

# Brain activity linked to the parental instinct

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Why do we almost instinctively treat babies as special, protecting them and enabling them to survive? Darwin originally pointed out that there is something about infants which prompts adults to respond to and care for them which allows our species to survive. Nobel-Prize-winning zoologist Konrad Lorenz proposed that it is the specific structure of the infant face, including a relatively large head and forehead, large and low lying eyes and bulging cheek region, that serves to elicit these parental responses. But the biological basis for this has remained elusive.

Now, a possible brain basis for this parental instinct has been reported in research published in the scientific journal *PLoS ONE* on February 27. This research was led by Morten Kringelbach and Alan Stein from the University of Oxford and was funded by the Wellcome Trust and TrygFonden Charitable Foundation. The authors showed that a region of the human brain called the medial orbitofrontal cortex is highly specifically active within a seventh of a second in response to (unfamiliar) infant faces but not to adult faces.

This finding has potentially important clinical application in relation to postnatal depression, which is common, occurring in approximately 13% of mothers after birth and often within six weeks. The present findings could eventually provide opportunities for early identification of families at risk.

The research team used a neuroimaging method called magnetoencephalography (MEG) at Aston University, UK. This is an advanced neuroscientific tool which offers both excellent temporal (in

milliseconds) and spatial (in millimetres) resolution of whole brain activity. Because the researchers were primarily interested in the highly automatized processing of faces, they used an implicit task that required participants to monitor the colour of a small red cross and to press a button as soon as the colour changed. This was interspersed by adult and infant faces that were shown for 300 ms, but which were not important to solve the task.

The authors found a key difference in the early brain activity of normal adults when they viewed infant faces compared to adult faces. In addition to the well documented brain activity in the visual areas of the brain in response to faces, early activity was found in the medial orbitofrontal cortex to infant faces but not adult faces. This wave of activity starts around a seventh of a second after presentation of an infant face. These responses are almost certainly too fast to be consciously controlled and are therefore perhaps instinctive.

The medial orbitofrontal cortex is located in the front of the brain, just over the eyeballs. It is a key region of the emotional brain and appears to be related to the ongoing monitoring of salient reward-related stimuli in the environment. In the context of the experiment, the medial orbitofrontal cortex may provide the necessary emotional tagging of infant faces that predisposes us to treat infant faces as special and plays a key role in establishing a parental bond.

Also, there is now evidence from deep brain stimulation linking depression to the nearby subgenual cingulate cortex which is strongly connected with the medial orbitofrontal cortex. This lends support to the possibility that changes to activity in the medial orbitofrontal cortex secondary to depression may adversely affect parental responsivity.

Postnatal depression is common and there are some experimental evidence suggesting that mothers with postnatal depression have

difficulties in responding to infant cues. Further research could identify whether the present finding of early and specific medial orbitofrontal responses to infant faces (own and others) are affected and even suppressed by depression, thereby helping to explain this lack of maternal responsiveness. The present paradigm could eventually provide opportunities for early identification of families at risk.

Citation: Kringelbach ML, Lehtonen A, Squire S, Harvey AG, Craske MG, et al (2008) A Specific and Rapid Neural Signature for Parental Instinct. PLoS ONE 3(2): e1664.doi:10.1371/journal.pone.0001664 ([www.plosone.org/doi/pone.0001664](http://www.plosone.org/doi/pone.0001664))

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