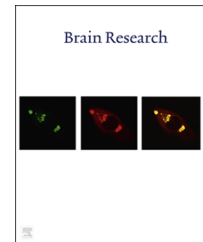


Available online at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/brainres

Research Report

Approaching the biology of human parental attachment: Brain imaging, oxytocin and coordinated assessments of mothers and fathers



J.E. Swain^{a,b,c,*}, P. Kim^d, J. Spicer^e, S.S. Ho^a, C.J. Dayton^{a,f},
A. Elmadih^g, K.M. Abel^g

^aDepartment of Psychiatry, University of Michigan, USA

^bCenter for Human Growth and Development, University of Michigan, USA

^cDepartment of Psychology, University of Michigan, USA

^dDepartment of Psychology, University of Denver, USA

^eDepartment of Psychiatry, Columbia University, USA

^fSchool of Social Work, Wayne State University, USA

^gCentre for Women's Mental Health, Institute of Brain Behaviour and Mental Health, Manchester Academic Health Sciences Centre, University of Manchester, UK

ARTICLE INFO

Article history:

Accepted 7 March 2014

Available online 15 March 2014

Keywords:

Parent–child relationship

Brain imaging

fMRI

Attachment

Parenting

Caregiving

Oxytocin

Maternal

Paternal

ABSTRACT

Brain networks that govern parental response to infant signals have been studied with imaging techniques over the last 15 years. The complex interaction of thoughts and behaviors required for sensitive parenting enables the formation of each individual's first social bonds and critically shapes development. This review concentrates on magnetic resonance imaging experiments which directly examine the brain systems involved in parental responses to infant cues. First, we introduce themes in the literature on parental brain circuits studied to date. Next, we present a thorough chronological review of state-of-the-art fMRI studies that probe the parental brain with a range of baby audio and visual stimuli. We also highlight the putative role of oxytocin and effects of psychopathology, as well as the most recent work on the paternal brain. Taken together, a new model emerges in which we propose that cortico-limbic networks interact to support parental brain responses to infants. These include circuitry for arousal/salience/motivation/reward, reflexive/instrumental caring, emotion response/regulation and integrative/complex cognitive processing. Maternal sensitivity and the quality of caregiving behavior are likely determined by the responsiveness of these circuits during early parent–infant experiences. The function of these circuits is modifiable by current and early-life experiences, hormonal and other factors. Severe deviation from the range of normal function in these systems is particularly associated with (maternal) mental illnesses – commonly, depression and

Abbreviations: MPOA, medial preoptic area; BNST, bed nucleus of the stria terminalis; dlPFC, dorsolateral prefrontal cortex; IPV-PTSD, interpersonal violence-related posttraumatic stress disorder; nACC, nucleus accumbens; ACC, anterior cingulate; IFG, inferior frontal gyrus; NAcc, nucleus accumbens; OFC, orbitofrontal cortex

*Correspondence to: Rachel Upjohn Building, 4250 Plymouth Road, Ann Arbor, MI 48109-2700, USA.

E-mail address: jamesswa@med.umich.edu (J.E. Swain).

<http://dx.doi.org/10.1016/j.brainres.2014.03.007>

0006-8993/© 2014 Elsevier B.V. All rights reserved.

anxiety, but also schizophrenia and bipolar disorder. Finally, we discuss the limits and extent to which brain imaging may broaden our understanding of the parental brain given our current model. Developments in the understanding of the parental brain may have profound implications for long-term outcomes in families across risk, resilience and possible interventions.

This article is part of a Special Issue entitled Oxytocin and Social Behav.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction to the parental brain

Human mothers and fathers exhibit a repertoire of parental thoughts and activities that manifest interesting similarities and differences as part of an array that crosses cultures (Hrdy, 2000) and species across species (Clutton-Brock, 1991) with the common goal of caring for offspring. For humans, besides meeting the primal evolutionary needs for survival and continuation of our species, parenting involves interrelated biological, psychological, and behavioral caregiving mechanisms that contribute critically to the first environment the child experiences as a new family member.

The rich animal literature on parental brain (Bridges, 2008) strongly supports the notion that a coherent understanding of the physiology governing parenting in humans is also possible. Indeed, much of the research on the human parental brain involves attempts to look for human homologs of 'parental' brain circuits found in animals. This approach has initially been successful using audiovisual stimuli of babies during functional imaging – particularly with contrasts of own vs. unknown babies – to activate brain regions that recognize and respond to the special salience for the parent of their own baby's stimuli (Barrett and Fleming, 2011; Swain, 2011b; Swain et al., 2007).

In this review, we summarize the state-of-the-art of human parental brain imaging in mothers and fathers. More specifically, we focus on the interpretation of brain-responses to baby-cry and baby visual stimuli respectively and consider attempts to integrate findings within the cognitive, affective, and social neurosciences. First, we selectively review the psychological and imaging evidence of relevant executive, emotion response/regulation and reward mechanisms that may be activated in the service of parental sensitivity. We then discuss these findings in the context of research on oxytocin, and review recent attempts to understand how parenting difficulties or even psychopathology may be understood as abnormalities or malfunctions of parental brain circuits. The importance of this mechanistic understanding of parenting is underscored by consideration of effects on offspring and possibilities to identify families at risk and optimize therapeutic interventions.

1.1. Parental sensitivity and child attachment

Ainsworth et al. (1978) first defined maternal sensitivity as a mother's ability to attend and respond to her child in ways that are contingent to the infant's needs. In the naturalistic context, sensitive maternal care behaviors show a great deal

of variation between individual mothers, despite being relatively stable in the same mothers across time and contexts (Behrens et al., 2012; Jaffari-Bimmel et al., 2006; Wan et al., 2013). Maternal sensitivity represents a pattern of behavior which provides the infant with its primary social experience. This suggests that it is important for organizing and regulating the infant's emotional, social and cognitive systems and is consistent with accumulating evidence that maternal sensitivity predicts a range of social-emotional child outcomes – including the quality of their attachment relationships (Bakermans-Kranenburg et al., 2003; De Wolff and van Ijzendoorn, 1997), self-regulation (Eisenberg et al., 2001), social functioning (Kochanska, 2002; Van Zeijl et al., 2006), socio-emotional development (De Wolff and van Ijzendoorn, 1997), and cognitive and language competence (Bernier et al., 2010; Tamis-LeMonda et al., 2001). Furthermore, the absence of skills needed to respond sensitively to child signals has been linked to risk for maltreatment (Milner, 1993, 2003). Poor maternal sensitivity in infancy predicts later harsh parenting (Joosen et al., 2012) and attitudes towards punishment (Engfer and Gavranidou, 1987). Frightening and anomalous maternal behavior confers profound risk to the parent–infant attachment relationship (Schuengel et al., 1999) to subsequent child outcomes and future parenting of their own children.

The concept of parent–infant attachment represents a landmark of contemporary developmental psychology (Bowlby, 1969b, 1973). In fact, Bowlby formulated his attachment theory after studying associations between maternal deprivation and juvenile delinquency, postulating a universal human need to form close, affect-laden bonds, primarily between mother and infant. He strongly argued, from an evolutionary perspective, that attachment represents an innate biological system promoting proximity-seeking between an infant and a con-specific attachment figure. This proximity then increases the likelihood of survival to reproductive age.

Because of this powerful biological instinct for attachment, and in response to the patterns of attachment identified in the Ainsworth mother–infant studies (Ainsworth et al., 1978), Bowlby (1977) hypothesized that all human infants attach to their caregiver but that children manifest different patterns of attachment “security” depending on the quality of the care they receive. Indeed, a vast literature in the study of attachment over last several decades has established that infants of caregivers who are available, responsive and sensitive to their emotional and physical needs tend to manifest patterns of “secure attachment.” Conversely, chaotic, unpredictable, rejecting or neglectful care in which non-contingent responses

Download English Version:

<https://daneshyari.com/en/article/4324123>

Download Persian Version:

<https://daneshyari.com/article/4324123>

[Daneshyari.com](https://daneshyari.com)