A role for cell competition in the elimination of aberrantly specified cells

Project ID: 3732

Supervisory team

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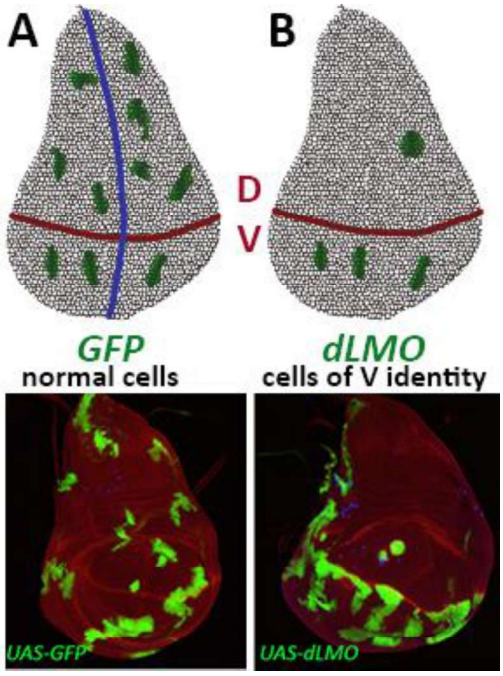
Other supervisors: Dr Catherine Hogan (Cardiff University)

Host institution: Cardiff University



Project description: Cells in an organ take life and death decisions based on the input they receive from their immediate neighbours. For example, some cancer cells cause their healthy neighbours to commit suicide. Indeed, cells with higher levels of the oncogene Myc expand at the expense of normal cells. This phenomenon, known as cell competition, was first discovered in Drosophila and is conserved in mammals. Cells compete for space, nutrients, growth factors and relative metabolic fitness.Several molecular players have been identified, but which mechanisms are common to all forms of cell competition remain unclear. Likewise, aberrantly specified cells, cells of wrong identity in the wrong place, are eliminated from tissues during development (see Figure), ensuring functional adult organs. Whether this is a form of cell competition is unknown and is the subject of this studentship.In the Hamaratoglu Lab, we have been developing quantitative assays and identified several players with roles in the elimination of aberrantly specified cells, among those neuronal protein Tau stands out (El Gammal, BioRxiv, 2026). There are commonalities as well as differences between cell competition and aberrant cell elimination. For example, JNK signalling was shown to play a role in both processes, but the pattern of activation is different. In cell competition, the genetic identity of the cell determines winner or loser status. For example, Myc expressing cells would always be winners in competition with wild-type cells. However, the identity of the majority determines the winners during elimination of aberrantly specified cells.The Piddini Lab has world-renowned expertise in cell competition. They established several cell competition assays using mammalian cells for translating their findings in flies into mammalian systems, latest one using human stem cells (Kulakova et al., in preparation). We plan to use this set up to establish whether tau expression induces competition in human embryonic stem cells. It will also be possible to differentiate these cells into neural stem cells to test the effect of Tau there, an interesting avenue given the role of Tau in neurodegeneration. In flies, we will test the molecular players identified in cell competition for roles in aberrant cell elimination and vice versa. You will join a dynamic and international research group and will be trained in the use of genomics, genetics, cell culture and microscopy techniques to investigate cell-cell interactions. You will also become a part of the interactive Cardiff and Southwest Drosophila communities.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable

greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.