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Mirror neurons and their implications on non human primates' behavior and cognition

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Mirror neurons (MN) have been originally found, and investigated for years, in the premotor cortex of the macaque monkey. Their pattern of activity and the anatomical connections with the descending corticospinal pathway prompted the idea that they are involved in several behavioral and cognitive processes, such as imitation and action recognition. More recent studies expanded our knowledge on the mirror mechanism and of MN functional role. By recording these neurons during the observation of actions under complex social conditions it has been shown that their discharge is modulated by several social stimuli (i.e. gaze direction of the observed agent), and by the possibility that the observed action implies a subsequent interaction with the monkey. These data suggest that mirror neurons are part of a network involved in decoding others' actions and intentions and that it is critically involved in social interactions. Moreover, the variation of mirror neurons activity under different experimental conditions suggest that environmental factors and experience can induce critical changes on how this mechanism respond to and decode social stimuli.

In the last decade the mirror mechanism has been investigated in early development to understand its potential implication in the emergence of key social behaviors. Several behavioral phenomena, already present in the early stages of development (neonatal imitation, facial mimicry), seem to involve a mirror mechanism. Electroencephalographic findings in newborn macaques support the hypothesis that a mirror mechanism operates in the early stages of postnatal development and that early adverse social experiences affect its functioning. This mechanism therefore could be used as a marker of social skills in postnatal development with critical implications for psychopathologies where social competence is compromised. MN thus may provide an original and unitary account of basic aspects of social cognition and behavior, and offer new insights on the interactions between brain plasticity, early experience and social behavior.