Targeting Cancer Cell Dormancy and Reactivation: Mechanisms of Latency and Relapse in Metastatic Disease

Project Description

Project duration:	Honours, PhD or MPhil
Description:	Cancer dormancy represents a major clinical challenge, as dormant disseminated tumour cells (DTCs) can persist for years after primary treatment and later reactivate to form incurable metastases. Understanding and targeting the biological mechanisms that regulate dormancy, and its reversal is key to preventing metastatic relapse in breast and other cancers. This project will investigate the molecular pathways that control the induction, maintenance, and escape from dormancy, using **established dormancy models**, **3D co-culture systems**, and **in vivo assays**. Drawing on recent advances from our lab **(**https://jeccr.biomedcentral.com/articles/10.1186/s13046-023-02663-8**)** and others, we will focus on: • Cell-intrinsic regulators of dormancy, including **cell cycle arrest**, **quiescence**, and **autophagy** • Dormancy-inducing signals from the tumour microenvironment, including **TGF-β**, **integrin**, **BMP and other pathways** • Identification of key molecular switches that trigger **reactivation from dormancy (various candidates have been identified)** • Functional validation of **candidate genes or druggable targets** that sustain latency or drive relapse We will use advanced techniques such as **time-lapse live-cell imaging**, **transcriptomics**, **functional genomics (CRISPR screens)**, and **patient-derived organoid models** to track and manipulate dormant cell behaviour in real time.
Expected outcomes and deliverables:	Students will: • Learn to culture and study dormant cancer cells using 3D and microenvironmental models • Identify dormancy-regulating factors through gene expression analysis and functional perturbation • Test potential inhibitors that may prevent dormancy escape or selectively eliminate dormant cells • Gain skills in cell biology, drug screening, and in vivo cancer models • Deliverables include a written thesis, conference presentations, and contributions to peer-reviewed publications

Suitable for:	Ideal for students interested in metastasis, therapeutic resistance, tumour cell plasticity, and cancer signalling. Prior experience in cell biology, cancer models, or molecular techniques is helpful but not required. Curiosity, creativity, and a translational mindset are highly valued.
Primary Supervisor:	Dr Murugan Kalimutho and Professor Kum Kum Khanna
Further info:	Interested applicants are encouraged to contact the research team prior to applying: e: Murugan.kalimutho@mater.uq.edu.au