**Full list of projects supported:**

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| **Lead Applicant** | **Co-Applicant(s)** | **Research Body of Lead Applicant** | **Proposal Title** | **Lay Summary** |
| Donagh Berry |  | Teagasc | Precision cattle breeding using precision genomics | The Agri-Food industry is the largest indigenous industry in Ireland. The objective of this proposal is to achieve the Irish government’s strategy of increased animal production through: 1) greater exploitation of more precise genetic information, 2) more precise estimation of how each genetic variant affects performance and 3) development of precision mating plans to fully maximise the long-term and sustainable benefit of all genetic variation present while minimising the accumulation of inbreeding. The results will be disseminated to industry through a low-cost, customised genotyping panel. Tools and resources developed are also applicable to other species and breeds. |
| Patrick Cullen | Paula Bourke (Dublin Institute of Technology (DIT)) | DIT | Cold plasma decontamination of cereal grains (PlasmaGrain) | This proposal addresses an identified need to develop advanced process technologies, which are a green alternative to fumigants for a sustainable grain industry. A non-thermal plasma will be induced within the confines of a grain conveyor aimed at rapid and continuous treatment of grain during conveying. The approach is low energy, overcomes current resistance issues found with fumigants, does not adversely affect grain quality and critically leaves no residual chemistry. System efficacy will be tested against grain pests, fungi, mycotoxins and residual pesticides. A pre-competitive prototype will be developed by the project to preserve cereal grain of high quality. |
| Fiona Doohan |  | UCD | Identifying disease resistance breeding targets in order to enhance the sustainability of cereal production and the security of food supply. | The challenge of increasing wheat production by 70% to feed the world population in 2050 is great. We have to make a concerted international effort to increase yields, not least by controlling the diseases that reduce yield and contaminate grain with toxins. This project focuses on unravelling novel mechanisms involved in wheat response to stress and delivering knowledge and tools that can be used in plant breeding and crop biotechnology in order to improve wheat resistance to disease. Consequently, it will contribute to our understanding of plant biology, and to the development of sustainable means for enhancing food productivity. |
| Justin Holmes |  | UCC | Silicon compatible, direct band-gap nanowire materials for beyond-CMOS devices | Increasing the number of transistors on a silicon chip enables the production of faster and smaller mobile and computing devices. However, current and prospective future mobile devices based on existing technology are energy inefficient due to high power consumption and the dissipation of a large amount of heat, leading to wasteful battery usage or the requirement for elaborate cooling systems. This project will develop new nanoscale materials for “energy efficient” electronic devices. Successful implementation of the materials developed in this project could instigate smarter and “greener” electronic gadgets. |
| Anne Marie Healy |  | TCD | Development of Fixed Dose Combination Products using Advanced Pharmaceutical Processing Technologies | It is well accepted that cancer, cardiovascular diseases, chronic respiratory conditions and diabetes are the main causes of disability/death within developed countries. Current dosing regimes are sub-optimal and require a significant pill burden leading to non-compliance. Improved dosage forms permitting reduced dosing frequency will improve patient compliance, clinical outcomes and management of the respective disease. Through the use of advanced pharmaceutical processing technologies, we will manufacture delivery systems capable of tailoring drug release to meet clinical demands. This project will be positioned at the rapidly developing interface between pharmaceutical and chemical engineering technologies. |
| Tia Keyes |  | DCU | Microcavity array supported lipid membranes: Highly versatile cell membrane models in sickness and in health | This progamme builds advanced models of the cell-membrane to address two issues away from the complexity of the living cell. The first models membranes reminiscent of health and of disease states (e.g. Alzheimers) to help understand how each affects membrane permeability towards different drugs. These models can help ensure drug effectiveness and safety before preclinical testing. The second model addresses structure and dynamics of sugar lattices that occur at the cell-membrane. They play an important role in autoimmune disorders and cancer and understanding how they form and the role of the membrane will aid in developing therapeutics for these diseases. |
| Walter Kolch |  | UCD | Overcoming drug resistance in metastatic malignant melanoma by personalizing treatment | Malignant melanoma is a skin cancer that is one of the deadliest cancers because of its tendency to spread rapidly and its resistance to drugs. The recent introduction of new drugs that inhibit Raf and MEK kinases has achieved remarkable treatment successes, which unfortunately are of limited duration. The aim of this proposal is to investigate the mechanisms of resistance to these drugs and based on this understanding (i) design personalized drug combinations that can avoid or overcome this resistance; and (ii) derive diagnostic biomarkers that predict which drug combinations will be most effective for individual patients. |
| Alexey Lastovetsky |  | UCD | Meeting the Future Challenges of Heterogeneous and Extreme-Scale Parallel Computing | In our digital era, computing becomes truly comprehensive and ubiquitous with more and more areas routinely relying on high performance computing (HPC). Science, engineering, Internet-based computing, data analytics and data mining, financial computing, smart cities just to name a few all need HPC resources. To respond to this ever increasing demand, HPC systems become highly heterogeneous, hierarchical and extremely large and complex. Traditional applications and software cannot efficiently utilize this new generation of computing systems. The goal of the proposed research programme is to develop fundamental algorithms and methods that would allow application programmers to efficiently use these platforms. |
| Seamus Martin |  | TCD | Pro-inflammatory ‘Cytokine fingerprinting’ for the stratification of Psoriasis patients for cytokine-targeted biologic therapy | Overproduction of immune messenger proteins, called cytokines, causes a number of immune disorders, such as psoriasis. Fortunately, a new generation of cytokine-blocking drugs (biologics) has tremendously improved treatment of diseases such as Crohn’s and rheumatoid arthritis. However, at present, the decision to treat patients with biologics is based upon clinical criteria rather than ‘molecular’ evidence that a particular cytokine is elevated in a patient. To improve biologic therapy, we need more precise ways of matching the correct biologic to the right patient. We aim to develop a new approach, called ‘cytokine fingerprinting’, to solve this problem. |
| Laoise McNamara |  | NUIG | Mechanobiology based approaches for osteoporosis therapeutics | Tissues of the human body can adapt in response to mechanical forces by a cellular process known as mechanobiology. Although mechanobiological processes are fundamental to normal bone physiology and may play an important role in the development of osteoporosis, the role of mechanobiology in bone development and changes occurring during ageing are not yet fully understood. Moreover mechanobiological responses have not been targeted as treatments for osteoporosis, nor have they been sufficiently exploited to develop novel regenerative tissue strategies. This research project will advance understanding of mechanobiology to develop treatment approaches for bone pathologies. |
| Grace Mulcahy |  | UCD | Application of New and Emerging Technologies to Develop Vaccines against Fasciola hepatica | Liver fluke infection (fasciolosis) is a global disease of farm animals and causes great losses to the agricultural community. By merging recent technological advances in molecular biotechnology we will gain a deeper understanding of how liver fluke parasites interact with their animal hosts, cattle and sheep. We will learn at a molecular level how these parasites invade their hosts, how they control and regulate their immune responses and how this leads to chronic disease, pathogenesis and death. Then, using this new knowledge, we will develop new effective vaccines to counteract the parasite and to protect farm animals from this disease. |
| John O’Doherty | Torres Sweeney (University College Dublin (UCD)) | UCD | The Macroalgal Fibre Initiative: ‘natural molecules naturally’. | Widespread use of antibiotics in veterinary and human medicine has, over time, selected for a broad spectrum of pathogens that are resistant to antibiotics. This is of major concern for public health and has resulted on an EU ban on ‘in-feed’ antibiotics in animals. Hence there is an urgent requirement to identify alternatives. The preventative and therapeutic properties of seaweed has been known since early times. The objective here is to characterise the molecules in native macroalgae that have health promoting properties, develop the large-scale methodologies to purify them and explore commercial avenues for them in the animal feed industry. |
| Noel O'Dowd | Sean Leen | UL | Multi-scale through-process characterization for innovative manufacture of next-generation welded connections (Mechanics) | This proposal will develop new modelling tools for Irish industry for more accurate design and assessment of materials and structures. The focus will be on welds, which are the most common location of failure in engineering components. The tools will be used to provide tailored combinations of welding and heat treatment parameters, to design material structures at the nano-, micro- and macro-scale. Specific applications are the design for optimum grain size in power-plant steels and improved designs for steel pipelines used in oil and gas offshore platforms. |
| Colm O'Dwyer |  | UCC | Diffractive optics and photonic probes for efficient mouldable 3D printed battery skin materials for portable electronic devices | For modern portable electronics, long-life, safe and high performance Lithium-ion batteries are a necessity. We will develop new materials and coating methods for a Li-ion battery skin that can function when coated onto 3D printed structures. Also, a unique, non-destructive tool for monitoring the state of charge of the battery skin will also be developed. This will be a non-destructive method that gives the battery status by the colour of the material, and can also be used during research to optimize the performance of these new materials to for better performance with longer lifetime. |
| Vincent O'Flaherty |  | NUIG | i–PAD: Innovative biological phosphate (bioP) and anaerobic digestion (AD) technology for waste treatment, energy generation and phosphorus recovery. | This research targets new technologies for treatment of wastewaters from industry (food production) and households (sewage). The output will be a system for simultaneous purification of wastewater, production of renewable energy and recovery/recycling of valuable nutrient resources (phosphorus). The proposed system relies on microorganisms, which transform wastewater pollutants into a readily usable fuel (methane/natural gas) by digestion of organic matter. Methane provides a competitive low-carbon fuel source, which can be used for transport, home heating and electricity production. The proposed research will have positive impacts towards more sustainable food production, economic competitiveness and innovation, environmental protection and climate change. |
| Richard O'Kennedy |  | DCU | Metabolomic and array-based biomarker approaches to understand human exposure to potent carcinogenic fresh water toxins | Colorectal and liver cancer are the 3rd and 6th most common cancers globally. The role that exposure to water and food toxins play in the development of these cancers is not fully understood. Increasing numbers of human poisonings globally are caused by freshwater algal microcystin toxins due to climate change and pollution. These toxins are linked to cancer but there is no means of measuring the extent of human exposure and thus determining how important they are in these diseases. We will identify and validate biomarkers of microcystin exposure and conduct surveys in low and high risk populations. |
| Jochen Prehn | Markus Rehm (Royal College of Surgeons in Ireland (RCSI)) | RCSI | Development of personalised medicine approaches for the clinical application of IAP antagonists in metastatic and high risk early stage colorectal cancer | Colorectal cancer remains the second leading cause of cancer death in the Western world. As many as 50% of patients with early stage disease don’t benefit from current chemotherapy; and less than 6% of patients with advanced disease are alive after 5 years. We aim to improve treatment of colorectal cancer by using a new drug that selectively “kills” cancer. Importantly, we will maximize the clinical impact of these drugs by developing a way of identifying patients who will benefit most from this treatment. Experienced teams in Belfast and Dublin and commercial partners will work together to deliver these goals. |
| David Reid |  | MI | Creating the knowledge for precision fisheries management: spatially aware ‘nudging’ to achieve Maximum Sustainable Yield using real-time fisheries incentives. | We aim for maximum productivity of commercial fisheries, constrained by the law (including the Marine Strategy Framework Directive), ensuring ecological sustainability. Paralleling precision farming, spatial ecological data and models enable maximisation of fishing yield within ecological constraints, to the finest possible spatial scale. This project develops the scientific tools to support an incentive scheme that guides fisheries to achieve maximum sustainable yields, accounting for ecological variability in time and space as well as stock status. Using ecological data to calculate maps of real-time incentives, leaves fisheries free to determine their best spatial distribution of effort to maximise profit sustainably. |
| Michael Rowan |  | TCD | Alzheimer’s disease patient-derived synaptic plasticity-disrupting soluble protein assemblies | Alzheimer’s disease kills millions world-wide due to an irreversible decline in the function and viability of nerve cells. Subtle changes in the brain can be detected indirectly using measures of key proteins in spinal fluid ten-to-twenty years before clinical diagnosis. This provides a window of opportunity to intervene early. We, and others, have implicated certain rogue forms of these proteins in the disruption of nerve memory mechanisms. This research will aid the development of new ways of assessing these rogue forms, both in spinal fluid and nerve cells derived from individual patient skin cells, and the selection of personalised therapies. |
| Marco Ruffini |  | TCD | O’SHARE: An open-access SDN-driven architecture enabling multi-operator and multi-service convergence in shared optical access networks | The main reason why many users experience inadequate broadband speeds is that the deployment of appropriate high-speed optical infrastructure to the customer home requires very large upfront investment. O’SHARE targets the problem by developing novel technologies that spread the infrastructure cost across a large number of service providers and network operators. The higher revenue generated by this model will incentivise the deployment of high-speed networks to many homes. In addition it will increase the competition, promoting novel applications, better services and lower prices. O’SHARE will demonstrate the developed technologies in an international testbed, supported by leading industry and academic collaborators. |
| Alan Ryder |  | NUIG | Advanced Analytics for Biological Therapeutic Manufacture (AA-BTM). | Many drugs for human health are complex biological molecules like proteins which are made in living cells on an industrial scale. Both the cell food (media) and the protein products have to be carefully analysed to make sure that they are good and safe. Both media and proteins are very complex mixtures that are difficult to analyse. Here we will build a faster, cheaper, and non-contact way of testing using light to generate chemical information from these mixtures. This information will then be analysed using advanced statistical methods (chemometrics) and the results used to improve manufacturing, and reduce drug costs. |
| Stefano Sanvito |  | TCD | Atomistic simulators for magnetic memories design: MMDesign | Our society produces immense quantities of data. In 2050 a hard disk with the diameter equal to the distance between the earth and the moon will be necessary to record all the information produced by humanity. For this reason the development of new, denser and faster ways to store information is key to maintaining our standard of life. The MMDesign project will construct a range of designing tools for developing such next generation of recording devices. In particular, it will create a simulator for fast magnetic memories and a protocol for identifying the most useful materials to fabricate such devices. |
| Martin Steinhoff |  | UCD | Neuro-immune communication in skin diseases: Cytokines and chemokines | Worldwide, itch is the most frequent symptom in dermatology with a significant impact on quality-of-life for patients and their family members. Therapy-resistant itch is a major medical burden in many diseases (skin, renal, dialysis, liver, leukemias) and elderly people. A major barrier for therapeutic progress is our poor understanding of the molecular mechanisms of itch in humans. To develop new treatments against therapy-resistant itch, we will first identify in a translational setting key cytokines and chemokines in different human itch subtypes. With companies, we will then test in human studies the beneficial effects of treating itch by blocking cytokine/chemokine pathways. |