MSCA Opportunities at Biodesign Europe

Biodesign Europe is looking to host experienced researchers via Marie Sklodowska-Curie Actions Global Fellowships. In order to secure funding, applicants will develop a proposal with senior academic research leaders in Dublin City University (DCU) and Arizona State University (ASU) DCU for the September 9th, 2020 deadline.

Organisation Description

Biodesign Europe is a recently established Transatlantic scientific research institute that leverages the research infrastructure capacity and expertise of ASU Biodesign Institute's 16 and DCU's research centres. Imagine an interdisciplinary team of more than 400 scientists – biologists, physicists, chemists, engineers, mathematicians – crossing all boundaries and working together, seeking nature-inspired solutions to grand challenges in health, sustainability and security for global impact.

Whether they are seeking a cure for Ebola, developing new advances in cancer therapeutics, removing toxic chemicals from air or water, or developing new paradigms for automation, data exchange and decision making in manufacturing technologies and processes, the scientists at the Biodesign Europe and Biodesign Institute take their cues from people and nature.

Health, sustainability and security – these are the three core areas where we are making a difference. By harnessing the natural design rules of life on this planet, and by translating discoveries into the clinic and marketplace, we are finding new solutions to today's complex global challenges.

Dublin City University, founded in 1981 is a young, dynamic and ambitious university with a distinctive mission to transform lives and societies through education, research and innovation. Excellence in DCU education and research activities has led to its ranking in the top of 1.5% of universities in the world. The University is consistently ranked among the top young universities globally, appearing in the QS Top 50 under 50, and Times Higher (THE) Top 100 under 50. Competitively won research funding is approximately €38 million per annum, and DCU invests considerable amounts of its resources to develop research infrastructure and support key programmes.

DCU is ranked in the top 150 of the most globally-engaged universities in the world. DCU is a member of the prestigious European university network, the European Consortium of Innovative Universities (ECIU) and is also a member of the Young European Research Universities Network (YERUN). The DCU International Office promotes an intercultural environment throughout the University and assists international staff and students in relocating to Ireland

Over the period 2013-2020, DCU has been involved in 68 H2020 projects, coordinating 22 and acting as partner in another 46, with the total funding value to DCU over €26M. These include 11 MSCA

Initial Training Networks (ITNs), seven Research and Innovation Staff Exchange Scheme awards, and 11 individual Marie Sklodowska-Curie fellowships.

Arizona State University lauded as "one of the most radical redesigns in higher education", ASU is a student-centric, technology-enabled knowledge enterprise that tackles complex global challenges through the focused lenses of sustainability, economic competitiveness, social embeddedness, entrepreneurship and global engagement. Since 2002, the university has established 24 new transdisciplinary schools and launched trailblazing multidisciplinary initiatives including the **Biodesign Institute**, the premier scientific research institute in the USA's fastest-growing research university, a collection of sixteen use-inspired research centers focused on biomedicine and health outcomes, sustainability and security; the **Julie Ann Wrigley Global Institute of Sustainability** and the nation's first School of Sustainability, entities that advance research, education and business practices to address social, economic and environmental challenges at the intersection of nature and the made world.

A five-time U.S. News & World Report designee as the "#1 most innovative" school in the nation (2016-2020), ASU has achieved record-breaking levels of traditional, online and international student enrolment, freshman quality and retention, research expenditures, diversity and is currently overseeing its third major research infrastructure expansion. ASU's meteoric ascent in quality, growth and comprehensive modernization has garnered its distinct rankings as one of the top 100 most prestigious universities in the world by Times Higher Education and a top 100 designation in the 2018 Academic Ranking of World Universities.

Areas with Current Opportunities

- **Bioengineering and Biomaterials**

Within Biodesign Europe, and in collaboration with the DCU's Medical Engineering Research Centre, we are developing innovative biomaterials-based systems that will revolutionise areas like Bioengineering and Tissue Engineering through the development of novel strategies to combat life-threatening diseases. Together with biomaterials, we are using stem cell technology to improve the existing healthcare systems. These concepts and technologies are being used for the treatment of different diseases, e.g. various cancers, cardiac failure, bone fractures and chronic skin injuries. We are also developing technology platforms to improve targeted and tailored drug/therapeutic delivery at different locations in the human body.

Potential Project Ideas - Bioengineering and Biomaterials

1. Design and delivery of a new genetic nanomedicine for the efficient treatment of chronic wounds
2. Application of non-viral vector delivery systems to promote tissue repair and healing
3. Potential of stimuli-responsive based functionalised hydrogels for on-demand nanomedicine delivery for bone repair applications
4. Development of a device to replace or augment the existing coronary stent which will inhibit or reduce cardiac reperfusion injuries
5. Potential for bioactive control of platelet and cell interactions with biomaterials for the development of degradable coronary stenting
6. Novel hydrogels for the reinforcement and regeneration of hypertrophic heart tissue
7. Development of biomaterial surfaces for the positive and negative control of angiogenesis around implants and tissue engineering constructs
8. Experimental and computational mechanics of gels, fibrous networks ±non-woven materials
9. Computational models of traumatic brain injury from the cell-level up to whole head modelling
10. Mechanical characterisation of central nervous system cells
11. Delivery of nanomaterials for accelerating tissue repair
12. Light-activated biomaterials for tissue sealing and wound healing
13. Nanoglues for combating surgical-site infections
14. Neural repair and regeneration using light-activated biomaterials and therapeutic delivery
15. Biomaterial platforms for generation and encapsulation of 3D tissue microenvironments

Potential Supervisors

1. Professor Nicholas Dunne (nicholas.dunne@dcu.ie)
2. Professor Silvia Giordani (silvia.giordani@dcu.ie)
3. Dr Andrew Kellett (andrew.kellett@dcu.ie)
4. Dr David Collins (david.collins@dcu.ie)
5. Dr Garrett McGuinness (garrett.mcguinness@dcu.ie)
6. Dr Tanya Levingstone (tanya.levingstone@dcu.ie)
7. Dr Owen Clarkin (owen.clarkin@dcu.ie)
8. Dr David MacManus (david.macmanus@dcu.ie)
9. Dr Mehdi Nikkhah (mehdi.nikkhah@asu.edu)
10. Dr Ann Jones (anne.katherine.jones@asu.edu)
11. Dr Julianne Holloway (julianne.holloway@asu.edu)
12. Professor Kaushal Rege (kaushal.rege@asu.edu)

- **Manufacturing and Bioeconomy**

Biodesign Europe, in collaboration with the SFI Research Centre for Advanced Manufacturing and Advanced Processing Technology Research Centre, is focused on Manufacturing, and its convergence with Digital Technologies to better develop, model and control a specific manufacturing process. Particular areas of interest are Additive Manufacturing and 'Batch of One' related technologies, which offer enormous potential to significantly disrupt traditional manufacturing and to create new markets and bespoke products not previously thought possible (e.g. automotive, aerospace, medical technology and pharmaceutical manufacturing). To achieve a larger scale and broader application of Additive Manufacturing and 'Batch of One', their cost structure needs to be lessened. In Biodesign Europe, we are investigating digital platform solutions and bringing manufacturing process understanding to a higher level, manufacturers are understanding the implications of reduced cycle time, less scrappage and increased quality during production.

Biodesign Europe is also developing alternative technologies to fossil fuels to produce everyday commodities that we use, based on renewable biological resources. Bioeconomy is being used to investigate biological resources sustainably to produce high-value valuable goods, such as bioactive molecules, chemical building blocks, plastics, fuels and energy. Currently, the agri-food and marine sectors produce high volumes of residues during food production. Thus, we are investigating research opportunities focused on the conversion of these residues to higher-value products will create new business and value chain opportunities, which will allow these industries to diversify and add value to the sector, increase resource efficiency and complementing existing food production activities.

Potential Project Ideas - Manufacturing and Bioeconomy

1. Design and synthesis of novel, ion-containing block copolymers to be used in materials ranging from membranes for water purification to biomedical immunostimulatory therapeutics
2. New data-driven algorithmic frameworks for computational design of large-scale molecular compounds to guide experimental molecular sub-structure assembly into large scale molecules
3. Strategies for the efficient operations of next-generation single lot production systems to realise individualised/micro-lot drugs within a biopharmaceutical context
4. Application of additive manufacturing technology to develop a stratified approach to promote healing of large bone defects
5. Additive manufacturing for biodiagnostics devices
6. Strategies for contamination detection and intervention control in manufacturing

Potential Supervisors

1. Professor Nicholas Dunne (nicholas.dunne@dcu.ie)
2. Professor Helen McCarthy (helen.mccarthy@dcu.ie)
3. Professor Dermot Brabazon (dermot.brabazon@dcu.ie)
4. Professor Stephen Daniels (stephen.daniels@dcu.ie)
5. Professor Christine Loscher (christine.loscher@dcu.ie)
6. Professor Anne Parle-McDermott (anne.parle-mcdermott@dcu.ie)
7. Dr Mary Pryce (mary.pryce@dcu.ie)
8. Professor Tim Long (telong@vt.edu)
9. Professor Gregory Raupp (raupp@asu.edu)
10. Dr Giulia Pedrielli (giulia.pedrielli@asu.edu)
11. Dr Matthew Green (mdgreen8@asu.edu)

- **Biotechnology and Precision Medicine**

Researchers within the Biodesign Europe, in collaboration with the Biodesign Virginia G. Piper Center for Personalized Diagnostics, the Biodesign Center for Applied Structural Discovery and DCU Cancer Research Centre, are currently working on understanding normal and diseased states, which will lead to revolutionary new treatments for conditions such as cancer, inflammatory diseases and inherited diseases. Such advances in therapeutics, based on Biotechnology, have ushered in an exciting new era known as Precision Medicine to develop prevention and treatment strategies that take patient variability into account (e.g. people's genes, environment and lifestyles) by providing the right patient with the right medicine at the right time. As an example, the treatment of several cancers has shifted away from the "One-Size-Fits-All" approach of treatment (e.g. chemotherapy) to a more focused and tailored strategy where targeted therapies are matched according to the molecular profile of a patient's tumour.

Potential Project Ideas - Biotechnology and Precision Medicine

1. 3D *ex vivo* model to improve our understanding of cancer progression and explore the potential of innovative nanomedicine treatment
2. 3D *ex vivo* cancer models using patient tissue to improve understanding of the role of stem cells in the development of resistance to androgen deprivation therapy
3. Personalised medicine for breast, prostate and ovarian cancer
4. Nano-engineered delivery systems for the targeted delivery of oncology drugs
5. Nanotherapeutic peptide delivery agents to improve the anti-tumour efficacy of radiotherapy
6. Antibodies: Linking the innate and adaptive immune response in breast cancer
7. Regulatory/coding mutations in PI3K/AKT pathway genes as novel treatment biomarkers for patients with trastuzumab refractory HER2-positive breast cancer
8. Determination of the functional impact of germline single nucleotide polymorphisms in ERBB-family genes associated with clinical resistance of HER2-positive breast cancer to Trastuzumab
9. The anticancer activity of combining ATM and ATR inhibition in p53 mutant cancer
10. Developing APR-246 bound RALA particles for the targeted treatment of p53 mutant cancer
11. Are functional genome-wide polymorphisms in DNA damage repair genes of pancreatic cancer patients associated with response to DNA damaging agents?
12. Clone Wars: Uveal melanoma organoids as preclinical models to study the spatial and clonal genomic drivers of UM

Potential Supervisors

1. Professor John Crown (john.crown@dcu.ie)
2. Professor Tia Keyes (tia.keyes@dcu.ie)
3. Professor Helen McCarthy (helen.mccarthy@dcu.ie)
4. Professor Paul Cahill (paul.cahill@dcu.ie)
5. Dr Naomi Walsh (naomi.walsh@dcu.ie)
6. Dr Alex Eustace (alex.eustace@dcu.ie)
7. Dr Denis Collins (denis.collins@dcu.ie)
8. Professor Josh LaBaer (Joshua.Labaer@asu.edu)
9. Professor Jim Allen (JAllen@asu.edu)
10. Professor Robert Kaindl (robert.kaindl@asu.edu)
11. Professor Stuart Lindsay (stuart.lindsay@asu.edu)
12. Dr Alexandra Ros (alexandra.ros@asu.edu)

- **Bioanalytics and Biodiagnostics**

Within Biodesign Europe, we are developing new biomedical assays to (i) diagnose diseases and conditions more accurately; (ii) classify disease more precisely; (iii) approach treatment more individually and (iv) identify who is at risk of developing a disease or condition. By adopting such an approach, variations in the sequence, structure or expression of a person's DNA, RNA or protein can be analysed using these diagnostic assays and used to stratify patients so that those who are likely to benefit from a specific therapy are identified and treated, while others who are unlikely to benefit can receive alternative treatments.

Additionally, we are investigating "Quality-by-Design" approaches that will enable time-efficient and cost-efficient scale-up from prototyping to production of microfluidic systems. Typical applications of these next-generation lab-on-a-chip technology platforms are sample-to-answer integration for biomedical point-of-care and global diagnostics, liquid handling automation for the life sciences, process analytical techniques and cell line development for biopharma as well as monitoring the environment, infrastructure, industrial processes and agri-food.

Also, within Biodesign Europe and in collaboration with the Biodesign Center for Biocomputation, Security and Society, we have an exciting research programme focused on the study of the biology of computation and computation in biology, including biological modelling of immunological processes and evolutionary diseases, cybersecurity, automated software repair and evolutionary computation.

Potential Project Ideas - Bioanalytics and Biodiagnostics

1. Personalised cancer detection and treatment using high-throughput and microfluidic drug screening
2. Low-cost automation of molecular diagnostic assays
3. Microfluidic chip-based systems to purify and isolate circulating tumour DNA for early cancer detection
4. Chronic wound infection model for accelerating drug development and improving live quality of diabetic-aging population
5. Biosensors for healthcare applications
6. Artificial intelligence in patient security and healthcare management
7. Artificial intelligence in human performance and management
8. Biological modelling of immunological processes and evolutionary diseases
9. Biological systems approach to cybersecurity and automated software repair

Potential Supervisors

1. Professor Noel O'Connor (noel.oconnor@dcu.ie)
2. Professor Tomas Ward (tomas.ward@dcu.ie)
3. Dr Kieran Moran (kieran.moran@dcu.ie)
4. Dr Dermot Walls (dermot.walls@dcu.ie)
5. Dr Aoife Morrin (aoife.morrin@dcu.ie)
6. Dr Tim Downing (tim.downing@dcu.ie)
7. Dr Denise Harold (denise.harold@dcu.ie)
8. Dr David Kinahan (david.kinahan@dcu.ie)
9. Dr Tanya Levingstone (tanya.levingstone@dcu.ie)
10. Dr Mehdi Nikkhah (mehdi.nikkhah@asu.edu)
11. Professor Stephanie Forrest (steph@asu.edu)

- **Sustainability for Health**

Biodesign Europe, in collaboration with the Swette Center for Environmental Biotechnology at the Biodesign Institute, is leading to new ways to clean up pollution, treat water and wastewater, capture renewable energy, and improve human health. For example, innovative approaches to renewable bioenergy using anaerobic microbes to convert biomass to useful energy forms (e.g. methane, hydrogen, or electricity) and using photosynthetic bacteria that can capture sunlight to produce new biomass are being investigated. Moreover, links between microbes, obesity and human health also are being explored through collaboration with the Mayo Clinic.

Other research opportunities, in association with the Biodesign Center for Environmental Health Engineering and the DCU Water Institute, are focused on determining where environment mass-produced chemicals wind up, their impact on health, and how to remove them from contaminated water resources, aquifers and agricultural soils. Specific toxins of interest include dioxins, antibacterial products, pharmaceuticals, organohalides, problematic plastics and their additives, as well as pesticides – all having potential health impacts, including adverse birth outcomes, inflammation and increased risk of cancer. In addition to toxins in wastewater, research is being conducted on the emission of toxic dioxin into the air from the incineration of triclosan-laden municipal sludge, or biosolids, and in a related study the first whole-genome sequencing of a naturally occurring bacterium uniquely capable of using toxic dioxins as a food source has been completed.

Potential Project Ideas - Sustainability for Health

1. Development of low-cost and portable testing instruments and lab-on-a-chip cartridges to support water monitoring and testing across a range of different environments
2. Fundamental/applied research to improve all stages of anaerobic digestion and methanogenesis
3. Providing optimal conditions to allow microorganisms to remove environmental contaminants
4. Detoxifying recalcitrant organic contaminants to promote biodegradability
5. Using photosynthetic microorganisms to convert sunlight and CO_2 directly into sustainable fuels
6. Understanding the impact of organic products microorganisms on the microbial activities and communities
7. Using biofilms to produce biologically stable drinking water while removing pollutants
8. Occurrence and impact of phthalates in the environment
9. Monitor toxins in groundwater and implementation of removal strategies from drinking water resources
10. Emission of toxic dioxin into air from incineration of triclosan-laden municipal sludge or biosolids
11. Lab-on-a-disc technology for phosphate sensing in catchments
12. Development of eDNA extraction methods for pathogen detection in water

Potential Supervisors

1. Professor Fiona Regan (fiona.regan@dcu.ie)
2. Professor Anne Parle-McDermott (anne.parle-mcdermott@dcu.ie)
3. Dr Blanaid White (blanaid.white@dcu.ie)
4. Dr Yan Delaure (yan.delaure@dcu.ie)
5. Dr David Kinahan (david.kinahan@dcu.ie)
6. Dr Konstantions Gkrintzalis (konstantinos.gkrintzalis@dcu.ie)
7. Professor Bruce Rittman (rittmann@asu.edu)
8. Professor Rolf Halden (rolf.halden@asu.edu)

Eligibility

Applicants:

- must fulfil the MSCA-IF mobility requirements[1]
- must be an experienced researcher i.e. should have a PhD or more than 4 years of research experience in a relevant research area of Biodesign Europe by the call deadline
- should demonstrate a promising track record of early research achievements

DCU internal procedure

If you are interested in applying please forward the following documents to the Director of Biodesign Europe, **Professor Nicholas Dunne (nicholas.dunne@dcu.ie),** by **Friday May 29th 2020**.

1. A short CV
2. A one-page research proposal
3. Details of the PIs you would like to work with at both institutions

Queries

If you have any queries please contact **Professor Nicholas Dunne (nicholas.dunne@dcu.ie)** and Dr Ines Perić (ines.peric@dcu.ie)

[1] **MSCA-IF mobility:** The researcher must not have resided or carried out the main activity (work, studies, etc.) in the country of the beneficiary for more than 12 months in the 3 years immediately before the call September 9th deadline (flexible 36 months in the 5 previous years if eligible for career restart or reintegration fellowship https://www.iua.ie/irish-marie-curie-office/funding-calls/individual-fellowships/)