Using machine learning to predict cell type and fate in heterogeneous populations.

This interdisciplinary project will use label-free ptychographic imaging to visualise behaviour of cells over time in heterogeneous cultures. Mixed neuronal cultures will be used to interrogate the behaviour of microglia, the resident immune cell population in the brain. Cells will be tracked over time to generate trajectories with information on distance travelled, velocity, changes in morphology, as well as unique metrics such as mass, granularity, cell volume. The student will use pattern recognition and machine learning algorithms to characterize particle movements with features extracted from the time-series. The local environment (e.g. density and dispersion of neighbouring cells) will be analysed and changes in behaviour related to any environmental differences. The aim is to identify a minimal set of measurements that can determine particular behaviour patterns and facilitate the identification of specific cell types within the heterogeneous population. Cell identity will be confirmed using established approaches, including immunocytochemistry and flow cytometry. The models developed, together with pharmacological and genetic approaches, will be used to explore basic biological mechanisms that regulate the behaviour of a relatively understudied cell type (microglia) that plays a critical function in the normal brain and in several disease states.

The project crosses disciplinary boundaries and could suit a computer science or mathematics graduate with a strong interest in biology or a computational biologist. The project will provide the student with key skills and exposure to new, cutting-edge technologies as well as applying established techniques to new problems.

For further information, any interested students can contact:
Julie Wilson <julie.wilson@york.ac.uk> (Maths),
Will Brackenbury <william.brackenbury@york.ac.uk> (Biology)
Peter O'Toole <peter.otoole@york.ac.uk> (Technology Facility).