

In Vitro and In Vivo Oxygen Imaging of Islet Encapsulation Devices: Lessons Learned and the Road Forward

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The lack of oxygen supply to the highly metabolic pancreatic islet cells is one of the major factors contributing to the failure of islet transplantation devices targeting the cure of type I diabetes (T1D). The loss of islets due to hypoxia is common in almost all modes of islet transplantation – from micro-encapsulation to macro-encapsulation devices and tissue grafts. Several approaches to improve oxygenation in these transplantation devices have been tested. However, the lack of available technologies to provide reliable oxygen partial pressure (pO_2) assessment in and around devices severely hinders the progress. With the support of JDRF, an “Oxygen Measurement Core” facility was established at O2M™ Technologies in 2019. Several leaders from academic institutions participated in the core by providing their specific islet encapsulation devices. All oxygen imaging experiments were performed using O2M’s preclinical oxygen imager, JIVA-25™ that works on electron paramagnetic resonance oxygen imaging (EPROI) principle. JIVA-25™ provides three-dimensional pO_2 maps with high spatial, temporal, and pO_2 resolution for objects up to 40 mm. For reporting oxygen concentration, JIVA-25™ uses injectable trityl radicals OX071 with relaxation rates R_1 linearly related to the absolute pO_2 . I will present key data and the technical aspects of oxygen imaging of cell encapsulation devices in the presentation.