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Side differences during odour processing in the honeybee brain

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Left-right asymmetric information processing is a common property of nervous systems. It is thought that lateralization serves to avoid functional incompatibilities between sensory representations and to increase coding capacity by parallel processing. Lateralized sensory processing has mainly been described at behavioral or anatomical level while asymmetric neuronal coding is less studied. We identified a left-right asymmetry in the honeybee's antennal lobes during odour processing. When both antennae were stimulated via a frontal odour source the neurophysiological distances between odours were higher in the right antennal lobe than in the left one. Moreover, the processing of odour mixtures differed between sides, as responses to mixtures were significantly stronger than responses to the strongest component in the right but not in the left antennal lobe. Our data suggest a functional left-right difference in the antennal lobe networks, with the right being tuned for fine odour discrimination. Behavioural data support this hypothesis: bees with only the left antenna in use failed in an olfactory foreground-background discrimination task, while bees with only the right antenna in use succeeded. The implementation of different neuronal coding strategies in the left and right brain side may serve to process opposing tasks at the same time, such as discrimination and generalization of similar odorants.