List of 26 funded Awards

Researchers	Research Body	Co-Funding Partner	Proposal Title	Approved Budget (Direct Costs)	Approved Award Duration (Months)	Lay Abstracts
Prof John Boland	Trinity College Dublin		Understanding, controlling and exploiting the structure and properties of nanoscale metal films	€1,818,164.00	60	Metals are used extensively for their mechanical, electrical and heat conduction properties. Nanoscale metal films form the essential contacts within every device and are patterned as interconnects between devices. Metals are comprised of grains separated by grain boundaries, and grain size, shape and orientation control properties in the bulk metal. The researcher has discovered that in nanoscale metal films the grains are often forced to tilt so that it is impossible to obtain flat surfaces. By controlling this grain tilting phenomenon it will be possible to better control the electrical properties of materials and their performance in devices.

Prof Andrew Bowie	Trinity College Dublin		Modulation of innate immune responses by SARM, a new therapeutic target in inflammatory disease	€1,947,730.00	60	Inflammation is normally a protective process initiated to combat pathogens and resolve tissue injury. Pattern recognition receptors (PRRs) and inflammasomes of the innate immune system direct inflammatory reactions, and when these are uncontrolled, diseases such as rheumatoid arthritis and inflammatory bowel disease can develop. The researchers have found that SARM, an ancient protein found in worms, flies and mammals, can regulate PRRs and inflammasomes in mammalian cells, to shape and direct inflammation. In this project they will examine how SARM works, in order to better understand how inflammation is controlled, which will allow new anti-inflammatory therapies for human disease to be developed.
Prof Adrian Bracken	Trinity College Dublin		Understanding the role of EZH2 deregulation in B-Cell Lymphomas and Malignant Rhabdoid Tumors: a novel approach to stratifying patient treatment	€1,283,367.00	60	A major problem in treating certain types of cancer with current therapies is that only a small proportion of patients benefit from it. The good news is that a new generation of very promising cancer drugs are becoming available to doctors. This research project will contribute to testing several new drugs that target the activity of a cancer gene, called EZH2. The project will also develop a diagnostic test, based on the biology of the cancer, which will allow doctors to select the patients likely to respond, while avoiding unnecessarily treating those not likely to benefit.

Prof Louise Bradley	Trinity College Dublin		Dynamic tuning of plasmonic structures	€876,154.00	48	Next generation devices for information communication technologies and sensing applications must address demands for faster data processing, further miniaturisation, greater detection sensitivity and increased functionality. Nanoscale manipulation of the light offers promising solutions. Metal particles with dimensions smaller than the wavelength of light can be used to confine light on the nanoscale. Electrical tuning of the nanoscale light-matter interaction at visible wavelengths is required for many applications. A smart antenna must have the capacity to be tuned across the spectrum and dynamically control optical emission. This project will investigate two promising material systems for electrically controlled smart antenna.

Prof Dermot Brougham	University College Dublin		NANO-MAG-FACTORY: Multi-functional Magnetic Nanocomposite Materials for Biomedicine	€1,204,663.00	60	This project is to develop next-generation bio-compatible stimulus-responsive hydrogel supports for growing cells on plates. The responsive gels will deliver drugs and growth factors to the cells at selected times, in controlled doses, and will generate dosage gradients across the cell sample. In natural tissue regeneration growth factor release is exquisitely controlled in time and space. Hence these advances will allow us to improve control over cell growth and response, with great implications for biological science. The approach will also open up new exploitable technologies which will contribute to human health and to the medical diagnostics/device industry in Ireland.

Prof Martin Caffrey	Trinity College Dublin		A High-Resolution Crystal Structure Approach to Targeting Bacterial Lipoprotein Post-translational Processing Enzymes For Antibiotic Design And Discovery	€2,019,877	60	Lipoproteins play key roles in bacteria. They are synthesized by enzymes that are essential in many pathogenic bacteria. Because they have no equivalents in humans, these enzymes are potential drug targets. We determined the crystal structure of one of these enzymes bound to an antibiotic. In this project, we propose to exploit this valuable molecular blueprint and those of related enzymes to develop new antibiotics targeting pathogens against which a growing number of antimicrobials are ineffective. The project will generate new knowledge and intellectual property in the form of tools, reagents and lead compounds for commercial exploitation.

Prof Michael Coey	Trinity College Dublin		Zero moment spin electronics (ZEMS)	€1,408,148.00	48	Magnets are vital in technology. All data on the Internet is written magnetically on hard discs and stored in huge data centres where everything is accessed in an instant. The big data revolution means we must handle ever more data ever faster every year. We have discovered a new class of magnetic material that is very efficient inside, where the electric currents flow, but looks completely nonmagnetic from the outside. New electronic devices built using thin layers of these 'half metals' will enable us to handle data 100 times faster and sustain the big data revolution for another 20 years.

Prof Jane Farrar and Prof Peter Humphries	Trinity College Dublin		Exploration of therapeutic strategies for ocular disorders	€2,004,584.30	48	Inherited retinal degenerations are the most frequent cause of blindness in people of working age. Genetic factors contribute to many other blinding diseases such as glaucoma and age-related macular degeneration (AMD), which previously, were not believed to be strongly influenced by genetics. Addressing these genetic factors may help develop new or improved treatments. It is believed that common cellular processes may be disturbed across these conditions. Our research proposes to explore therapies targeting known causative genes for specific ocular disorders (IMPDH1; Opa1) or therapies targeted towards modulating disease mechanisms common to multiple eye disorders, such as, glaucoma and AMD.

Prof James Gleeson	University of Limerick		Mathematical Modelling of Social Spreading Phenomena	€891,957.74	60	In this project the research team will develop new mathematical techniques and models to help revolutionise the understanding of how information spreads online. They will develop an algorithm to identify the users of social networks who are the “superspreaders”, i.e., those users whose retweets can make information travel faster to everyone else. A better understanding of how information spreads through social influence will help find ways to spread important information more quickly (e.g., for health or terrorism alerts), and to control undesirable aspects of social media such as the spreading of misinformation and false rumours.

Prof Paolo Guasoni	Dublin City University		Stationary Financial Risks	€854,966.00	60	Price fluctuations in common stocks and bond portfolios are mostly random and permanent – variations indefinitely accumulate over time. By contrast, commodities and long-term safe assets are driven by stationary fluctuations, which recede as time passes. Over the past decade, interest in such asset classes has significantly increased from both individuals and institutions, but existing approaches are inadequate, as they do not reflect their stationarity. This project investigates the implications of stationary risks for portfolio construction and asset pricing, and develops theoretical and computational tools to mitigate risk and optimize business processes in the financial industry.

Prof Marcel Jansen and Dr Alan Morrison	University College Cork		Exploiting narrow-band UV-LEDs for Sustainable, Innovative, Technology-Enabled Cropping (UV-SINTEC)	€917,669	60	Ultraviolet (UV) light can improve plant quality in terms of nutritional value, architecture and ability to resist pests. This has positive impacts on the sustainability of food production, and human health and well-being. This study will develop state-of-the-art LED technology that will enable scientists to manipulate UV to advance understanding of how plants respond positively to UV-wavelengths which, until now, has not been possible due to the limitations of current UV-technologies. This pioneering combination of electronic engineering and plant biology will have global implications for the horticulture industry.

Dr Stephen Keely	Royal College of Surgeons Ireland		Pharmaceutical and nutraceutical targeting of the farnesoid X receptor for treatment of chroinc intestinal diseases	€1,071,597	60	Diarrhoeal diseases are chronic and debilitating conditions that impact the lives of many people. Since current options for prevention and treatment are often ineffective, these diseases are a huge burden to society in terms of healthcare and lost hours of work. The researchers will develop new pharmaceutical and nutraceutical approaches to activate the farnesoid X receptor (FXR), an intestinal protein that controls cellular processes involved in disease pathogenesis. Through developing these new, complimentary, therapies this project aims to deliver improved health and quality of life for many thousands of Irish people, while also creating new opportunities for commercial development.

Dr David Kenny, Dr Sean Fair and Prof Patrick Lonergan	Teagasc, UL and University College Dublin	TEAGASC	An integrated multidisciplinary approach to revolutionise dairy cattle breeding, through the application of state-of-the-art technology to advance the identification, sexual maturation, fertility and availability of semen from genetically elite sires	€1,520,108	48	The Irish dairy industry is cumulatively worth over €3 billion annually to the Irish economy. The ability to use DNA information to identify the most genetically elite animals, coupled with use of artificial insemination (AI) has revolutionised dairy cattle breeding. However, the timely availability of semen from young bulls together with limited capacity to predict the fertility of individual bulls, best suited for AI, is hampering the speed of genetic progress. This novel, innovative and multi-disciplinary research proposal aims to devise strategies to address these issues thus underpinning the continued development of one of Irelands most important indigenous industries.

Dr Johannes Klaas Slingerland	National University of Ireland, Maynooth		Topological Order, Entanglement and Quantum Information Processing	€500,822.00	60	Quantum computers can in principle perform tasks which are impossible with traditional computing technology. This should spectacularly improve our capability to model complex physical systems including novel materials and chemicals. Quantum mechanical devices are easily disturbed by noise, but robust quantum hardware can be constructed using physical media with "Topological Order" which store information using global (topological) properties which are not affected by noise. The goals of the project are to: find and characterize the possible types of topological order, propose and study devices which can measure and manipulate topological quantum information and work on methods to model topological systems on classical computers.

Prof Ulla Knaus	University College Dublin		Impact of ROS on intestinal health in inflammatory bowel disease	€2,013,697.00	60	Inflammatory bowel diseases (IBD) are chronic inflammatory gut disorders, affecting 1 in 250 persons in Europe. The condition greatly impacts the quality of life and is rapidly rising in children. To date there is no known cure or cause for the disease. IBD is associated with hyperinflammation that can be fuelled by an abundance of oxidizing agents or even lack thereof. The long-term goal of the research team is to improve patient care by understanding how changes in the oxidant/antioxidant balance will affect intestinal health. This includes evaluating changes in the protective lining of the gut and in the composition of gut bacteria.

Prof Sergei Lebedev	Dublin Institute for Advanced Studies	Geological Survey Ireland and the Marine Institute	Structure, evolution and seismic hazard of the Irish offshore: An investigation using the first broadband, ocean-bottom seismometer deployment offshore Ireland	€1,248,989.00	60	90% of Ireland's territory is offshore. This underwater territory contains vast natural resources but also hazards: Ireland's offshore earthquakes are its largest and can trigger undersea landslides, causing tsunamis. In this project we will deploy, for the first time, an array of ocean-bottom, broadband seismometers offshore Ireland. Together with dense existing arrays onshore, the array will cover the entire Irish territory. The unique new data will yield important insights into basin-evolution processes, the origins of the volcanism that formed the Giant's Causeway and other geological landmarks, the offshore-seismicity distribution and hazard, and the development of conventional and geothermal energy resources.

Prof Kingston Mills	Trinity College Dublin		Understanding the role of T cells in sustained protective immunity to Bordetella pertussis to inform the design of third generation vaccines against pertussis	€1,996,376	60	Whooping cough (pertussis) is a severe and sometimes fatal infectious disease of the respiratory tract caused by the bacterium Bordetella pertussis. Pertussis vaccines developed in the 1940s were effective but caused side effects and were replaced by more refined acellular pertussis (aP) vaccines in the 1990s. Unfortunately, the newer aP vaccines, while safer, are not as effective and pertussis is now re-emerging as a serious threat to children's health. This project will exploit the researchers' expertise in immunology to make fundamental discoveries that will inform the design of a more effective third generation vaccine to control the re-emergence of pertussis.

Prof Paul Moynagh	National University of Ireland, Maynooth		Discovering and Exploiting novel regulatory pathways in inflammation for therapeutic advantage	€2,016,852.00	60	We are familiar with the signs of inflammation. These are redness, swelling, pain and heat. These symptoms underlie an important process that is indispensable for clearance of disease-causing microbes from the body. However, if inflammation is not turned off we end up with chronic inflammatory diseases like diabetes and Crohn's disease. In order to identify new treatments for these currently incurable diseases we need to identify the molecules in the body that control the inflammatory response. The research in this project investigates the role of Pellino proteins in inflammation with a view to assessing their importance in health and disease.

Prof Paul Murphy	National University of Ireland, Galway		Enhancing the scientist's toolbox using synthetic carbohydrate chemistry	€1,043,540.00	60	Sugars on our cell surfaces stick to other molecules, called sugar receptors, found in organs and in our immune system. When this happens the sugar receptors can cause cancer to spread and inflammation, or it can lead to nasty infections, as bacteria or viruses also stick to our sugars. So it is highly desirable to develop even stickier molecules called glyco-mimetics to block them. The research here deals with developing glyco-mimetics and it is hoped that once they are developed they will be used to treat diseases like cancer and asthma, and prevent infections like HIV and influenza.

Prof Rosemary O'Connor	University College Cork		Targeting regulators of cellular metabolism to promote healthy ageing	€1,457,077.00	60	The Insulin-like Growth Factor (IGF) hormonal system is required for normal growth. People with very low IGF levels (dwarfism and inherited mutations) are protected from cancer and have extended lifespans. On the other hand, high IGF levels cause cancers to grow and become unresponsive to therapy. Thus, reducing or suppressing IGF activity is a way to prevent and suppress cancer. But, to achieve this we must understand how the system works in cells and tissues. This research programme addresses this by investigating how the IGF system protects cells and testing new ways to inhibit its activity in cancer.

Prof Corrado Santocanale	National University of Ireland, Galway		Uncovering the fundamental roles of the CDC7 kinase and of its regulatory subunits through genome editing technology	€1,323,591.00	48	This project will focus on a protein called CDC7, which is essential for cell division. Drugs that block CDC7 working are in clinical trials as a potential treatment for cancer. However, the lack of a good understanding of how CDC7 works is impeding the development of CDC7-based therapies. Using novel genetic technologies, researchers are now, for the first time, in a position to discover the role that CDC7 plays in several processes important for cell division. This research will greatly contribute to understanding how cells divide and to the development of new therapeutic strategies for cancer patients.

Prof Miles Turner and Dr Gary Lanigan	Dublin City University and Teagasc	TEAGASC	Novel plasma technology for valorisation of organic manures and carbon-free fertiliser manufacturing	€519,461.00	48	Fertilisers have tripled agricultural production, and thus enabled half the world's population to be fed. However, producing fertiliser emits greenhouse gases, and using fertiliser damages ecosystems and human health. So there is sharp conflict between feeding the world and sustaining the environment, which will likely be resolved only by innovation applied to agriculture. This project will produce fertiliser via an electrically driven plasma process free from greenhouse gas emissions, and further reduce emission by treating slurry with the process product. These techniques could eliminate polluting emissions presently priced at €500 million annually in Ireland, or $250 billion annually worldwide.

Prof Frank Wellmer	Trinity College Dublin	Environmental Protection Agency	A new avenue for crop protection: generating Brassica cultivars with supernumerary trichomes	€898,259	60	The protection of crops against diseases and pests is one of the main challenges of 21st century agriculture to ensure that sufficient food can be generated for a growing world population. Trichomes, or hairs, have been implicated in the defence of plants against chewing and sap-feeding insects. In this project, we will generate new varieties of Brassica, which comprises important crops such as oilseed rape and cauliflower, with supernumerary trichomes on leaves, stems and seed pods. We will then test the performance of these plants and their resistance to insect pests in field trails.

Prof Andrew Wheeler	University College Cork	Geological Survey Ireland and the Marine Institute	Mapping, Modelling and Monitoring Key Processes and Controls on Cold-water Coral Habitats in Submarine Canyons (MMMonKey_Pro)	€874,329.00	48	Submarine canyons in the deep ocean are rich environments supporting fisheries and oil reservoirs although often closed for conservation. One such canyon, the Irish Porcupine Bank Canyon (PBC) supports deep-water coral reefs and is studied here as an example of others. We use advanced robotic technology and novel 3D visualisation tools to explore and monitor the PBC defining seabed processes that dictate where corals occur and their sensitivity to climate change and fisheries/oil industry impacts. Recommendations for sustainable responsible fisheries and hydrocarbon activity and for effective management during climate change will be defined to the benefit of society.

Prof Michael Zaworotko	University of Limerick	Environmental Protection Agency	Green Adsorbents for Clean Energy (GrACE)	€1,901,505.00	60	New materials, processes and technologies are urgently needed to address global challenges related to climate change and energy security. The proposed research will have an innovative and transformative impact since it will design, discover and develop a new generation advanced materials, sorbents, for low-cost, energy-efficient commodity purification and storage (e.g. carbon capture, natural gas storage). These sorbents belong to a class of materials known as Metal-Organic Materials, and their impact upon the CleanTech sector has the potential to revolutionize existing industries (commodities purification, energy production, energy storage) and enable new industries (carbon negative processes and products).

Prof Anding Zhu	University College Dublin		5GMMPA: Digitally Linearized High Efficiency Millimetre Wave Power Amplifiers for Next Generation High Speed Wireless Communications	€901,821.00	48	Wireless communication has become a necessity in every person's life, just like the power grid and transportation systems. The next phase of the wireless revolution, the 5G, is likely to be the most far-reaching and disruptive to date. It will unlock many new services, driven by many use cases from connected cars to augmented reality, to multi-K movies on mobile devices and many more. This project aims to develop a set of new technologies to enable super high speed wireless data transmission with minimum energy consumption while at the meantime maintaining high quality of data services in 5G.