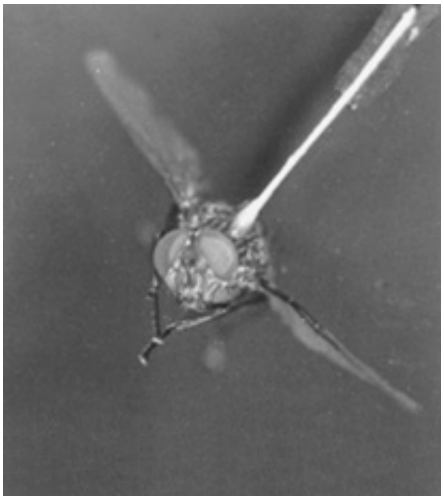
It takes nerves for flies to keep a level head

July 22 2008



A fly keeping a level gaze during an aerial manoeuvre

The nerve connections that keep a fly's gaze stable during complex aerial manoeuvres, enabling it to respond quickly to obstacles in its flight path, are revealed in new detail in research published today (22 July 2008).

Scientists from Imperial College London have described the connections between two key sets of nerve cells in a fly's brain that help it process what it sees and fast-track that information to its muscles. This helps it stay agile and respond quickly to its environment while on the move.

The study, published in the journal *PLoS Biology*, is an important step towards understanding how nervous systems operate, and could help us improve our knowledge of more complex animals. It could also be used

to improve technical control systems in autonomous air vehicles - robots that stay stable in the air without crashing and with no need for remote control.

Just as goalkeepers need to keep their heads level when flying through the air for a save, no matter how they tilt their bodies, so flies need to keep their gaze steady during their slightly more complicated areal manoeuvres. This enables them to process visual information about their surrounding environment more efficiently and modify their movements accordingly.

The new research shows that the way in which two populations of nerve cells, or neurons, communicate with each other is the key. The lobula plate tangential cells receive input from the eyes. This generates small electrical signals that inform the fly about how it is turning and moving during its aerial stunts.

The signals pass on to a second set of neurons that connect to the neck muscles, and stabilise the fly's head and thus its line of sight.

Lead researcher, Dr Holger Krapp, from Imperial's Department of Bioengineering says the pathway from visual signal to head movement is ingeniously designed: it uses information from both eyes, is direct, and does not require heavy computing power. He continues:

"Anyone who has watched one fly chasing another at incredibly high speed, without crashing or bumping into anything, can appreciate the high-end flight performance of these animals.

"They manage even though they see the world in poor definition: their version of the world is like a heavily pixelated photo compared with human vision. However, they do have one major advantage. They can update and process visual information more than ten times faster than

humans, which is vital for an insect that relies on fast sensory feedback to maintain its agility."

Dr Krapp adds: "Keeping the head level and gaze steady is a fundamental task for all animals that rely on vision to help control their movements. Understanding the underlying principles in simple model systems like flies could give us useful leads on how more complex creatures achieve similar tasks."

Source: Imperial College London