**Science and Technology in Medicine**

**ResearchProjectProforma(SchoolofMedicine)**

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| **Research Title:**<br><br>**Keywords (up to 5)** | **Modulating cardiomyopathies using optogenetics in human induced pluripotent stem cell models in 3D.**<br><br>Human induced pluripotent stem cells (hiPSCs), cardiomyocytes, genetic engineering, tissue engineering, ARVC |
| **Supervisor:**<br>**Job Title:**<br>**Department:**<br>**Email Address:**<br>**Telephone:**<br>**Webpage link:** | Dr. Vinoj George<br>*Lecturer in Stem Cell Biology & Regenerative Medicine*<br>ISTM<br>v.george@keele.ac.uk<br>(0)1782 674383<br><br>https://www.keele.ac.uk/istm/staff/vinojgeorge/ |
| **Type of projects offered (delete as appropriate)** | Intercalation |

## (1) Outline the broad aims of your research and its medical relevance (150 words):

Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) is a predominantly inherited cardiac muscle disorder that affects the structural integrity of heart muscle cells, which in turn, can lead to irregular heart rhythm (arrhythmia) and in some cases, sudden cardiac death. The genetic mutation may be passed on to a child from an affected parent, but manifests with varying severity on reaching early adulthood, suggesting that ARVC is a 'cardiac disease of maturity'. With explanation for disease severity still elusive, this project proposes a translational model to understand and control the genetics of ARVC severity using light (optogenetics) on human induced pluripotent stem cell-derived cardiomyocytes (hPSC-CMs) in 3D. ***Therefore, the project aims to test novel genetic regulators of ARVC by their optogenetic modulation in normal and patient-related mutant ARVC hPSC-CMs in three dimensional cardiac models.***

## (2) Indicate the skills/techniques the student will learn (100 words)

The cross-disciplinary project combines expertise in stem cell/cardiomyocyte biology and tissue engineering to apply cutting-edge technology for translating optogenetics and biomaterial engineering ***to address current limitations in understanding mechanism of severity in ARVC and to create multicellular 3D translational models to predict patient conditions more accurately than current models.*** To achieve the above goal, we will use a gene-modifying tool called CRISPR **(genome engineering)** for non-invasive modulation of host cell gene function using light **(optogenetics)**. Coupling this with recent developments in producing mature adult-like cardiomyocytes on electrically-conductive nanofiber scaffolds **(tissue engineering)**, it becomes feasible now to develop 3D translational models of mature ARVC disease.

Please submit this form electronically to Prof Divya Maitreyi Chari on d.chari@keele.ac.uk