How the brain decides what to eat

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This is a cartoon of a picking fly. Credit: Hannes Tkadletz (graphic department of the IMP)

Having a balanced diet is a vital concern to all living organisms, not only humans. Animals choose between different food sources according to their nutritional needs. In a study just published in the journal *Current Biology*, Carlos Ribeiro, group leader in the Champalimaud Neuroscience Programme at the Instituto Gulbenkian de Ciencia (Portugal), and Barry Dickson, at the Institute of Molecular Pathology (Austria), provide the first indication of the genes and brain circuits involved in this decision process, in the fruit fly *Drosophila melanogaster*, opening the way for understanding feeding decisions in other organisms, from the malaria-carrying mosquito to humans.

Carlos Ribeiro followed *Drosophila* foraging habits for several weeks and found that fruit flies choose between different food sources

according to their nutritional requirements, gender and mating status. Carlos describes their findings, 'Normally when kept on "complete food" (with sugar and yeast) and given the choice, flies do not eat food with proteins (yeast-enriched). However, after a few days on a protein-poor diet, flies preferred a yeast-rich diet. Female flies switch diets more quickly than males, and mated females quicker than virgin females.

The researchers used a simple and clever assay to follow the type of food flies preferred: they added a blue dye to the yeast-enriched food and a red dye to the 'sugar rich food', and then looked at the bellies of the flies, to know which food they had eaten.

Carlos says, 'This assay, and the powerful genetics of the fruit fly, allowed us to take the next step, and describe the molecules and neurons which make mated females react faster than virgin females, as well as the molecules which act in the brain of flies to detect a lack proteins and make the flies change their decisions - the sensor, so to speak'.

Flies get blue bellies after ingestion of the yeast-enriched food colored with a blue dye. Credit: Carlos Ribeiro, group leader in the Champalimaud Neuroscience Programme at the Instituto Gulbenkian de Ciência (Portugal)

The sensor turns out to be the same that might regulate feeding habits of both female mosquitoes and vertebrates. In humans, regulation of protein and carbohydrate uptake could be an important component of eating disorders - a major health problem in western societies. Amongst mosquitoes, it is the female who stings to get the proteins needed to make eggs. The urge to sting and ingest blood could be regulated by the same molecular brain sensor that Carlos Ribeiro now identified in *Drosophila*.

Carlos again, 'Maybe if we could understand how the sensor works in the *Drosophila* brain to control the urge to eat protein-rich food, we might be able to alter the urge of mosquito females to ingest blood and, thus, interfere with the transfer of the malaria parasite between hosts.'

Research in the fruit fly has helped unravel several mechanisms which proved to be relevant in humans, too. This study appears to be on the same track.

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