Making Sense of Smell in Moth Brains

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Two agriculturally important moth species

Scent is first processed in the antennal lobe of moths

Sustained neurons in the antennal lobe of a moth brain

Antennal lobe is subdivided into smaller structures known as glomeruli

Male moths have a subset of glomeruli specialized for detecting female released odors

Female moths may also have specialized glomeruli

For most animal species the ability to smell and process odors is important in many life-sustaining activities. Animals use odors to identify or attract receptive mates and locate suitable prey or host plants. An impressive example of the importance of smell is the ability of male moths to detect minute amounts of female sex pheromones and respond to them by flying upwind. Female moths release odors (pheromones) into the air, where they drift downwind. Olfactory (smell) receptor cells on the male antenna are extremely sensitive to the female-emitted pheromone components and respond to them by generating behavioral responses. These receptors have axons that project to the antennal lobe, the primary integration center for olfactory information. The antennal lobe is divided up into small knots of neurons known as glomeruli, which process smell input. Males possess a specific subset of enlarged glomeruli, known as the macrogglomerular complex (MGC) specific for processing female sex pheromone information.

In the animal kingdom, the external appearance of olfactory systems differs greatly. Despite the physical appearance, the underlying neuroanatomical