

## NEUROSCIENCES AND ATTACHMENT THEORY: A BRIEF REVIEW

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### ABSTRACT

*The attachment theory was proposed and elaborated by John Bowlby.*

*Over the last ten years the attachment theory has attracted considerable interest in the field of mental health as it emphasizes how relationships that are established in the earliest stages of development have an impact on man in an indefinable and lifelong manner.*

**Keywords:** attachment theory, neurosciences, fMRI, cortisol.

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### Introduction

The attachment theory was proposed and elaborated by John Bowlby. This theory was first put on the "The International Journal of Psychoanalysis" in three articles and then expanded into the three volumes "Attachment and Loss". The first volume of this trilogy "Attachment and Loss. The attachment to the mother" (1969), deals with Bowlby's survey of mother-child attachment in the second "Attachment and Loss. Separation from the Mother" (1972), Bowlby focuses on anxiety events occurring in children following an episode of separation from the reference figure. In the third volume "Attachment and Loss. The Loss of the Mother" (1980), Bowlby instead reflects on the long-term effects that the loss of the reference figure can cause<sup>(1-4)</sup>.

Over the last ten years the attachment theory has attracted considerable interest in the field of mental health as it emphasizes how relationships that are established in the earliest stages of development have an impact on man in an indefinable and lifelong manner<sup>(1-4)</sup>.

### Attachment and Neuroscience

The theory of classic attachment over the years has undergone significant expansion due to the multiple contributions offered by the biological sciences<sup>(5-10)</sup>.

Humans, like other animal species, have an innate, evolutionarily driven, biological predisposition for social interaction. Infants actively and instinctively seek and maintain their caregiver's proximity and care.

Caregivers also instinctively seek and respond to their infants. These early caregiver–infant interactions give rise to caregiver–infant attachment, which influences physiological and psychological processes by modulating brain sensitivity. Furthermore, early social interaction between caregiver and infant influences infants’ cognitive and socio/emotional development, and subsequently the development of social, familial, and romantic relationships later in life. Caregiver–infant attachment shapes neural pathways involved in socio-emotional regulation.

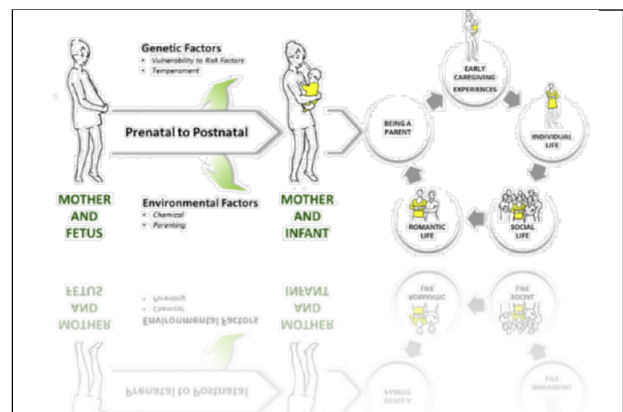
These patterns of socio-emotional regulation are thought to remain relatively stable over an individual’s lifetime, suggesting important links between early caregiver–infant attachment and health related physiological processes (e.g., stress) and vulnerability to risk-factors (e.g., the capacity for managing stress-related metabolic demands). Attachment formation is influenced by multiple systems, including environmental factors, such as prenatal chemical signals from the mother to the fetal brain, as well as parenting and genetic factors, such as vulnerability to risks and temperament. Current approaches to the study of caregiver–infant attachment should consider its multilevel nature<sup>(11-35)</sup>.

Moreover, the more recent theory about attachment is essentially a theory of regulation, inspired by neuroscience research, and able to clarify even more in-depth how early emotional communication within the attachment relationship facilitates the maturation of central nervous systems involved in affective stimulation and self-regulation. In this framework, attachment transactions may be considered as the critical points for the development of the right brain structural systems involved in non-conscious processing of emotion, stress modulation and self-regulation.

According to this theory initially emotions are regulated by others, but in childhood they become increasingly self-reliant as a result of neurophysiological development and experienced affective experience. In this perspective, “The diaphanic interaction between the infant and the mother ... serves as a regulator of the internal homeostasis of the developing individual” and in fact it has been shown that optimal experiences with care-giver facilitates the improvement of both the processes that underline interactive emotional regulation when the child is engaged with other human beings, the ones that base the self-regulation of emotions in autonomous contexts.

It is also well known that mother-to-child emotional interactions act as an essential promoter of the development and maintenance of synaptic connections during the establishment of the right brain functional circuits in the early years of life<sup>(36-44)</sup>. The latter is a lateralized emotional brain deeply connected to the body and the autonomic nervous system; It has autonomy, physiology and a bio-chemistry other than the left hemisphere that develops later: Neural substrates of perception of voices, faces, gestures, odors and pheromones, as evidenced by modern neuropicture techniques, are characterized by a general pattern of functional asymmetry of the right hemisphere.

In conclusion, from childhood and for all subsequent phases of life, this right lateralized system is centrally involved in implicit affective processes and in controlling vital functions that allow the body to cope with the challenges and challenges. The application of neuroscience, in particular fMRI (Functional Magnetic Resonance), to the attachment theory has also allowed two important anatomical alterations in adults with borderline disorder that children had experienced traumatic experiences that led them to develop a Disorganized attachment. The alterations found on this group of patients are a significant increase in the left side of the amygdala and an increase in cortisol levels during the evocation of a parent's memory. The development of amygdala occurs in the first five years of life and is influenced by early traumatic experiences. It seems that particularly stressful and painful behaviors such as those that characterize an unorganized attachment induce an enlarged amygdala to trigger a prompt, physiological and cognitive response to the perceived stimulus as an adversary.



**Figure 1:** Modified from Esposito G, et al. Behav Brain Res. 2017 May 15;325.

As for the increase in cortisol levels, this would be due to mechanisms similar to those previously used in response to stressful events<sup>(56,100)</sup>. (Figure 1) in dopaminergic systems (24-26) and related to sympathetic hyperactivity as CVS<sup>(27-74)</sup>.

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