



RESEARCH SUMMARY

Oxytocin modulates neural reactivity to children's faces as a function of social salience

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The hormone oxytocin, which is sometimes known as the “cuddle hormone” or the “love hormone”, is one of the principal chemicals affecting positive emotional states in humans and other mammals. It is released in large amounts during and after childbirth, stimulates breast feeding, and is thought to promote both pair bonding and parental attachment. Several studies have shown that administering oxytocin through the nose can increase both pro-social feelings and behaviour, for example increasing the degree of trust shown by participants in economic games and reducing signs of stress during conflict within couples. Within the brain, the highest density of the receptors that bind oxytocin is found in regions that have been associated with reward and pleasure (such as the striatum and globus pallidus) and with processing emotion (such as the insula, amygdala, and superior temporal cortex).

Much of the research into the effect of oxytocin on parenting behaviour has focused on the mother. However, this hormone is also known to affect the bonding between fathers and their children. Fathers with higher levels of oxytocin in their blood plasma have been observed to bond better with their infants and to participate in more stimulating play. So far, however, there have been few specific studies of correlations between neurological activity and attachment between parents of either gender and their young children. A group of scientists led by Dina Wittfoth-Schardt of Hannover Medical School, Hannover, Germany have now attempted to disentangle the patterns of brain activity that are associated with paternal attachment and how changing oxytocin levels can affect these.

The researchers recruited nineteen healthy, right-handed fathers of children of German kindergarten age (3-6 years) into the study. None of the participants had a history of neurological or psychological illness, and all were living with the participating children and their mothers during the study. Nine of the participating children were girls. All fathers attended two sessions during which the activity of different regions of their brains was measured using a technique known as functional imaging. During both sessions, each father viewed recent digital photographs of their own child; of another child known to them, such as one of their child's playmates (the familiar child); and an unfamiliar child. The familiar and unfamiliar children were of the same gender and approximate age as the fathers' own children, and most fathers reported neutral or pleasant feelings towards the familiar children. All the photographs used were of children looking directly towards the camera with pleasant facial expressions. Each father was administered a dose of oxytocin or placebo through the nose before each session, and asked to fill in a questionnaire before and after each session, to rate both their mood and their feelings towards the children in the photographs.

The activity levels recorded in each father's brain were compared using statistical tests. The first comparison was between the effects of viewing the pictures of the three children without drug present (i.e. when placebo had been administered). A second set of comparisons

measured the effect of oxytocin on the fathers' responses to each of the children separately. Results from brain regions that showed particularly significant, consistent differences in different conditions were analysed further.

As expected, all fathers reported higher attachment scores for their own child than the other children, and for the familiar child than the unfamiliar child, under all treatment conditions. There were no significant differences in mood or anxiety levels after oxytocin administration. Comparison of the fathers' response to the photos after placebo showed that many brain regions associated with reward and pleasure, most significantly the left globus pallidus, were stimulated most by photos of the participants' own children and least by the unfamiliar children. However, this difference between activation levels in the left globus pallidus was decreased when the fathers were tested after the administration of oxytocin. The hormone also decreased the amount of connectivity between this region of the brain and others that was observed during the experiment.

These results showed that the left globus pallidus showed a particularly high activity pattern when the participating fathers viewed pictures of their own children; other brain regions that were stimulated were also connected with reward and pleasure. The activity and the connectivity the left globus pallidus during the test could be reduced by the administration of oxytocin. Similar results have previously been obtained in similar studies of mothers' responses to their and other children. These, however, have tended to show differences in the response of mothers to familiar versus unfamiliar children that were not observed here, which possibly reflects the fact that mothers often have more contact with their children's friends than fathers do.

Wittfoth-Schardt and his colleagues have also shown that the administration of oxytocin can reduce the fathers' strong neurological response to their own children compared to others. This may seem surprising, as the general effects of this hormone are concerned with strengthening loving ties. It seems likely, therefore, that oxytocin exerts at least some of its effects through damping down automatic neurological responses to social stimuli, thus reducing anxiety and increasing social approach. Further research into the role of oxytocin in promoting different kinds of pro-social behaviour should clarify this further.