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## Advanced Materials Research Group

### project summary

<b>Project Title</b>	The development of a human mesenchymal stem cell-based chitosan construct for joint repair
<b>Researcher</b>	Alexander Popov
<b>Project Summary</b>	<p>The aim of this project is to produce a novel osteochondral construct for the repair of cartilage defects. Regenerative therapeutic solutions are required to address the increasing prevalence of osteochondral diseases within the population. Joint damage often originates from osteoarthritis or trauma whilst existing treatments, such as bone graft reconstructions or the use of biomaterial implants are insufficient. The primary reason for the inadequate treatment of joint diseases is due to the limited capacity of articular cartilage to regenerate. Additionally, osteochondral implants have been established to fail mechanically in the long-term. This is generally the consequence of poor anchorage between the implant and the native tissue.</p> <p>To address these issues, the project endeavours to model the osteochondral interface using a porous chitosan scaffold seeded with human mesenchymal stem cells (hMSCs). Particular focus has been applied to optimise hMSC culture conditions and allow simultaneous differentiation, along osteogenic and chondrogenic lineages, within a single scaffold. Attention has also been applied to reduce the use of animal-derived culture products because this is essential for the translation of medical research to the clinic. In addition to the optimisation of cell culture conditions, scaffolds with a graduated pore architecture and surface chemistry are being developed. The scaffold design seeks to provide region-specific cues and regulate cell</p>

differentiation. The differentiation will be further enhanced through the use of a novel perfusion bioreactor system. By successfully creating bone and cartilage tissue within a single construct, this research can offer an improved model of the osteochondral interface and a potential treatment for cartilage defects.

DAPI staining of hMSC nuclei, 24 hours after seeding onto porous chitosan scaffold.

