farmed in an intensive manner in a single enclosure for the entire period, with automated and effective water change. (PI: Foong Shaohui, SUTD)

**102.ING137073-ENG(IGN) Impedance Spectroscopy On Battery Stacks for Continuous Battery Lifetime Monitoring In Electric Vehicles:** To use impedance spectroscopy for continuous monitoring of impedance of every cell in the battery pack to make a better prediction of the age and the remaining lifetime. Useful for battery packs in cars, buses, Etc. (PI: Reinhold Koch, TUM)

**103.ING137075-BIO(IGN) A Membraneless Clog-Free Microfiltration System for Large Scale Cell Retention From Perfusion Bioreactors:** To develop a microfiltration system that exerts minimum damage to the cells, maintains a high cell viability, cleanable, sterilizable, reusable and cost saving. This microfiltration system will form part of bioreactors. (PI: Han Jongyoon, SMART)

**104.ING14081-ENG (IGN) Self-retaining lighting system for open deep cavity surgeries:** The device is small, easy to use and provides sufficient and consistent lighting for the targeted deep cavity surgical procedures. (PI: Tan Ngian Chye, NCCS)

**105.ING148082-ICT (IGN) Planar Structure Designer (PS-Designer) A design tool and service that deliver construction kits for onsite concrete casting:** "PS-Designer" is a generative CAD tool that creates kits of parts from 3D models based on rules for physical manufacturing. Construction kits for onsite concrete casting are developed for any shaped structure from simple rectangular shapes to complex curved forms at similar costs. (PI: Chen Lujie, SUTD)

**106.ING148083-ENG (IGN) High quality 8" III-V engineered substrates on Si:** This technology is used to make Ge-on-insulator (GOI) wafers, with the goal of making large (8") III-V engineered substrates (such as InP) on low cost 8" Si substrates that can be used by the compound-semiconductor industry (PI: Kenneth Lee, SMART/LEES)

**107.ING148084-ENG (IGN) Self-driving pace car for formulae E:** To develop and demonstrate in a safe yet high-profile fashion self-driving technology, at speeds and under conditions that are representative of highway driving for production vehicles (PI: Emilio Frazzoli, SMART/FM)

**108.ING148085-BIO (IGN) Pulsed electromagnetic field (PEMF) systems to promote the maintenance of bone and muscle:** Pulsed Electromagnetic Field (PEMF) systems are developed to enhance recovery of individuals having undergone Anterior Cruciate Ligament reconstructive surgery during their normal rehabilitation protocol. (PI: Alfredo Franco-Obregon, NUS)

**109.ING149092-ICT (IGN) Future Mobility Sensing:** A mobile phone platform provides a new brand of activity-based analysis by monitoring what people do (over an extended period of time), not what they say they do (at one point of time). This mobility sensing application will increase the effectiveness of policy and investment decisions by public and private entities that impact the everyday lives of citizens. (PI: Zhao Fang, SMART/FM)

**110.ING149093-ICT (IGN) zSense – A novel technology to allow shallow depth gesture recognition on smart wearables:** A novel gesture recognition technology enables recognition of close proximity gestures while consuming low processing power and energy. The application is ideal for smart wearable devices with limited battery and processing power. (PI: Suranga Nanayakkara, SUTD)

**111.ING149094-ENG (IGN) CMOS THz imager for non-invasive and portable security scanner:** A CMOS full-integrated THz imaging system has been developed. The application is for portable and non-invasive security scanning. (PI: Hao Yu, NTU)

**112.ING149095-ENG (IGN) An intelligent system for determining sources of air pollution:** A novel sensing system (LEDIF-Air) is developed to simultaneously detect key pollutants and quickly identify potential sources of air pollution. The system has particular application when accuracy and mobility are required. (PI: Kelvin Ng Chee Loon, SMART/CENSAM)



**113.ING149096-ENG (IGN) Large-area direct-write lithography with CMOs integrated LED arrays:** This novel monolithic CMOS integrated LED array is designed to provide mask-less prototyping of integrated circuit chips. The high packing density of the micro-nano-LED array will solve the low throughput issue faced by most of other mask-free lithography techniques. (PI:Zhang Li, SMART/LEES)

**114.ING149097-ENG (IGN) Development of proton exchange membrane fuel cell and fuel processor with an energy efficient thermal management system:** A novel heat transfer system is designed for an exchange membrane fuel cell/fuel processor combination. Heat is removed from the fuel cell and is transferred to the fuel processor with a 38% energy saving compared to the conventional thermal management system. (PI:Sundar Pethaiah,TUM)

**115.ING149098-BIO (IGN) Ultra-fast full range optical coherence tomography for real-time human eye imaging:** An ultra-fast full-range line-scan SD-OCT system for real-time imaging of the human eye is disclosed. The system would provide an affordable and accurate system with full eye imaging. (PI:Chen Nanguang, NUS)

**116.ING149099-ENG (IGN) Commercializing EVA-Electric Taxi for Singapore:** EVA is an electric passenger car specifically designed as a taxi for tropical megacities like Singapore. It incorporates a super-fast charging concept to ensure long operating times without hours-long charging breaks. (PI:Stephan Schickram, TUM)

**117.ING1510109-BIO (IGN) Novel aldehyde-free double crosslinked tissue adhesives for seroma prevention and other in vivo application:** to develop a novel aldehyde-free double-crosslinked tissue adhesive for seroma prevention and other in vivo applications. (PI:Wang Dongan, NTU)

**118.ING1510110-BIO (IGN): Novel device for managing esophageal anastomotic leaks a medical device that:** (a) removes the fluids in the abscess cavity and (b) seals the defective operational site to prevent further leakage into the abscess cavity. (PI:Asim Shabbir,NUHS)

**119.ING1510111-BIO (IGN): Development of posterior capsule shield using Robotic technology for cataract surgery (PROTECTS) device:** To develop a soft robotic posterior capsule shield to prevent posterior capsule rupture during cataract surgery. (PI: Marcus Ang,SNEC)

**120.ING1510112-ENG (IGN) Development of novel sustainable concrete products with the ability to gain strength by sequestering CO<sub>2</sub>:** Reactive magnesia (MgO) cement offers technical and sustainability credentials over traditional Portland cement. This area will be developed to determine a first market opportunity (PI:Cise Unluer, NTU)

**121.ING1510113-ENG (IGN) Next generation silicon fuel cells with robust membrane stability:** to demonstrate scalability of a silicon fuel cell using industrial silicon semiconductor foundry process, and to develop a stack level prototype. (PI: Su Pei Chen, NTU)

**122.ING1510114-ENG (IGN) Towards a new digital image sensor based on the negative photoconductivity effect in the soft breakdown oxide:** The technology represents a potential solution to the dark current noise issue in the CMOS image sensor. Moreover, the nanometer size breakdown region allows closer separation between individual sensing elements without any crosstalk problem, thus enabling further enhancement of the digital image resolution into the several tens of mega pixels range. (PI:Ang Diing Shenp, NTU)

**123.ING1611122-ENG (IGN) Multicolour LEDs on 8" Si wafers:** The combination of LEES-developed AlGaInP red LEDs, InGaN LEDs and semiconductor conversion layers on 8" Si wafers, along with LEES proprietary wafer bonding schemes, provides a multicolor LED device. The wafer provides full integration of red, green, and blue LEDs with Si-CMOS. (PI: Wang Bing, SMART LEES)

**124.ING1611123-ENG (IGN) Piezoelectric Antenna:** An antenna array for 5G cellular networks where speed requirements are of the order of 1 Gb/s. The piezoelectric antenna array will result in more compact mobile phone handsets and wireless handheld devices. (PI: Huang Shaoying, SUTD)

**125.ING1611124-ENG (IGN) Remote autonomous powered sensing (RAPS):** A solar powered device capable of tracking the flow of goods and containers globally. More generally, we have developed a power solution for persistent autonomous remote sensors that combines low-power communication electronics, developed at the SMART LEES (Low-Energy Electronic Systems)



IRG, with solar power systems, developed at the MIT PVLab. (PI: Tonio Buonassisi, SMART LEES)

**126. ING1611125-ICT (IGN) Telepresence robot apps for elderly care service:** A telepresence robot to assist in elderly care and to detect emergency situations through voice classification and activity analysis. The telepresence robot is able to trigger an alert in case of emergency situations. (PI: Zuo Bingran, SMART FM)

**127. ING1611126-BIO (IGN) Automatic chronic wound assessment system and monitoring using a smartphone and mobile imaging :** An automatic wound assessment system using a smartphone and novel imaging and machine learning algorithms will provide objective, quantifiable and timely diagnosis of wound healing. (PI: Cheung Ngai-Man, SUTD)

**128. ING1611127-BIO (IGN) Superabsorbent hydrogels for the treatment of disorders associated with excessive food consumption :** Orally ingestible agents are developed to reduce food consumption, leading to prevention of weight-gain, promotion of weight-loss, and additional metabolic benefits (PI: Sujoy Ghosh, NUS)

**129. ING-000067 ENG IGN Development of novel impact resistant bio-inspired materials using novel 3D fabrication technique :** An impact-resistant material is fabricated by controlling the orientation of the polymer fibers within the composites. The architectural design will enable the composites to absorb mechanical energy before they fracture or rupture. Such composites can find applications in sporting goods as impact resistant materials. (PI : Avinash Baji, SUTD)

**130. ING-000070 BIO IGN Combining pEffects of Pulsed Electromagnetic Fields (PEMFs) on Breast Cancer Progression in Post-Menopausal Women:** A novel non-viral based  $\lambda$ -integrase mediated transgene targeting system was developed that can precisely insert multi-transgene cassettes (~10Kb or even more) at known loci of human genome with appreciable efficiency, minimal safety concerns and has been validated in a spectrum of cell lines including human embryonic stem cells. (PI: Alfredo Franco-Obregon, NUS)

**131. ING-000091 ICT IGN Acoustic Analytic Apps for Smart Telehealth Screening – creating a big data** An e-health application is developed to optimize perioperative patient screening using computer assisted analytics, machine learning, and algorithms to objectively assess the acoustic quality of a patient's cough. (PI : Hee Hwan Ing, SingHealth)

**132. ING-000115 ENG IGN Slicing of Diamond using thermo-chemical process:** A thermo-chemical machining process using an ultra-thin wire to slice diamond workpieces with produce insignificant material loss and no surface damage to the cutting plane. (PI : Rahman Mustafizur, NUS)

**133. ING-000133 BIO IGN Silencing bacterial communication (“SilenceBac”): Natural and derivative quorum sensing inhibitors to overcome bacterial resistance:** SilenceBac has the potential to provide a novel therapeutic means for controlling or preventing pathogenic bacterial infections. It can also be used in a synergistic way so as to enhance the performance of antibiotics against multi-resistance phenotypes. (PI : Karina Gin, NUS)

**134. ING-000134 ENG IGN High-Speed Infrared Dopant Profile Mapper for Solar Cell Process Control:** A miniature mapping tool for the solar cell fabrication uses several wavelength bands across mid-/far-infrared to probe the p-n junction and dopant profile of silicon wafers. This tool will be used to analyze and control the diffusion process that forms the heart of the solar cell production. (PI : Johnson Wong , NUS)

**135. ING-000140 ENG IGN GaN Transparent Transistors:** Transparent and high performance GaN transistors are produced and tested. (PI : Liu Zhihong, SMART LEES)

**136. ING-000141 ENG IGN Solar powered GPD Tracker :** A GPS tracker will be field tested to locate shipping containers using an energy concerning solar-powered system (PI : Tonio Buonassisi , SMART LEES)