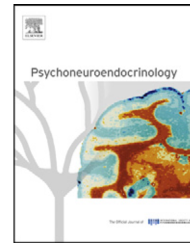
Psychoneuroendocrinology (2012) 37, 1277—1285

Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/psyneuen



Oxytocin during the initial stages of romantic attachment: Relations to couples' interactive reciprocity

Inna Schneiderman [a], Orna Zagoory-Sharon [a], James F. Leckman [b], Ruth Feldman [a,b,*]

[a] Department of Psychology and the Gonda Brain Sciences Center, Bar-Ilan University, Ramat-Gan, Israel
[b] Child Study Center, Yale University, New Haven, CT, USA

Received 3 October 2011; received in revised form 29 December 2011; accepted 29 December 2011

KEYWORDS
Oxytocin;
Romantic attachment;
Pair bonding;
Reciprocity

Summary Romantic relationships can have a profound effect on adults' health and well-being whereas the inability to maintain intimate bonds has been associated with physical and emotional distress. Studies in monogamous mammalian species underscore the central role of oxytocin (OT) in pair-bonding and human imaging studies implicate OT-rich brain areas in early romantic love. To assess the role of OT in romantic attachment, we examined plasma OT in 163 young adults: 120 new lovers (60 couples) three months after the initiation of their romantic relationship and 43 non-attached singles. Twenty-five of the 36 couples who stayed together were seen again six months later. Couples were observed in dyadic interactions and were each interviewed regarding relationship-related thoughts and behaviors. OT was significantly higher in new lovers compared to singles, $F(1, 152) = 109.33$, $p < .001$, which may suggest increased activity of the oxytocinergic system during the early stages of romantic attachment. These high levels of OT among new lovers did not decrease six months later and showed high individual stability. OT correlated with the couples' interactive reciprocity, including social focus, positive affect, affectionate touch, and synchronized dyadic states, and with anxieties and worries regarding the partner and the relationship, findings which parallel those described for parent—infant bonding. OT levels at the first assessment differentiated couples who stayed together six months later from those who separated during this period. Regression analysis showed that OT predicted interactive reciprocity independent of sex, relationship duration, and the partner's OT. Findings suggest that OT may play an important role at the first stages of romantic attachment and lend support to evolutionary models suggesting that parental and romantic attachment share underlying bio-behavioral mechanisms.

* Corresponding author at: Department of Psychology and the Gonda Brain Sciences Center Bar-Ilan University Ramat-Gan 52900, Israel. Tel.: +972 3 5317943; fax: +972 3 535 0267.
E-mail address: feldman@mail.biu.ac.il (R. Feldman).

0306-4530/$ — see front matter
doi:10.1016/j.psyneuen.2011.12.021

Introduction

Romantic relationships have a profound effect on adult life. Happy and stable intimate bonds have been associated with physical and psychological health (Burman and Margolin, 1992), whereas the inability to establish or maintain close relationships is linked with physical and emotional distress (Bloom et al., 1978; Simon and Marcussen, 1999). Yet, neuroedocrine processes supporting the formation of human romantic attachment and their relations with the couple's behavioral repertoire has received little empirical attention.

The formation of romantic attachment in humans is a developmental process involving changes in the relationship over time, for instance, a gradual increase in the degree of closeness between partners as the relationship progresses. As such, it is likely that this process would be accompanied by alterations in brain activity and neurohormonal processes. Indeed, evidence suggests that romantic love represents a dynamic process and each stage is marked by distinct neural and endocrine features. In particular, the initial stage of a romantic relationship has been associated with greater neural activity in the left posterior cingulate cortex and caudate regions (Aron et al., 2005; Bartels and Zeki, 2000; Kim et al., 2009) as compared to later stages of the relationship. On the other hand, activations of cortical regions including the anterior cingulate, insular cortex, and ventral pallidum were increased in long-term pair-bonds (Aron et al., 2005; Bartels and Zeki, 2000; Kim et al., 2009). Interestingly, brain regions implicated in parental—infant attachment were also found to be activated in prolonged romantic relationships as assessed by both fMRI (Acevedo et al., 2011) and ERP (Weisman et al., 2011) measures, suggesting that the formation of parental and romantic attachment share underlying mechanisms (Feldman, in press). In addition to differences, studies have also described substantial overlap in the neural activations implicated in the different stages of a romantic relationship. Both the initial period of romantic love and long-term relationships are associated with neural activity in dopamine-rich reward and basal ganglia systems, such as the ventral tegmental area (VTA) and dorsal striatum (Acevedo et al., 2011; Aron et al., 2005). These studies point to the centrality of reward-related systems for the development of romantic attachment and may suggest that elements within the relationship that are associated with reward, such as warm touch or affective matching, may be related to individual variability in physiological systems that undergo reorganization during the initial stages of romantic love.

Brain areas supporting the formation romantic attachment are those rich in oxytocin (OT) receptors (Acevedo et al., 2011), underscoring the potential role of OT in romantic bonding. OT is a nonapeptide hormone associated with affiliative bonding in mammals (Insel et al., 1997) that is known to mediate social behavior, pair-bonding, and parental attachment across a variety of species (Carter, 1998). Specifically, OT has been shown to play a critical role in the regulation of pair-bond formation in monogamous mammals (Ross and Young, 2009). In humans, intranasal administration of OT was found to increase bonding-related behavior, including gaze to eye region (Guastella et al., 2008), interpersonal trust and empathy (Hurlemann et al., 2010; Kosfeld et al., 2005), and social cognition (Kirsch et al., 2005). OT has also been shown to play a role in human parenting and peripheral levels of OT have been associated with reciprocal parent—infant interactions in both mothers and fathers (Feldman et al., 2010). In addition, research has pointed to the central role of transmembrane glycoprotein CD38 in OT neuropathways and in the release of OT from axon terminalis (Jin et al., 2007), and recent findings showed associations between plasma OT, genetic variability in the *CD38* rs3796863 SNP, and the degree of reciprocity and touch between parents and their infants (Feldman et al., in press), pointing to the potential involvement of OT in the development of reciprocal interactions between attachment partners.

Human studies lend support to the involvement of OT in romantic attachment. Acevedo et al. (2011) found higher activations among romantically attached individuals in regions implicated in pair-bonding in monogamous rodents, and OT administration has shown to increase couples' positive communication (Ditzen et al., 2009). However, findings regarding peripheral OT are mixed. Whereas some found links between plasma OT and positive communication, affiliation, and emotional support (Gonzaga et al., 2006; Grewen et al., 2005; Holt-Lunstad et al., 2008), others showed associations with negative emotions, anxiety, and distress in romantic couples (Marazziti et al., 2006; Tabak et al., 2010; Taylor et al., 2010). In addition, research has shown that the early stages of romantic love may be linked to alterations in plasma levels of cortisol, sex steroids, nerve growth factor (NGF), and brain derived neurotrophic factor (BDNF) (Marazziti et al., 2009), as well as decreased density of the serotonin transporter in platelets (Emanuele et al., 2006; Marazziti et al., 1999; Marazziti and Canale, 2004), suggesting that the initial period of romantic attachment is linked with neuroendocrine changes. Similarly, warm contact between romantic partners has been associated with elevations in a subset of serum proteins (Matsunaga et al., 2009). However, we are aware of no study that examined peripheral levels of OT across the initial period of romantic love.

In light of the above, the present study sought to extend research on the role of OT in human romantic attachment, particularly the expression of OT across the dynamic period of pair-bonding. We focused on the initial stages of romantic attachment and assessed new romantic partners during the period of falling in love and six months later in comparison to romantically unattached singles. Plasma OT, the couple's interactive behavior, and the partners' mental representations of the relationship were assessed using hormonal, observational, and interview methodologies. Specifically, we examined whether (a) plasma OT levels in new lovers would be higher than those observed in singles and would be stable across the period of pair-bonding in humans, and (b) OT levels would be associated with the couple's reciprocal behavior, similar to the findings reported for parent—infant interactions (Gordon et al., 2010a). Consistent with animal research, our overall hypothesis was that OT is essential for bond formation and we expected higher levels of the hormone among new lovers as compared to singles. We also expected to find a correlation between peripheral OT and the degree of reciprocity between partners, consistent with the perspective that periods of parental and romantic bond formation share underlying bio-behavioral mechanisms (Feldman, in press) and with research linking OT and reciprocal interactions between parents and infants (Feldman et al., 2011; Gordon et al., 2010b).