SFI TIDA Project Titles	Lay Abstract
Dr Robert Sheehan (CIT) Development of Athermal Laser for Deployment in Data Centre WDM Transmission Systems Award: €125,501	More and more people are using entertainment services such as Netflix and YouTube. To ensure everyone can watch their favourite shows without delays or buffering interruptions we need to develop the system over which data is sent with more laser technology. At the moment laser technology is not being used too much since it is expensive and uses a lot of electricity. This project aims to create low-cost lasers which operate without cooling, these can be put into the system to allow more data to be transmitted which will prevent delays and buffering interruptions from occurring in the future.
Dr Aisling Byrne (DCU) Core-Shell Nanoparticles with Spatially Separated Reference and Probe for Ratiometric Oxygen Concentration and pH In-Cell Sensing Award: €121,279	The oxygen levels and pH inside living cells indicate if they are healthy. Means to measure these parameters are very valuable to pharmaceutical and biotechnology sectors who routinely want to understand cell health in response to therapeutics. Currently such measurements are difficult to make accurately. We will develop O2, and pH sensors that can be easily used to give accurate insight into cell health using conventional lab instrumentation. The sensors comprise tiny particles, that can be directed inside the cell at defined regions to allow them to monitor the cellular environment dynamically without causing damage to the cell.
Prof Martin Clynes (DCU) A new monoclonal antibody directed against a novel cell surface cancer target: research towards development of a new cancer therapeutic agent.	Aggressive cancers urgently require the development of more effective treatments to improve patient outcome. Therapeutic antibodies work by binding to proteins on the surface of cancer cells, blocking their ability to function or targeting them for destruction by the immune system. We have developed an antibody which binds to a novel protein on the outside of cancer cells and shows low expression in normal tissues. This project will explore the potential of this protein to be targeted as relatively new, highly specific, anti-cancer drug called an antibody drug conjugate (ADC) where the antibody is linked to a potent chemotherapeutic

Award: €128,422	
Dr Creina Slator (DCU) Pre-Clinical Evaluation of Chemotherapeutic Z-DNA Forming Di-Copper(II) Metallodrugs Award: €96,767	Mutations in breast cancer can yield to poor-prognosis of patients affected due to the lack of targeted therapies available. As such, there is an unmet clinical need to expand treatment options. This project seeks to develop a novel class of copper-based anticancer agents for preclinical evaluation. Therapeutic studies will be conducted in a range of mutated breast cancer cell lines and models to understand unique DNA interactions that can overcome innate repair mechanisms. The project presents a promising commercialisation opportunity for the Irish Biopharmaceutical sector in the area of Cancer and Oncology.
Prof Brendan Duffy (TU Dublin) Bio-functional Coating for Osteointegration and Bone Healing of Titanium Orthopaedic Implants (Bio-COHT) Award: €129,656	Over 4,500 hip replacements are carried out in Ireland every year. Almost 500, otherwise successful, surgeries require further intervention to repair the implant because of loosening between the device and the bone. This is painful for the patient and costly for the health service. This project will help to solve this problem by developing a new surface treatment for the implant that will make it easier for the bone and implant to 'stick' together which will improve adhesion and reduce the risk of failure.
Dr Niall Barron (NIBRT) READER LOST IN TRANSLATION - An epi-transcriptomic-based approach for development	The Biopharmaceutical industry uses Chinese Hamster Ovary (CHO) cells to produce therapeutic proteins which are the fastest growing group of medicines today, however they are very expensive to make. Improving CHO productivity will help to reduce the cost of production and ensure future access for all patients. RNA contains the instructions for how to make these proteins in cells. We have discovered a particular chemical modification of RNA that increases the efficiency by which cells can convert these instructions into a

of high producer Chinese Hamster Cells Award: €124,910	protein. We propose to incorporate these modifications using advanced genetic engineering techniques to generate more productive CHO cell lines.
Prof Michael Butler (NIBRT) Production of single structural forms of monoclonal antibodies by solid-state chemoenzymatic transformation Award: €126,506	Monoclonal antibodies (Mabs) are a category of very effective biomedicines developed for the treatment of serious human disorders such as cancer. They are produced from genetically-engineered cells in bioreactors. Their complexity is such that each batch of Mabs contains variable chemical structures with varying effectiveness. This proposal seeks to reduce this complexity through chemical changes during the purification process. The result will be to decrease the complexity of each sample to produce near homogeneous forms of Mabs. This will enable the most efficacious forms to be used in therapy.
Dr Adrienne Gorman (NUIG) Validating promising RIP2 inhibitors as a new therapeutic option in triple negative breast cancer Award: €128,440	There is an unmet clinical need for treatments for triple negative breast cancer (TNBC) which lack targeted therapies and has a 20% lower survival rate than other breast cancers. This project will develop the commercial potential of 15 novel compounds that we have identified that can sensitise TNBC cells to chemotherapeutic drugs thus increasing treatment efficacy. These 15 compounds are predicted to target RIP2, a protein that is present in TNBC cells at high levels and that is known to promote their resistance to chemotherapeutic drug-induced cell death.
Dr Eimear Dolan (NUIG) ImmunoCell: A cell reservoir device for replenishable delivery of natural killer cells for ovarian cancer treatment.	Ovarian cancer is the fifth most frequent cause of cancer death in women. Current standards of care include surgery and chemotherapy however the mortality rates remain unacceptably high. Therefore, new disruptive treatment options are required. Using the body's own immune cells to fight tumours represent a new approach to treat ovarian cancer. However, these immune cells require local delivery to increase efficacy and reduce toxicity. A device that can be implanted close to the tumour can enable ease of

Award: €129,995	access of immune cell therapy. This device can also serve to reduce toxicity associated with delivery through the bloodstream.
Dr Haroon Zafar (NUIG) Development of Smart Endovascular Renal Denervation Verification and Efficacy Device Award: €91,205	Renal denervation (RDN) procedure is aimed at treating high blood pressure not controlled by medication. There is a need for a device that can easily be adopted into the RDN and provide live information to clinicians. The objective of this project is to develop the feasibility of a novel device to provide real-time feedback to clinicians to verify the successful operation of RDN. The proposed device is a sensor that will reside in the patient over the course of the procedure. The device will provide live data pre and post treatment and so confirm whether the procedure has been successful.
Prof Mark Johnson (NUIG) Macroalgae: the next generation functional and sustainable aquafeed ingredients through microbial fermentation (Blooms2Feeds+2) Award: €123,956	This project will develop processed seaweeds for blending into fish feeds in salmon aquaculture. The aim is to generate health benefits in both fish (welfare) and humans (nutrition, i.e. higher salmon quality). Seaweeds can support a sustainable product by reducing environmental impacts and the carbon footprint associated with intensive fish farming. Seaweed polysaccharides can promote gut health in fish and have a positive impact on intestinal integrity and the gut microbiome, potentially stimulating appetite and feed utilisation. The key innovation of this project will be to use advances in fermentation technology, to stabilise and confer enhanced properties on seaweed-based fishfeeds.
Prof Michael Madden (NUIG) Autonomous lifeguard and search system using	Using Computer Vision techniques, collaborators Prof Madden and Dr Enda Barrett propose to enhance the safe-guarding of persons in aquatic environments by automating the detection and tracking of individuals. The proposed system can be deployed using a stationary camera or on a fleet of drones for both search and rescue and safety monitoring. In search and rescue scenarios the system can cover a wide search area with low cost off the shelf drones for a fraction of

computer vision and machine learning techniques to accurately detect people in noisy aquatic environments Award: €124,367	the cost of current search procedures which employ helicopters or low flying planes. In a safety monitoring scenario, the software will monitor patrons reducing the number of personnel required.
Dr Bryan Hennelly (NUIM) Label-free life-science microscope with continuously variable magnification. Award: €112,672	This project aims to build and develop a novel quantitative phase microscope with a number of key advantages over existing research microscopes used in life science: • Continuously variable magnification, resolution, and field of view, by moving the sample. Traditionally, the microscope objective must be changed in order to change magnification and only a small number of discrete magnifications are available e.g. 10x, 20x. • Label free staining of subcellular features. The ability to identify and visualize the cellular nucleus without the use of labels and/or fluorescence microscopes offers a significant breakthrough for the life science community.
Dr Roger Preston (RCSI) A novel pro-haemostatic agent for the treatment of inherited and acquired bleeding disorders Award: €123,313	Individuals with haemophilia exhibit increased propensity to bleed and are treated with a synthetic version of the blood clotting protein they are missing. In addition, there are numerous other medical conditions in which uncontrolled bleeding is life-threatening, such as after major trauma or childbirth. Therapies to control bleeding are available but not optimal. To address this, we have developed a new drug that uses a different approach to promote clotting. In the proposed study, we aim to test this new therapy in pre-clinical models as a precursor to clinical trials in patients.
Dr Olga Piskareva (RCSI)	The development and approval of new oncology drugs are very slow processes. This is mainly due to the big differences in physiology of cancer cells grown on plastic and in native microenvironment. Tissue engineering of tumour systems has a great potential to bridge this gap. This proposal aims to develop a tissue engineered tumour model that can be used in testing new drugs and new combinations of existing drugs. This will reduce the attrition rate of the drug

3D cell culture model of neuroblastoma using collagen-based scaffolds for tumour-immune system interactions and therapeutics screening Award: €128,233	development process and lead to more effective and tailored therapies while lowering associated costs.
Prof Sally-Ann Cryan (RCSI) A Tubular Bioengineered Scaffold that supports Epithelialization and Vascularization for Tracheal Tissue Regeneration (TracheoColl) Award: €116,723	There is currently no definitive treatment for patients with extensive tracheal damage that results in tracheal stenosis or conditions, including tracheal/bronchial cancers that lead to significant, life threatening airway obstruction. This proposal aims to develop an artificial trachea (TracheoColl) using 3D printing technology that can be tailored for a specific patient, seeded with the patients cells and then implanted to regenerate the lost/damaged tissue. By using a mixture of natural and synthetic materials that are known to be biocompatible in the body, this tubular scaffold will maximize tracheal regeneration by promoting airway cells to grow, keeping the airway open, and supporting the development of new blood vessels within the tissue.
Prof Yurii Gun'ko (TCD) Environmentally-safe membranes and adsorbents for complex water treatment Award: €125,630	In many places around the world, clean water is a rare and precious resource. Water for both domestic and industrial use increasingly requires careful control and protection. Improved filter membranes, the basis of the water purification industry, are therefore a key requirement for harnessing this natural resource. The main aim of this proposal is to develop a new generation of membranes for water purification and facilitate the technology implementation by industrial partners in Ireland. New materials and improved processing methods will afford membranes that are more resistant to fouling and blockage whilst improving efficiency and recyclability in filtration processes.

Dr Stephen Maher (TCD) Therapeutic development of a series of clinically relevant novel radiosensitising agents for cancer Award: €129,386	Cancer of the oesophagus, or food pipe/gullet, is an aggressive disease with a poor outlook. The majority of patients with this disease receive treatment with radiation, termed radiotherapy, to shrink their tumours before surgery. Unfortunately, while approximately 30% of patients tumours have an excellent response to radiation, the majority are resistant to treatment. We have identified a number of naturally-occuring molecules, called microRNAs, that increase the sensitivity of oesophageal tumour cells to radiation. In this study we aim to develop synthetic microRNAs and determine if these can be used like a drug to enhance the sensitivity of tumours to radiotherapy.
Dr James Phelan (TCD) Evaluating the immunometabolic potential of desferrioxamine to augment antibiotic treatment against Mycobacterium tuberculosis Award: €127,349	Immune cells change the way that they break down sugars by regulating their metabolism after they are infected with bacteria. This change in metabolism is essential for the production of specific protective proteins, called cytokines, that fight the infection. We will study drug combinations, which are licensed for use in humans at the moment, to enhance the metabolism in cells from the human lung infected with resistant strains of tuberculosis bacteria. We will investigate if we can improve current antibiotics used to treat tuberculosis by enhancing metabolism at the same time and identify ways in which these drug combinations can affect the behavior of immune cells.
Dr Rocco Lupoi (TCD) Supersonic-assisted laser ablation for the deposition of thin coatings at high rates Award: €124,323	Pulsed Laser Deposition (PLD) is widely used to make thin films not amenable to conventional methods, such as thermal evaporation and sputtering. Despite critical technical advantages, PLD presents low deposition rates and currently finds limited applications in industry. In this TIDA we will investigate and assess a new thin film deposition technique (called SALA), based upon PLD principles, but with the potential to deliver high deposition rates and within an atmospheric environment. Laser ablation is used to vaporize the coating material, where it is entrained in a supersonic gas flow and carried at high velocity to a substrate for deposition.

Dr Sarah Doyle (TCD) Investigating the use of IL-36 to reduce oedema and neovascularisation in models of retinal degeneration Award: €127,354	Age-related macular degeneration (AMD), is a blinding condition where central vision is lost. "Wet" AMD is the most severe form of AMD, in which unwanted blood-vessel sprouting and leakage causes blindness. A significant number of patients do not respond to the current therapies for wet AMD, therefore new therapies for this debilitating blindness are needed. We have found that a chemical made by our immune system, which is found naturally in our bodies can control aspects of blood vessel growth. Our research will test how manipulating our immune system can enhance the body's ability to prevent unwanted blood-vessel sprouting in wet AMD.
Prof Ed Lavelle (TCD) Sugar Coating Immunity for Enhancement of Biomaterials Award: €95,811	When an injury is so large that normal healing is compromised, medical implants can support and restore function to the wounded skin. Medical devices constitute a multi-billion euro industry that continues to grow; global medical device manufacturing currently exceeds $200 billion. A major cause of implant failure results from the patient's immune system attacking the foreign material. There is therefore a need to develop materials that are immune-friendly, as natural healing is a vital role of the immune system. By coating biodegradable scaffolds with a natural sugar, we aim to stimulate a healing immune environment to dramatically increase clinical success.
Prof Jacintha O'Sullivan (TCD) Inhibition of tumour angiogenesis as a strategy to circumvent acquired resistance to anti-cancer agents in oesophageal cancer: links to the Irish NEO-AEGIS clinical trial Award: €126,269	Cancer of the oesophagus, the pipe connecting the mouth to the stomach, has a dismal prognosis and few therapies exist. Patients undergo a treatment (chemotherapy and radiation) before surgery to decrease the size of the tumour to make surgery more successful. However, only 70% of the patients do not respond, suffer the toxic side effects, have a delay to surgery, impacting survival. Using scientific, clinical expertise and clinical trial samples, this proposal will examine a novel drug we have developed that could be given with chemotherapy to boost response and ultimately impact survival rates.

Dr Matthew Campbell (TCD) A gene therapy-based approach to epilepsy treatment Award: €125,610	Up to 50 million people worldwide suffer from epilepsy. It is characterised by recurrent, spontaneous seizures caused by abnormal electrophysiological activity in the brain and up to 30% of affected patients will not respond to drug therapy. Recently, we have made a series of discoveries to suggest that a major component of the so-called blood-brain barrier (BBB), namely the gene claudin-5, is significantly disrupted in brain material resected from epilepsy patients during neurosurgery. We hypothesise that re-introducing functioning claudin-5 to the seizure region of the brain will prevent seizure activity and thereby treat refractive epilepsy.
Prof Michael Morris (TCD) Polymer Self-Assembly of Hierarchical Surfaces for Enhanced Phase-Change Heat and Mass Transfer Award: €120,670	Heat is generated in devices such as laptops, tablets and mobile phones. This heat is wasteful in terms of energy and cost and can limit performance. Cooling is normally performed using fans which are noisy and ineffective. Liquid cooling is more efficient, but systems are bulky and costly but familiar to 'gamers' in ensuring maximum performance of devices. We will engineer substrates that can dramatically improve cooling efficiency by enhancing evaporation rate. These substrates provide a technology that would allow reduced running costs, greater performance and a lower energy footprint at a fraction of the cost of other technologies.
Prof Peter Humphries (TCD) Glaucoma gene therapy: standardization of ocular iPerfusion system for use in outflow measurements in human eyes ex vivo Award: €125,791	Glaucoma is one of the commonest vision-threatening diseases. Pressure is necessary within the eye to keep it inflated. If too much pressure builds up, the optic nerve head degenerates leading if untreated to complete blindness. Up to 10% of patients respond sub-optimally to conventional pressure-reducing medications, hence extensive commercial interest in development of improved medications. This proposal addresses one component of a gene therapy in development, currently undergoing validation in primates, and involves optimizing equipment currently in use for monitoring fluid movement from the eyes of rodents such that it can be applied to the human eye.

Dr Stephen Dooley (TCD) Technology for Economically Viable Advanced Biofuels from Lignocellulosic Waste Award: €122,213	Ireland must reduce its CO2 emissions by 20% relative to 2005 levels by 2030. The transport sector is the 2nd largest contributor to our CO2 emissions, due to a reliance of fossil derived petrol and diesel. Researchers at TCD and UL have figured out how to make petrol and diesel from household and plant wastes. This is important, as these biofuels are both made from non-food feedstocks and are carbon neutral. This TIDA allows for tests that will determine how affordably the prototype laboratory technology can actually work in the real world using real world waste materials. This information will inform as to how cheaply the "bio-petrol" and "bio-diesel" produced can be sold for. If the fuels can be produced at a price competitive with fossil petrol or fossil diesel, the technology will greatly aid in decarbonizing the transport sector.
Prof Peter Parbrook (Tyndall) Spectrally pure high efficiency micro-Light Emitting Diodes (microLEDS) using nanostructured active regions Award: €129,987	We use displays every day, whether it be a computer screen, our phones, or a television. Each element, or pixel, in the display contains three elements to emit a controlled amount of red, green and blue light. For the highest brightness high resolution displays inorganic semiconductor pixels are desired. These can be made using so-called microLEDs (micro-light emitting diodes). Tyndall has a strong record in this area with a spin-out company. Here we plan to target a method to create a brighter more controlled pixel emitter using a nanostructure in the light emitting part of the device.
Dr Gerard McGlacken (UCC) Development of novel small molecule therapeutics targeting the ghrelin receptor to modulate appetite	Ghrelin is a gut hormone which is key to the regulation of hunger and resulting weight gain/loss. Compounds that can mimic ghrelin would be of tremendous use in healthcare. Blocking ghrelin could curb appetite and be beneficial for weight loss, whereas enhancing the hunger signal would be hugely beneficial in clinical situations where muscle wastage can be fatal. There are currently no commercial drugs targeting ghrelin. We have developed a compound which activates the ghrelin receptor and increases appetite in mice. Further chemical synthesis and biological studies

Award: €129,502	are required to bolster our initial findings and move towards a viable drug.
Prof Thomas Walther (UCC) Development of an angiotensin II type 2 (AT2) receptor specific non-peptidic agonist based on in silico modelling, in vitro approaches, and functional assays Award: €128,912	The main goal of this project is to identify unique compounds which can stimulate the very beneficial AT2 receptor to preserve vessel function. We will develop small molecule drugs to be tested in clinical trials for the treatment of the life-threatening acute lung injury, with possible future applications in other diseases where dysfunction of the vessels is central to pathology, such as cerebral malaria or haemorrhagic fever. The creation of an exploitable portfolio of intellectual property around our new therapeutics will lay the ground for a new company, which has the potential to drive economic growth and employment in Ireland.
Dr John Morrissey (UCC) New yeast strains for production of low-FODMAP baked products Award: €108,587	An increase in food intolerance has created a growing market for speciality foods that are gluten-free, lactose-free or low-FODMAP. This project will develop novel yeast strains that can be used to make bread and other baked products that are low in FODMAPs. These food components are small chains of sugars and other molecules that are associated with intestinal discomfort and bloating. The new yeast strains from this project will naturally remove FODMAPs from dough during fermentation (bread-making) and will allow bakers make baked products suitable for suffers of IBS and other intestinal disorders.

Dr John O'Toole (UCC) Neuromonitoring of preterm infants in intensive care (NeuPIC): continuous grading of the electroencephalogram using artificial intelligence Award: €124,712	Worldwide, over 2 million infants born prematurely are at an increased risk (1 in 3) of brain injury. This injury can be fatal or can result in a lifetime of disability. Knowing which infants are at risk ensures that that the right infants get the right medical care at the right time. We propose to develop a computer-based system that can continuously monitor the brain health of the infant in intensive care. We will pursue commercial pathways to transition this technology from academia to industry in order to safeguard the brains of this vulnerable population.
Dr Gabriella Farries (UCD) An integrated genomics and transcriptomics approach to the development of predictors of aerobic fitness and training adaptation for application in the Thoroughbred industry Award: €73,054	The Thoroughbred racing industry is a multi-billion euro global industry, in which Ireland is a key player. Currently racehorse trainers and breeders rely on pedigrees and observation of the horse to make decisions about the selection and training of horses. This project aims to identify genetic markers to be used to inform industry professionals about the genetic aptitudes of horses in terms of aerobic fitness and response to exercise training, a characteristic shown to be under genetic control in humans. Markers identified can then be developed into a genetic test to be sold to the Thoroughbred industry globally.
Dr Fiona McGillicuddy (UCD) Development of a novel biomarker-based clinical management platform for obesity and associated comorbidities Award: €119,853	2.2 billion people worldwide are obese. Obesity increases the risk of heart disease, diabetes and cancer however not all obese people develop these conditions. Identification of individuals at highest risk would guide clinicians to the appropriate treatment plan to prevent associated diseases. We have identified a panel of markers that change on high-density lipoprotein (HDL) particles ('good-cholesterol') in obesity and these markers could distinguish between healthy and unhealthy obese individuals. In this grant we will develop a new high-throughput method to isolate HDL from blood and in parallel we will produce a robust diagnostic test to measure these markers.

Dr Crystal O'Connor (UCD) Development and Comprehensive Market Analysis of Cyclic AB Substrates as a Safe, Sustainable and Economical Hydrogen Storage Medium Award: €106,227	H2 is an abundant and clean source of energy. However, direct storage of H2 requires high-pressure containment in metal cylinders which presents significant safety hazards and inefficiencies. A safer and more reliable method is chemically incorporating H2 into an appropriate carrying material, i.e., ammonia borane (AB) and release H2 using a specific catalyst. AB regeneration is problematic due to the nature of dehydrogenated products. Cyclic AB analogues are liquids at room temperature and are dehydrogenated into well-defined products. These products can be catalytic re-hydrogenated off-board using high-pressure H2 which has the commercial advantage of using low-cost H2 gas.
Dr James Rice (UCD) A Nanomaterial Composite Sensor Platform Award: €101,907	Effective and early detection of sexually transmitted diseases (STDs) is critical to good patient outcomes and in stopping the emergence of antibiotic resistance strains. As STDs are a growing public health problem in Ireland and internationally there is a very strong demand for diagnostic solutions. Proposed is to create a method that blends the use of laser-based sensing with materials science to detect STDs on-the-spot. Our technology brings benefits relative to current approaches in speed, accuracy and cost, these are the significant factors that medical practitioners are demanding in new STD monitoring technology.
Dr Akeem Olaleye (UL) Smart Flow Aids for Efficient Transport of Cohesive Dairy Powder Award: €111,280	Cohesive powder transport is one area in dairy processing responsible for poor powder quality and production downtime. To develop a novel transport system capable of handling cohesive powders, we propose flow-aided pneumatic conveying components. Our aim is to perform experiment and numerical simulation on pneumatic transport of cohesive/sticky powders. The experiment will be conducted in our existing test rig modified with flow-aids at the pipe bends. We will utilize the experimental data to validate the numerical model. Our findings will advance our understanding of cohesive powder transport and help shape the design and deployment of improved conveying systems.

Dr Sinead O'Keeffe (UL) Photonic Sensor for Brachytherapy Dosimetry Award: €125,072	This project aims to advance the development of novel optical fibre sensors to monitor the amount of radiation cancer patients receive during brachytherapy (a form of cancer treatment using radiation sources internal to the body). This will ensure optimum radiation dose to the tumour, while ensuring nearby critical structures (e.g. urethra and rectal wall) do not receive too much radiation. Such low dose rate sensors currently don't exist and the information provided by these sensors would play a crucial role in the decision-making process for personalised dose-led brachytherapy treatment.