3-D fruit fly images to benefit brain research

September 5 2007

The fragile head and brain of a fly are not easy things to examine but MRC scientists have figured out how to make it a little simpler. And they hope their research will shed light on human disease.

Using an imaging technique, originally developed at the MRC Human Genetics Unit, called optical projection tomography (OPT) they have generated startling 3D images of the inside of a fruit fly for the first time. The OPT images could help to speed up genetic research into Alzheimer's and other human diseases that affect brain cells.

Dr Mary O'Connell of the MRC Human Genetics Unit who led the research explained: "Neurodegeneration, the gradual loss of function of brain cells that occurs in Alzheimer's, Parkinson's and motor neurone diseases, isn't a strictly human phenomenon. Insects are affected by it too. In the autumn, bees and wasps often develop erratic behaviour before they die."

Because the fruit fly (Drosophila melanogaster) and human share many genes with similar functions, the fly is widely used by genetic researchers to study how genes influence human disease.

"It's already known that defects in the equivalent fly genes involved in human brain diseases cause brain cells in fruit flies to lose function as they age," Dr O'Connell continued.

OPT could help researchers to look at how the fly brain changes in response to alterations in the normal activity of a specific gene without

the risk of damaging tissue through dissection.

In a paper published in the September 5 issue of the online, open-access journal PLoS ONE, the team describes how they have already used the technique to image individual cavities within the brain of an ageing fly and see the brain deteriorate.

MRC PhD student Leeanne McGurk who captured many of the OPT images explained why the technique works: “The dark colour of the fly exoskeleton prevents us from seeing inside it using a standard light microscope. In the past this has meant scientists have had to tease apart fruit fly tissues by hand – a laborious process. Now, we have got over the problem by bleaching the fly exoskeleton. When the fruit fly becomes colourless it is possible to use imaging techniques not only to view its internal organs but to generate 2D and 3D images of the entire fly. ”

Using OPT images in this way will allow scientists to visualise where and how the products of selected genes are present in the fly. These patterns of gene expression, as they are known, will help to identify genes that control parts of the central nervous system and so provide detailed information about the human brain.

Bleaching of the exoskeleton to clear away the colour also allows images to be generated using other microscopic techniques that depend on penetration of light.

Dr O’Connell concluded: “This research is not simply limited to the study of conditions like Alzheimer’s but can also be used to study fly anatomy. The shape and size of organs can be affected by diseases like diabetes so imaging may yield clues to further our understanding of other conditions too.”

Source: Public Library of Science