Optical Molecular Imaging and Sensing during *Ex Vivo* Lung Perfusion - *ENLIGHTEN*

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Purpose: The ENLIGHTEN programme brings together three institutions (Edinburgh, Glasgow and Newcastle) to implement and validate novel real-time optical technologies to image and sense pathology and aberrant physiology in the *ex vivo* human lung using multiplexed optical endomicroscopy (OEM) and optical sensors (lab-on-a-fibre). These technology approaches being developed in the MRC Centre for Inflammation Research (www.proteus.ac.uk) will enable immediate point-of-care read-outs in the human lung and the vasculature. During *ex vivo* lung perfusion (EVLP) and ventilation we will dynamically interrogate infective, inflammatory and physiological indices in the lungs and the perfusate and utilise novel non-toxic optical imaging agents and sensing/imaging fibres to monitor key pathological processes. Ultimately, these approaches have the potential to incisively monitor *ex vivo* lung reconditioning and generate a temporal molecular record of pulmonary function from explantation, EVLP reconditioning and re-implantation.

Retrieval and Considerations: This research involves lungs deemed unsuitable for transplant and authorised for research purposes. Retrieval in Scotland for this study will only be undertaken by Glasgow and Newcastle teams. Retrieval for the purpose of this research should not compromise the retrieval or integrity of other organs destined for transplant. Lung retrieval will be documented by the CT retrieval team as per normal practice. Both DCD or DBD donors will be considered ***only*** if a CT retrieval team has already been mobilised for a potential transplant and that other functions of the team, particularly heart retrieval, are not impeded.

- If lungs have been accepted for transplant, removal should take place as per normal practice. If lungs are then discounted on the back table, they will be provided for research.
- If the heart is placed clinically and the lungs accepted for research, the heart and other clinical organs will be retrieved according to normal practice, followed by the lungs. In this scenario, the availability of a CT surgeon must be considered. If it is possible, a CT surgeon would wait and retrieve the lungs after the heart is taken to the transplant centre and after other clinical organs are removed.

It is at the ***retrieval team's discretion*** as to whether they remove the lungs for the purposes of this study, and this will be primarily based on whether there is any other clinical transplant activity in their retrieval zone at the time. If the team are not required elsewhere and are able to wait, the team will retrieve the lungs after the abdominal team have completed Perfadex infusion, as per normal practice.

In addition, if NRP is used in DCD retrieval of abdominal organs, the cardiothoracic team will not retrieve the lungs until abdominal retrieval has finished.

Delivery logistics: At present, all lungs authorised for the ENLIGHTEN study will go to Edinburgh for research. The research team will organise a courier to securely and safely transport lungs to the Queen's Medical Research

Institute, Edinburgh. The SNODs will liaise with the research team to coordinate timings and will be responsible for providing lungs to the courier.