**Title**: The Development of a Library of Digital Reanimated Mitral Valves

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**Project Overview**: The overarching aim of this project is to advance our understanding of mitral valve mechanics in aged cardiac structures. This is critical to advance success of emerging transcatheter mitral valve replacement (TMVR) implants.

The current state-of-the-art for cardiac implants’ path to clinical use include: CAD (computer aided design) modelling, in silico evaluation, prototyping, benchtop mechanical testing, and safety and efficacy evaluation in preclinical large animal models (typically porcine or ovine). However, there is no large animal model of valvular disease. This project presents a unique opportunity to create a digital (advanced mathematical modelling with finite element analysis – FEA) library of reanimated aged cardia to rigorously investigate mitral valve mechanics in realistic environs, particularly for emerging mitral prostheses.

Through the Anatomy Donor Programme at RCSI, Dr. Conway has access to a unique set of fixed human cardia. These cardia will be imaged, reconstructed, visualised and reanimated using advanced numerical techniques (FEA). This dataset will be further used to generate a pathological library and complementary ‘virtual’ or parameterised model hearts showing extent of influence of disease on TMVR procedures.

The specific objectives of this project are to first reconstruct aged human cardia imaging (previously acquired with high resolution microCT) to create a digital cardiac library with realistic anatomical morphologies. Secondly, to extract, from diffusion-tensor magnetic resonance imaging (DTMRI), the inferred network of cardiac myocytes. Thirdly, to electrically and mechanically activate cardiac library using advanced FEA techniques. Finally, to quantify the biomechanical effect of introduced pathologies (chordae tethering, annular dilation and calcification) on the cardiac library.