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CIC biomaGUNE
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Smart Biomaterials in Ophthalmology: Human Stem Cell-Based 3D-Bioprinted Hemi-Corneal Tissues

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Host: Aitziber L. Cortajarena

Wednesday, 26th February
12.00PM

CIC biomaGUNE - Seminar Room

According to the WHO, approx. 1 billion people worldwide suffer from moderate to severe vision impairment, with over 100 million experiencing blindness due to corneal diseases and cataracts. While Corneal transplantation is considered the most effective surgical intervention in the world, there is a significant global shortage of high-quality donor corneas, with only one cornea for every 70 needed. To address this critical issue, an innovative approach using 3D bioprinting technology to create complex, anatomically analogous hemi-corneal tissue equivalents composed of three cellularized layers could be used. Previous results demonstrated that the cellularized 3D bioprinted material exhibited transparency and a cell density of 700-1300 cells/mm^2, and with no observed cytotoxicity towards human Corneal Stroma-Mesenchymal Stromal Cells (hCS-MSCs). Functionalization with antimicrobial peptides (AMPs) conferred significant antimicrobial properties to the 3D bioprinted scaffolds, resulting in 90-96% killing of Pseudomonas aeruginosa, and 70-87% of Candida albicans, without compromising hCS-MSCs viability.

To this aim SMART-3DCORNEA project aims to involve the use of human stem cells, smart biomaterials and antimicrobial peptides to produce transplantable corneal equivalents. This multidisciplinary project will include cutting-edge 3D bioprinting techniques, eye cell isolation and characterization, and GMP-certified production processes. By integrating the expertise and technologies of these renowned entities. SMART-3D-CORNEA aims to develop a nanocellulose-based 3D bioprinted hemi-corneal tissue equivalent incorporating native corneal cells (human corneal stroma-mesenchymal stromal cells, corneal epithelial cells, and corneal endothelial cells) and AMPs to prevent infection during surgical procedures, ultimately offering a promising solution to preserve vision for patients worldwide. A collaboration among leading institutions like CIC biomaGUNE's Hybrid Biofunctional Materials group, Oslo University Hospital's EyeTec research group, and the Veneto Bank Eye Foundation could help to reach the project goals.