SIRG Proposal Titles	Proposal Lay Abstract
Joseph Byrne – NUIG Carbohydrate-based sensing materials as platforms for 3D-printed microfluidic pathogen detection devices with diagnostic and environmental monitoring applications. Award: €419,585	Rapid diagnosis of bacteria is vital to inform appropriate medical treatment strategies and combat increasing antibiotic resistance globally. Many bacteria produce specific 'carbohydrate-binding proteins'. Designing modular luminescent sensors containing carbohydrate (sugar) molecules, which will show colour changes (fluorescence) upon binding with these characteristic proteins is an underexplored diagnostic strategy. We will incorporate these sensors into polymer materials and use the emerging technology of 3D-printing to create innovative bio-sensing microfluidic devices for use in clinical diagnostics (and environmental monitoring), giving the user easily-read visual feedback. This can address problems such as diagnosis of P.aeruginosa infection, a key cause-of-death in CF patients.
Gediminas Juska – Tyndall National Institute (UCC) Deterministic photonic cluster states from Pyramidal site-controlled quantum dots for measurement-based quantum computation. Award: €422,593	The unparalleled calculation power of quantum computers will transform multiple aspects of present life. However, building one is a formidable task. Maintaining and continuously performing multiple quantum interactions within a complex network of quantum objects (qubits) is an extraordinary challenge. This project aims to remove the burden of this complexity by providing proof-of-concept, key functional components for an alternative type of quantum computation architecture. These elements are based on tiny bits of semiconductor, quantum dots, capable of shining strings of light quanta (photons) closely interconnected by quantum mechanical interactions, to be utilized for a novel game-changing simplified quantum-calculation procedure.
Hugh Geaney – UL Silicon Anodes through Nanostructural Development (SAND). Award: €424,873	Li-ion batteries have changed the way we live by powering smartphones and other handheld devices. The next stage of battery development will allow vehicles to become electric, but improvements to the battery components used are required to make this a reality. SAND will develop silicon-based material for next generation Li-ion batteries that can significantly boost the amount of energy stored, enabling vehicles to travel further on a single charge. The project will overcome hurdles associated with the use of silicon in batteries by developing nanostructures with dimensions 1000 smaller than a grain of sand.
Chris Mark – UCD Advanced Geochronology of Earth-System Processes (AGE-Pro): Constraining rates and dates of geological processes by novel U-Pb analysis. Award: €419,926	This project applies a novel mineral-dating approach to key geological questions. Uranium decays over time to lead. Importantly, lead becomes mobile when minerals are heated above a characteristic temperature by geological processes (e.g., granite intrusion), allowing the lead to diffuse towards the outside. Diffusion results in a decreasing amount of lead from the mineral core to the rim. Because the speed of lead loss is temperature-dependent, we can reconstruct the time-temperature history with diverse applications, e.g. solving the mystery of how continent-scale regions can be exhumed from

	100km-depths; fingerprinting sediment from melting ice-caps; and dating the formation of gold deposits.
Amir Pakdel - TCD Thermoelectric Nanomaterials for Energy Scavenging from Human Body. Award: €424,944	Nowadays, the large proliferation of portable and wearable electronic devices has stimulated research interests in lightweight, flexible, and sustainable energy sources. Thermoelectric generators provide the unique capability to directly convert heat to electricity. I aim to use semiconducting nanomaterials and conducting polymers for cost-effective and easy manufacturing of thermoelectric generators with 3D printing processes. Such small flexible thermoelectric devices can be attached to human skin or clothes to harvest the always-freely-available heat from our body and turn it into electricity. This electric power could continuously charge portable and wearable electronic devices with microwatt to milliwatt power levels.
Steve Campbell - TCD SpeedDemon: Quantum speed limits in thermodynamic processes and coherent control. Award: €400,373	SpeedDemon presents an ambitious research proposal aimed at designing practical schemes to achieve the ultimate control of complex quantum systems. By bringing together several fundamental bounds related to the communication of quantum information, the thermodynamic cost of computation, and the limits on the speed of a quantum evolution, SpeedDemon will develop a new paradigm for the coherent manipulation of quantum systems. The final result will be to provide a clear roadmap to the realisation of energetically efficient quantum devices.
Colm Browning – DCU Flexible Photonic Network Convergence Enabling Future Mobile Communications (COMPhLEX). Award: €421,505	How society interacts with the internet is changing, and so too are the communications networks which underpin it. In order to deliver services such as ultra-high definition video steaming or virtual reality, future mobile communications networks must harness the advantages of optical fibre transmission and 'cloud' computing in powerful data-centres. This merging of mobile and data-centre networks presents unique challenges in terms of how they may be co-designed to operate in harmony. This project will tackle those challenges by demonstrating how new optical technologies can be used to satisfy network requirements and help sustain the growth of the internet.
Sinead McParland – Teagasc Infrared spectroscopy analysis of milk as a low-cost solution to identify efficient and profitable dairy cows. Award: €375,873	Global growth in demand for dairy products currently exceeds supply and this is anticipated to continue. Efficient cows, which have higher milk solids output per unit input, are required to help meet this shortfall. However, it is not possible to identify the most efficient cows using currently available tools. The aim of this project is to develop the tools necessary to identify the most efficient animals in the national herd from which to breed the subsequent generations. This will yield a more efficient and sustainable national herd benefitting producers, processors, and consumers nationally and internationally.

Cristina Trujillo - TCD Theoretical Development of New Class of Phase Transfers Catalysts: Applications in the Pharmaceutical Industry. Award: €402,788	The synthesis of chiral molecules, molecules which can exist as one of two mirror-image forms called enantiomers, has increased because those molecules can have different biological effects. One way of exclusively obtain one enantiomer is catalysing its formation with a chiral catalyst. I will use computational methods to design novel metal-free chiral catalysts in a more efficient and 'green' process. The main objective is obtaining pharmaceutical compounds following a highly efficient procedure. This will be a novel demonstration of using computational methods for initial chemical design, rather than the usual situation where computational methods are used to explain experimental findings.
Meadhbh Brennan – TCD 3D Printed Extracelluar Vesicles for in situ Bone Tissue Regeneration. Award: €417,516	Stem cell therapy can repair bone defects caused by trauma or resection of cancerous tumors. Stem cells secrete small packages called extracellular vesicles (EVs) which are thought to be involved in this healing. The objective of this innovative research is to develop implants comprised of EVs and biomaterials to heal bones. Cutting-edge technology will permit the fabrication of implants to exactly fit the shape of the patient's broken bones. Since this is a cell-free, off-the shelf therapy, it will reduce pain since it won't require a bone or bone marrow harvest, be less expensive, and available to more patients, compared to stem cell therapy.
Gerard Brien – TCD Targeting underlying disease mechanisms in cancer using targeted protein degraders, a novel class of molecular therapeutic. Award: €423,816	A major problem for treating certain cancers with current therapies is that many patients won't benefit. In such cases we need to understand more about what causes these diseases, so we can design more effective treatments. Our work is focused on just this, we are gaining new insights on the causes of difficult to treat cancers. Through these insights we are designing new cancer drugs that will be more effective than traditional therapies. In particular, we are creating a new class of drugs termed "degraders". These drugs trick cancer cells into eliminating proteins needed for survival, ultimately killing the cancer.
Fiona McDonald – UCC A trilogy of stressors in the NICU: Towards therapy for preterm adversity. Award: €424,913	Preterm babies are born too soon. Immature development of breathing and necessary interventional treatment in the intensive care unit results in improper unstable oxygen status, which can impact on health even into adulthood. Late onset hospital acquired infection in preterm babies is an urgent unmet clinical need with up to 20% fatality. The combined effects of impaired oxygen status due to immaturity and acquired infection on physiological health will be examined in a novel pre-clinical animal model. A novel protective dietary antioxidant intervention will be explored with a view to the development of therapies for preterm babies into the future.

Sudipto Das – RCSI DETECT - DNA Methylation Signatures for Personalising Ulcerative Colitis Treatment. Award: €424,989	Ulcerative colitis patients are routinely treated with Infliximab, however about 40% of these patients do not respond to this treatment. Currently, there is no effective way to predict if a patient will respond to Infliximab or if in a certain patient the disease will get worse (also known as disease progression) which would lead to the patient being treated with Infliximab. This project aims to identify genes that can allow doctors to decide at an early stage, if a patient should be treated with Infliximab, this will ultimately spare the patient from consequences of unnecessary treatment.
Maria Prencipe - UCD Targeting co-regulators of the Androgen Receptor as a novel therapeutic approach for prostate and breast cancer. Award: €424,910	Prostate and breast cancer are the two most common invasive cancers in men and women respectively. Despite the huge improvement in the treatments available for these patients when their cancer is diagnosed early, we still don't have effective treatments when the cancer has spread outside the prostate or breast into other parts of the body. The aim of this proposal is to understand why cancer cells do not die in response to current treatments and to use this information to develop new drugs that will work better, leading to clinical trials of new therapies which are urgently needed.
Nicholas Payne -TCD Thermal scaling: rethinking how temperature drives macro-ecological patterns. Award: €419,559	The physiological thermal limits of species are thought to be determined by the range of environmental temperatures they normally encounter in their natural range; i.e. tropical species have evolved to tolerate a narrow range of temperatures because the tropics are thermally stable. However, a recent idea about how temperature influences the rates at which organisms process energy is beginning to question this classical paradigm. By collecting data on species' thermal niches from the laboratory, field, and from the published literature, I will revisit core principles of thermal ecology, and test new ideas about how temperature regulates the distribution of species.
Konstantinos Gkrintzalis – DCU Metabolomic approaches in mechanistic toxicology. Award: €425,000	Assessment of pollution and its impact in aquatic ecosystems is important. The current approaches lack in prediction and provide minimal biological information for the mechanism of action of pollutants. Focusing in freshwater ecosystems we will approach this matter using high throughput metabolomic approaches to better understand the impact of pollutants and novel materials using an aquatic organism; Daphnia magna. Generating metabolic fingerprints from known pollutants and comparing them with similar metabolic fingerprints from animals exposed to actual water samples (from rivers and lakes) will provide means to predict pollution before it reaches precarious levels.
Gary Brennan – RCSI Molecular mechanisms of epileptogenesis and epilepsy-induced cognitive impairments; a dual role for m6A. Award: €419,472	Epilepsy is a neurological disorder characterised by seizures and reduced cognition. Changes in how genes are expressed in neurons can drive the development of an epileptic brain following an epilepsy-inciting event. There is usually strict regulation of gene expression in brain cells which goes awry in epilepsy. Here we will study a new method by which genes are regulated which involves chemically modifying RNA to change how it gets converted to protein. We will use a mouse model of epilepsy to map these changes and then attempt to treat

	epilepsy and its associated cognitive impairment by blocking this chemical modification.
Amanda Sosa-Avendano – UCD Sustainable biomass supply chain development for the Irish bioeconomy. Award: €403,167	The agricultural sector is the major contributor to the overall greenhouse emissions in Ireland and is currently in the process to incorporate environmental considerations in parallel with looking for new valorisation paths for agricultural waste. This project addresses the potential transformation of agri-waste into high value, low carbon products by analysing and enhancing current and emerging agri-waste supply chains. It is envisaged that this project will contribute to the economics of waste management and enhance the Irish bioeconomy.
Aine Hennessy – UCC Functional indicators of iodine status in pregnancy - an outcome-driven, personalised nutrition approach. Award: €424,896	The nutrient iodine plays a central role in the production of thyroid hormones. During pregnancy, iodine deficiency can result in severe and long-lasting consequences for an infant's developing brain. In Ireland, three-quarters of women have inadequate iodine intake. However, the magnitude of this impact on the brain development of Irish infants is unknown. As there is no reliable measure of individual iodine status, this proposal will test the suitability of thyroid hormones to be used as a proxy measure. The data from previous studies will be used to describe the impact of maternal iodine deficiency on neurodevelopment of Irish infants.
Rebeca Garcia Lopez – DIAS Precision Imaging of GEO satellites in Space - PIGS in Space Award: €408,873	The ability to track and view objects orbiting the Earth (Space situational awareness) has become a major concern for both military and civil space applications. However, due to the large distance from the Earth of GEO satellites, interferometry is the only technique able to provide the required spatial resolution (~10 cm) to image these objects at high fidelity. This project aims at developing a statistical imaging reconstruction method to be implemented in a new software tool for GEO satellite imaging. This will allow us to image, identify and characterise these valuable assets, monitor their environment, and performing diagnostic evaluations.