# Even fruit flies have an orientation memory: Recall tested in a virtual space

July 10 2008

In order to cope with their environment, animals must be able to remember the location of their destination in situations in which they temporarily lose sight of it. This ability, known as orientation memory, is found in primates and has now also been observed in fruit flies.

"We can say for certain now that flies have an orientation memory," says Professor Roland Strauss of the Institute of Zoology at the University of Mainz. Research conducted by his team has shown that flies can remember the position of an object for several seconds after the object has been removed from their environment.

The scientists also found that this orientation memory is attributable to a small group of neurons. The results obtained by the neurobiologists in Mainz were published online in the scientific journal *Nature.*

For their investigations, Roland Strauss's team constructed what can be described as a 360 degree cinema screen from a cylinder and put their subject, the fruit fly Drosophila melanogaster, into this cylinder. Visual objects in the form of vertical black stripes were then displayed to the flies.

Professor Strauss described the experiment as follows: "We showed them two objects at different locations and then had them vanish one after the other. Once the first object was no longer visible, the flies used the second object for orientation. When this object was also removed, the flies still moved in the direction of the first object, although this was

no longer visible."

In view of the behavior of the fruit flies, it can be concluded that they have the ability to store the position of their original destination in an orientation memory for at least four seconds. It is assumed that the animals have this ability in order to ensure that they can reach their destination in complex natural environments, even if they temporarily loose sight of it or have to make a detour. "This strategy is also known as 'path integration' and has been observed in other insects such as ants and bees," says Strauss.

Working on the assumption that the ability requires a signal path that is responsible for operant learning (learning by means of trial and error), the scientists were even able to identify the brain region in which this capability is localized. It was found that a small group of 40 neurons in the so-called ellipsoid body of the fly's brain was responsible. Here the ring neurons in the ellipsoid body play an important role as 'processors' of the impulses.

"This is where the memory function is located. Once this part of the brain has been removed, the recall ability is also lost. When it is intact, this small number of cells is enough to provide a fully functional orientation memory system." The neurobiologists suspect that the same neurotransmitter system that is responsible for the visual orientation memory in the pre-frontal cortex of monkeys is also responsible for the orientation memory in the central complex of fruit flies.

Citation: "Analysis of a spatial orientation memory in Drosophila": www.nature.com/nature/journal/ … ull/nature07003.html

Source: University of Mainz