

Project title:

Integrating Artificial Intelligence and Virtual Pathology to Transform Drug Response Prediction in Oesophageal Cancer

Project Summary:

Recent advances in digital pathology are redefining the traditional role of histological assessment, moving beyond diagnosis towards data-driven personalised medicine. The integration of artificial intelligence (AI) with high-resolution whole-slide imaging (WSI), combined with genomic and transcriptomic data, now enables the identification of histological and molecular features that can predict drug response and patient outcomes directly from conventional H&E slides.

Oesophageal cancer (OC) remains a major clinical challenge, with a five-year survival rate of only 15% and ranking as the seventh leading cause of cancer-related deaths in the UK. This poor prognosis is largely due to late-stage diagnosis and limited response to conventional chemotherapy. Our group has constructed a single-cell atlas of the OC ecosystem using state-of-the-art single-cell technologies, revealing unique tumour microenvironments and phenotypic diversity associated with therapeutic response and long-term survival. However, despite their power, these technologies are expensive and technically demanding, limiting their broader clinical application.

This project aims to bridge that gap by developing AI-powered virtual pathology models capable of inferring single-cell transcriptomic profiling to predict drug response and long-term outcomes in OC. By combining advanced single-cell profiling with AI-driven image analysis, this work will provide mechanistic insights into tumour heterogeneity, support precision treatment decisions, and identify novel therapeutic targets.

The supervisory team combines expertise in single-cell biology, digital pathology, and AI-based image modelling, in alignment with the scope of the CRUK Clinical Academic Training Programme. The project will leverage high-quality clinical datasets from Imperial College Healthcare NHS Trust and The Royal Marsden Hospital, both leading UK centres for OC treatment.

This multidisciplinary collaboration offers a unique opportunity for the PhD candidate to develop and translate next-generation AI tools that integrate histopathology and molecular profiling, ultimately improving personalised therapy and outcomes for patients with oesophageal cancer.

Supervisory Team:

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Prof Robert Goldin, Department of Cellular Pathology, ICL

Dr Monica Terlizzo, Department of Pathology, The Royal Marsden Hospital

Dr Wenjia Bai, Associate Professor in Artificial Intelligence in Medicine, Department of Barin Science, ICL

Clinical Specialities:

Histopathologist, Surgeon, Oncologist, Gastroenterologist