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Research

The University of Birmingham has a strong research interest in adult and embryonic stem cell biology. BUSCC incorporates two focused research themes as well as a number of other activities in the areas of the experimental and social sciences.

Research activities encompassed by BUSCC include work on basic adult and embryonic stem cells and tissue regeneration. This covers a wide range of research areas from neural stem cells, skeletal muscle stem cells, tooth stem cells and germ cells derived from embryonic stem cells to studies on 3D materials for tissue engineering.

BUSCC also incorporates individuals with an interest in the ethical, social and legal impact of stem cell science.

Summary of Research Themes

Stem cell regulation in the immune system

The first research theme is to understand how the earliest stem cells and progenitors that underlie the immune system are regulated throughout life and how defects in the normal control processes can lead to age-related deficiencies or cancer.

Several groups are investigating transcription control in haemopoietic stem and progenitor cells. Epigenetic regulatory mechanisms in both haemopoietic stem cells and embryonic stem cells, making use of technology that enables analysis of very small numbers of primary cells, constitutes the second major focus of this theme.

Strong links exist between clinical haematologists and basic researchers in terms of comparing transcriptional and epigenetic regulatory mechanisms between normal haemopoietic stem cells and cancer stem cells that are characteristic of specific leukaemias. In addition, expertise in isolating and characterising haemopoietic stem cells, including the use of human-mouse xenograft models, is being used to validate a novel strategy for expansion of adult stem cells.

Use of stem cells in tissue repair and regeneration

The second theme is to explore the potential of adult stem cells in novel approaches to tissue repair and regeneration. In particular, the aim is to capitalise on expertise in immunology and transplantation to investigate the host/stem cell interaction and to define how this may be modified to maximise the chances of successful incorporation of replacement donor cells in a clinical context.

An important strength in basic research in this area is the expertise in animal models of transplantation and artificial stem cell niches. Basic research on the nature of specific haemopoietic stem and progenitor cell niches is performed by a number of groups.

Factors influencing traffic of stem cells to and from the bone marrow and recruitment of stem cells to damaged liver are greatly facilitated by state-of-the-art intravital microscopy. It is planned to develop the liver studies to investigate how replacement hepatocytes (generated either from ES cells or an adult stem cell source) might become successfully and functionally incorporated into a host liver, either with a view to providing a bridging therapy during a period of acute liver failure or as replacement for a chronically injured or genetically deficient organ.

A second strength of this research theme is the wealth of local immunological expertise, and reflecting this most of the investigators involved in these projects are associated with the MRC Centre for Immune Regulation.

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