US-Ireland R&D Programme project details:

Project tittle and award details	Lay Abstract
Title: Mechanics of the Formation and Function of 2D Material Pleats - An Integrated, Multidisciplinary Study. **Lead applicant:** Prof. Graham Cross (TCD) **Co-applicants:** Dr. Gareth Tribello (NI) and Prof. Robert Carpick (US) **Lead RoI institution:** TCD **Value of award** including overhead: €445,933 (Direct: €349,256 + Overhead: €96,677) DfE funding ca. £286 k d+o/h NSF funding ca. $530 k d+o/h **Partner institutions:** Queen's University Belfast (NI) University of Pennsylvania (US)	The project is in the area of materials science and aims to establish a deep understanding of the mechanics underlying the spontaneous formation of long, folded pleats of 2D materials such as graphene approaching macroscopic size. The team's broader vision is to enable a new electro-mechanical device science known as pleatronics, eventually coupling mechanical with optoelectronic properties for a new class of nanomechanical actuators, valves, optical shutters, switches, oscillators, antennae, and plasmonic metamaterials with novel capabilities.
Title: Intelligent Data Harvesting for Multi-Scale Building Stock Classification and Energy Performance Prediction **Lead applicant:** Dr. James O'Donnell **Co-applicants:** Prof. Neil Hewitt (NI) and Prof. Wangda Zuo (US) **Lead RoI institution:** University College Dublin **Value of award:** including overhead: €453,796 (Direct: €349,997 + Overhead: €103,799) DfE funding ca. £236 k d+o/h NSF funding ca. $389 k d+o/h **Partner institutions:** Ulster University (NI) University of Colorado Boulder (US)	The project area is energy and sustainability research, and it aims to reduce residential building energy consumption and its related greenhouse gas (GHG) emission and environmental impacts through creation of a novel tool chain for recommendation of complementary solution for predicting GHG reduction potentials for building owners and policy makers. This tool chain will be enabled by harvesting the inhomogeneous datasets from various sources and automatically generating building energy prediction models at multiple scales using physics-informed machine learning
Title: Strained Engineered Germanium Quantum-Well Laser on GaAs and Si for Nanoscale Photonics	The project is within the areas of materials sciences and optics and photonics. The research

Lead applicant: Dr. Tomasz Ochalski **Co-applicants**Dr. Supriya Chakrabarti (NI) and Prof. Mantu Hudait (US) **Lead RoI institution:** Munster Technological University **Value of award:** including overhead: €382,567 (Direct: €296,740 + Overhead: €85,827) DfE funding ca. £298 k d+o/h NSF funding ca. $391 k d+o/h **Partner institutions:** Tyndall National Institute (ROI) Ulster University (NI) Virginia Tech (US)	objective of this work is to develop an engineered germanium laser with a tuneable wavelength integrated on different substrates for use in nanoscale photonics, and in particular for unique Optical Coherence Tomography imaging .
Title: A unified framework for the emulation of classical and quantum networks **Lead applicant:** Prof. Marco Ruffini **Co-applicants:** Prof. Mauro Paternostro (NI), Dr. Boulat Bash (US) and Prof. Prineha Narang (US) **Lead RoI institution:** Trinity College Dublin **Value of award:** including overhead: €431,357 (Direct: €333,198 + Overhead: €98,159) DfE funding ca. £300 k d+o/h NSF funding ca. $755 k d+o/h **Partner institutions:** Queen's University Belfast University of Arizona (US) Harvard University (US)	The project area is at the intersection between classical and quantum networks and aims to develop a foundation for research for the coexistence of these two domains in existing telecommunications infrastructure. The ability to overlay quantum communications over today's ubiquitous optical fibre networks is key to enable worldwide cost-effective deployment of the future quantum Internet as we are entering the new era of quantum computing and communications. The project will target the key aspects of network control systems, which constitutes the brains of the network, in order to provide methods for autonomous optimisation of hybrid classical-quantum communications systems. The research will be based on the modelling of quantum network systems and on the development of intelligent algorithms based both on analytical formulation and data-driven machine learning.
Title: Design of Genetically Engineered Tensile Load-Bearing Soft Tissues Inspired by Embryonic Tendon Development	The objective of this project is to identify the structural changes and biological mechanisms that drive normal embryonic tendon development and to use this knowledge to

Lead applicant: Prof. Paula Murphy **Co-applicants:** Prof. Nicholas Dunne (ROI), Prof. Helen McCarthy (NI) and Prof. Spencer Szczesny (US) **Lead RoI institution:** Trinity College Dublin **Value of award:** including overhead: €452,258 (Direct: €349,987+ Overhead: €102,271) DfE funding ca. £300 k d+o/h NSF funding ca. $473 k d+o/h **Partner institutions:** Dublin City University (ROI) Queen's University Belfast (NI) Pennsylvania State University (US)	enhance the maturation of tissue-engineered tendon constructs via nanoparticle-hydrogel gene delivery system. The primary reason for this study is that traditional scaffold-based approaches hinder cell self-assembly and do not replicate normal embryonic tendon development.
Title: Sensor Application to Peatland Hydrology in Remote Environments (SAPHIRE) **Lead applicant:** Dr. Tiernan Henry **Co-applicants:** Dr. Raymond Flynn (NI) and Prof. Berry Lyons (US) **Lead institution:** National University of Ireland Galway **Value of award:** including overhead: €423,055 (Direct: €341,350 + Overhead: €81,705) DfE funding ca. £296 k d+o/h NSF funding ca. $350 k d+o/h **Partner institutions:** Queen's University Belfast (NI) Ohio State University (US)	The objective of the project is to employ sensors and telecommunications technologies in a proof-of-concept study to demonstrate the value of existing commercially available systems and communications technology to better characterise hydrologic and biochemical processes operating in natural and more degraded catchments covered in blanket bog in remote environments. Understanding these mechanisms and continuous monitoring are critical for better quantifying the risk of economic and environmental impacts on water quality, aquatic communities, stream flow/flood risk, and the loss of nutrient sink functions.
Title: Ultrasensitive Nitrogen Sensor using Imprinted Polymer Assisted Bacteria for Real-Time Monitoring of Water Quality **Lead applicant:** Prof. Noel O'Connor **Co-applicants:** Dr. Panagiotis Manesiotis (NI) Dr. Rick Relyea (US) and Dr. Shayla Sawyer (US) **Lead institution:** Dublin City University	The is in the area of environmental monitoring and aims to design, build, validate and field test a prototype sensor system for the real-time detection of the three most commonly monitored forms of nitrogen: nitrate, nitrite and ammonia/ammonium. Such sensor will use 1) polymers to separate and concentrate each form of nitrogen, 2) bacteria to convert each form of nitrogen into a single form (nitrite), 3) advanced 3D printed microfluidics with integrated valves to ensure routes toward the

Value of award: including overhead: €374,206 (Direct: €297,328+ Overhead: €76,878) DfE funding ca. £300 k d+o/h NSF funding ca. $620 k d+o/h **Partner institutions:** Queen's University Belfast (NI) Rensselaer Polytechnic University (US)	active sensor in a complete analyser platform for field deployment, and 4) a more sensitive colorimetric-based detection system for nitrite using novel ultrasensitive hybrid material photodetectors.