Neurobiological Underpinnings of Bonding Analysis

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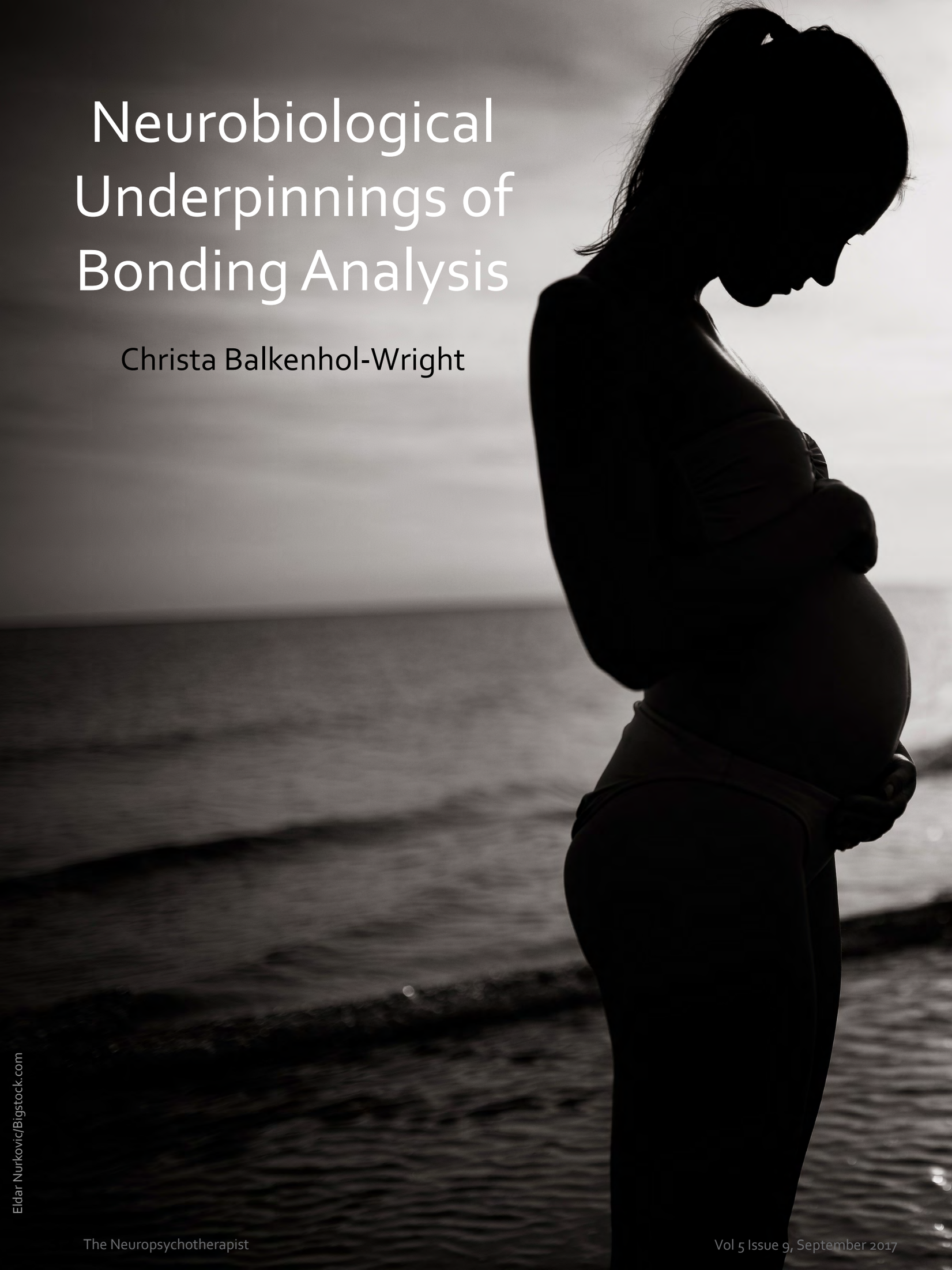

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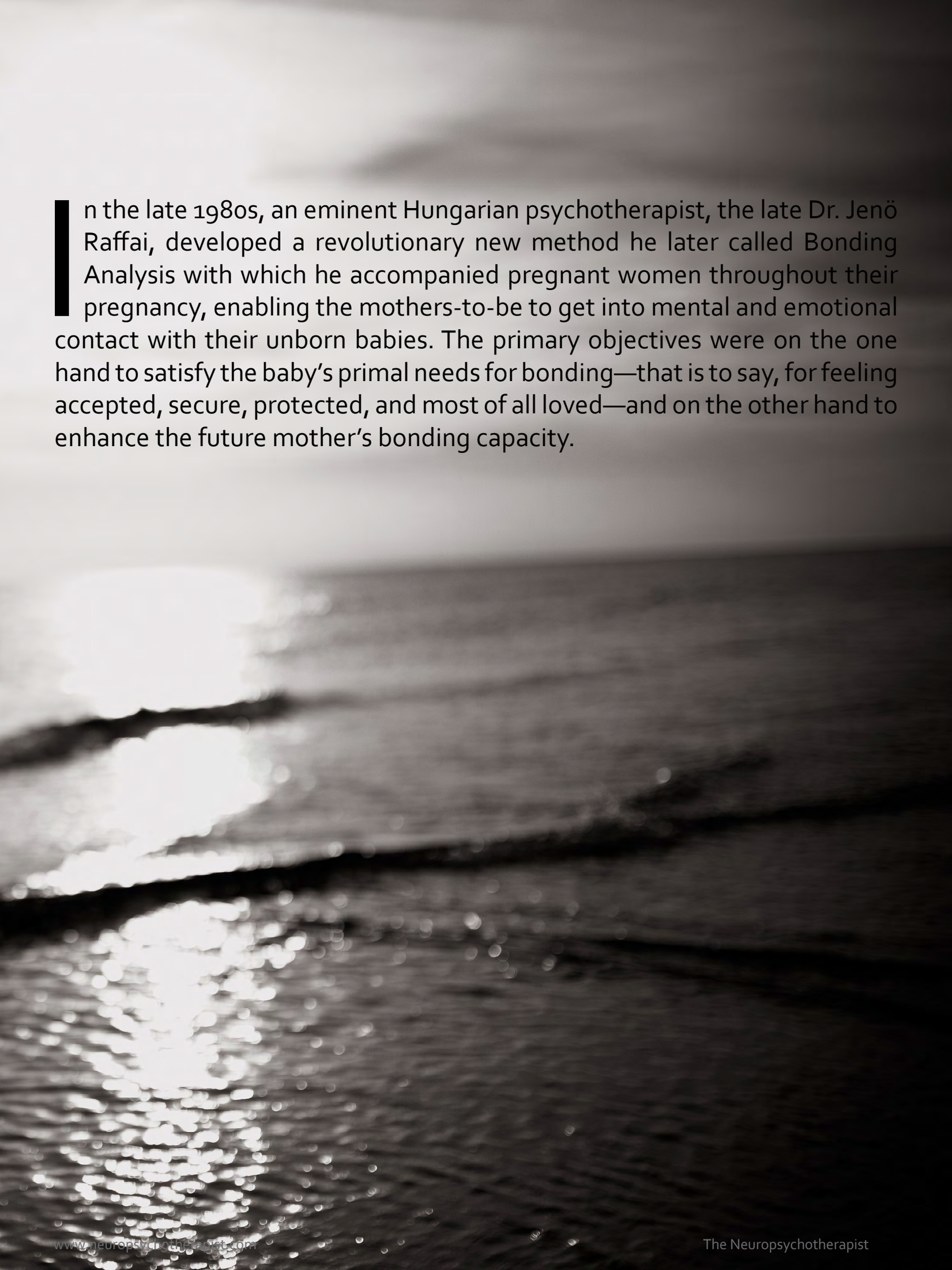

In the late 1980s, an eminent Hungarian psychotherapist, the late Dr. Jenö Raffai, developed a revolutionary new method he later called Bonding Analysis with which he accompanied pregnant women throughout their pregnancy, enabling the mothers-to-be to get into mental and emotional contact with their unborn babies. The primary objectives were on the one hand to satisfy the baby's primal needs for bonding—that is to say, for feeling accepted, secure, protected, and most of all loved—and on the other hand to enhance the future mother's bonding capacity.

The Origins of Bonding Analysis

The origins of this new approach were rooted in Dr. Raffai's psychoanalytical treatment of a particular psychotic youth. Dr. Raffai discovered that the youth's psychic disturbances could be traced back to the time he had spent in his mother's womb. What he predominantly lacked was the conscious feeling of his physical boundaries, which made it impossible for him to perceive himself as an autonomous being, making him feel devoid of having a body of his own. Search-

ing for the causes of these phenomena, Raffai found out that the youth's mother had suffered the loss of her husband during the pregnancy. Instead of mourning that loss in an adequate way she had transferred this trauma to her unborn baby, considering it thenceforward to be an integral part of her own body and not wanting to let it go, so she would not lose it as she had lost her husband. At that moment the development of the baby's self-perception of its physical boundaries came to a standstill.

Raffai explained that by transferring that image to her baby it stopped perceiving itself as an autonomous being. The baby could no longer differentiate between its own body sensations, feelings, and cognitive processes and those of its mother. The development of an autonomous self can only take place if the baby perceives its own self on the basis of the image that has developed in the mother's consciousness; this is imperative for allowing the unfolding of fetal self-awareness (Raffai & Hidas, 2010).

Prenatal Bonding

To be mirrored necessitates the existence of another person, which form the basis of a relationship. With regard to the prenatal and postnatal relationship between mother and child, the two appropriate terms are *bonding* (on the mother's side) and *attachment* (on the baby's side). Raffai concentrated his work on developing a method of analyzing the bonding capacity of pregnant women and then worked towards strengthening it; in cases of poor bonding, he would endeavor to find the reasons for this and then make the women aware of the problem, thus empowering them to establish a healthy, stable, protective, and supportive bonding relationship with their babies long before their birth. In this way the securely attached babies were themselves being empowered to develop a healthy self, and later, outside their mothers' wombs, socially and emotionally stable relationships. The primary focus of Raffai's work was the utmost importance of the emotional and mental states of pregnant women during the gestation period and their impact on the babies.

Bonding is the baby's most essential primal need because when fulfilled it secures its survival. The infant behaves in ways that elicit contact or proximity to the caregiver—in most cases the mother. The newborn baby possesses the necessary innate instinct to use a certain behavioral repertoire, transmitted via genetic programming and the transfer of intergenerational experiences, to ensure that its primary caregiver provides food and conveys feelings of protection and affectionate support when catering to its needs (Hüther, 2006).

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Prenatal Bonding: Its Importance, Functioning, and Neurobiological Processes

The essential questions are now, first, why is *prenatal* bonding more important than the bonding that starts after birth, as is still a common assumption among the public at large? Second, how does prenatal bonding work? And, last but not least, what are the neurobiological underpinnings of prenatal bonding and its impact on the developing brain?

The answer to the first question is given by Professor Gerald Hüther, a renowned German neurobiologist and brain researcher: the first bonding, which actually starts at conception, is the very first and earliest bonding experience of every human being and serves as an internal working model for all future relationships (Hüther, 2006). Hüther's model is based on the expectation/assumption that others are trustworthy, that one sees oneself as valuable, and that this self is effective when interacting with others.

Furthermore, and as essential as the first reason, prenatal bonding definitively has the greatest positive effect on the development of the fetal brain, especially the limbic system and the brain stem. The system that controls the bonding behavior is situated in the orbitofrontal cortex of the right-brain hemisphere. This region harbors the circuitry between the lower emotional areas and the higher cognitive regions—the place where cognitive and emotional processes are integrated and coordinated. It has been shown, for example, that emotional negligence and child abuse lead to a reduction in the growth of synapses within the orbitofrontal cortex. (The synapses are the linking elements within the neuronal networks; information is transported from cell to cell by neurotransmitters.) The orbitofrontal cortex represents the highest level of behavioral control and regulation of limbic excitation, including the newborn's capacity for self-regulation (Hüther, 2012).

The prenate's brain development starts as early as the 18th day after conception with the formation of the neural tube that will grow during the next six weeks into the main brain structures of cerebellum, thalamus, basal ganglia, and cerebral cortex. Every day, around 700 new synaptic connections are formed in the prenate's brain, creating altogether around 60 million new neuronal networks per day. The baby is born with approximately 100 billion neurons while the adult brain consists of hundreds of billions of neurons connected via thousands of billions of neural synapses that determine our cognitive, emotional, and behavioral processes. The more synapses a human brain has the more complex and differenti-

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ated its neuronal networks will be.

The setting up of the highly complex interconnected neuronal networks—comprising all cognitive and psychological processes linked by neuro-electrical and neuro-chemical activity—begins in the womb. Genetic information constitutes the basis for the development of the nervous system, but the neuronal connections may be influenced by negative factors such as maternal stress and alcohol or drug abuse. Neural networks can also be altered with the help of effective early bonding experiences that subsequently have a positive impact on the development of a child's adult personality. Neuronal circuits are extremely plastic, which means they can easily adapt to new circumstances.

Professor Hüther (2008) explains the function of the synaptic connections in the following way. They turn into inner representations (mental pictures) that ingrain themselves into the baby's brain. With every new image the baby expands its knowledge about the world outside its mother's womb so that the moment it is born it already possesses a vast amount of these mental images and associative connections. This experience also helps the baby to form a positive interior maternal image that is not only linked to the visual cortex but is also associated with her special voice and scent and is especially marked by their common experiences. The more positive internal images the mother conveys to her baby the more anchored and consolidated that kind of experience becomes in the prenate's brain (Hüther, 2008).

How does Raffai's bonding analysis work? Communication between mother and baby takes place via mental pictures, visualizations, and verbal messages. Everything that is being sent and said is registered by the baby's mind and body. This communication is made possible through mirror neurons, which form the neuronal basis of the human capacity for emotions such as empathy. After the first series of baby sessions the flow of information and communication becomes more and more intense and the mother develops intuition for her baby's needs. That way the baby's learning ability is enhanced and its brain intensely stimulated (Balkenhol-Wright & Karrasch, 2017).

Another channel through which mother and baby communicate is via the different brainwaves—*alpha*, *delta*, and *theta* waves. At the root of all our thoughts, emotions, and behaviors is the communication between neurons in our brains. Brainwaves are produced by synchronized electrical pulses resulting from masses of neurons communicating with each other. Alpha brainwaves open the door to meditative states and facilitate the vis-

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ualization of mental images: they aid overall mental coordination, calmness, and mind/body integration. Delta brainwaves are generated in deepest meditation and dreamless sleep: they suspend external awareness and are the source of empathy. Theta brainwaves are dominant in sleep and deep meditation: they open the gates to learning and memory. When these waves are active our senses are withdrawn from the external world and focused on signals originating from within. Vivid imagery is enhanced, and intuition and information beyond our normal conscious awareness are being activated. This is exactly what happens when a pregnant woman is gently led into a meditative state during bonding analysis sessions.

The Impact of Maternal Stress During Pregnancy

In all the years Raffai accompanied pregnant women he saw that the majority of them were to a greater or lesser extent in situations of stress. How does stress affect the development of the prenate's brain? If the unborn baby is flooded by its mother's stress hormones, or if the mother's anxiety is transferred to the baby for a long period of time, then the baby might not be able to structure and understand the outside world. Consequently, if there is no mental or emotional connection with the mother, the brain's structuring process is at risk of being destabilized or even regressing. The baby thus experiences a feeling of its own coping disability and incompetence whereupon both are structurally anchored in its brain instead of a positive sense of capacity and competence. Maternal stress during pregnancy has numerous other negative impacts on the developing brain, for example, it can lead to disorders of the hormone production of the hypothalamus, the hypophysis, and the adrenal glands—the so-called HPA axis. The constant arousal of the HPA axis eventually leads to an impairment of the immune system as the higher level of cortisol hampers the genes that are responsible for the production of immune transmitters (Balkenhol-Wright & Karrasch, Christine, 2017).

During the bonding analysis sessions, the bonding facilitator and the mother-to-be search for the factors or circumstances that may be causing the stress, and then together they work out ways and means to deal with it in order to relieve the pregnant woman's tension and consequently that of her baby. This also helps to put new impulses into the baby's brain.

The Impact of Prenatal Influences: A Case History

To ascertain the role of prenatal influences on the unborn child, researchers have for some time been using the experimental technique of *cross-fostering* to

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determine how far both prenatal and postnatal environmental factors interact with genetic disposition (nature vs. nurture). Hüther (2012) describes one experiment in which they changed the offspring of two rat mothers immediately after birth. One rat mother had proved to be especially competent and caring with a previous litter whereas the other had treated her offspring in a rather negligent and incompetent way. The result was clear: to turn into a caring mother does not necessitate a genetic disposition but very early positive experiences.

The researchers then carried out further experiments to verify whether cross-fostering yielded the same results under intrauterine conditions. They transferred female rat embryos almost immediately after fertilization, using distinct phyla—the first one appeared to be very cautious when experiencing new surroundings and the second one possessed good spatial orientation skills. Later, after birth and when grown up, the rats behaved in the same way as the mothers that had born and reared them. The experiment clearly showed that intrauterine experiences prevail (Hüther, 2012).

The extent to which these findings could be applied to the human species might be demonstrated by the case history of Annette, a 24-year-old German student, who began bonding analysis in the 13th week of her pregnancy (Balkenhol-Wright & Karrasch, 2017). At the time she began the sessions, she did not like or accept the idea of being pregnant. She had had a brief relationship with another student who, when learning about the pregnancy, was deeply appalled and furiously demanded an abortion. So, the first inner picture the fetus received was that of utter rejection from both sides, mother and father.

According to Rien Verdult, a Belgian psychotherapist who specializes in the treatment of emotional problems rooted predominantly in life before and immediately after birth, this very early rejection is one of many formative traumas that the unborn baby may suffer at the beginning of its intrauterine life (Verdult, 2014)

Annette had also considered having an abortion, but as a Roman Catholic she finally decided against this course of action. However, Annette's inner deliberations about having an abortion reached the unborn baby and caused a second trauma; and when she told her parents about the pregnancy, her mother in particular reacted quite violently and said that she should give the baby up for adoption immediately after birth.

It turned out, during the course of the bonding analysis, that Annette's mother had never liked her daughter; in fact, she had always expressed disappointment at having had a daughter first, and had clearly given preference to Annette's younger brother. So it seems that

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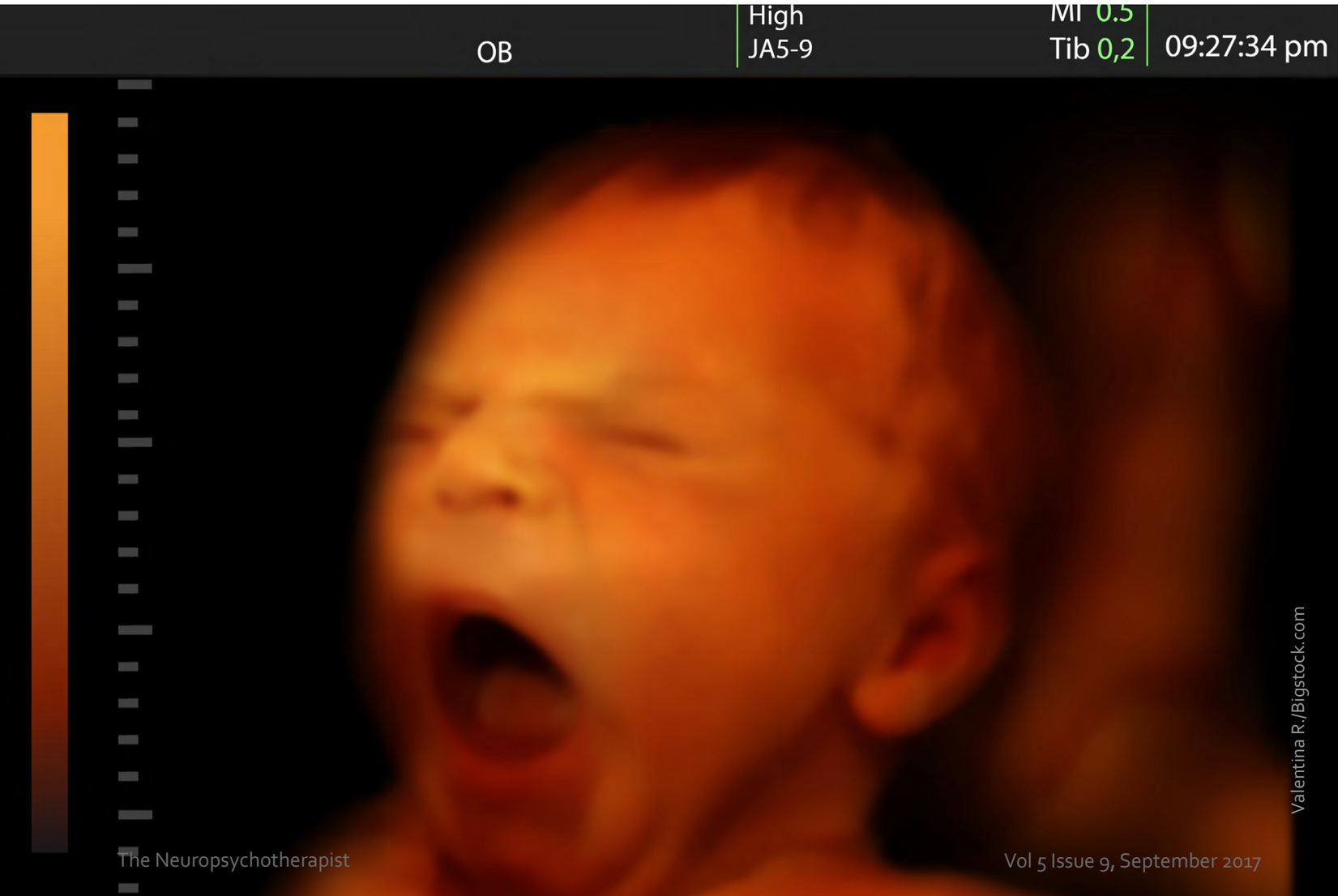
rejection ran in the family, and when Annette learnt that she was expecting a baby girl, she felt deep despair and even panic. With the help of the special techniques of the bonding analysis elaborated by Raffai, and in the course of an intense developmental and maturation process, Annette eventually succeeded in accepting her womanhood and hence her motherhood. Raffai's objective that the pregnant woman should stop being "her mother's child" in order to become the mother of her own child was achieved (Raffai & Hidas, 2010). Thus Annette no longer saw her baby as an enemy (a sort of culprit that had ruined her life) and by the end of the bonding analysis sessions she even perceived her baby girl as an ally. During the inner dialogues, Annette established affectionate contact with her baby: in her mind's eye she took her baby in her arms, caressed and cuddled it, and most importantly, smiled at it. She conveyed all those images to her baby through the channels previously explained. Moreover, by doing so, she also triggered firing of the mirror neurons in her baby's brain!

Through her mother's mirroring the prenate internalizes and assimilates the image that reflects her mother's perception of her, allowing her to build a positive representation of her own self. This kind of emotional attention also has a positive influence on the formation of neuronal connections and synaptic circuitry. Accepting the baby—especially when accompanied by affectionate feelings—is a very strong bonding experience that forms the neurological basis of the baby's capacity to enter into emotionally solid relationships later in adult life (Balkenhol-Wright & Karrasch, 2017).

Translating Annette's transformation into neurobiological terms, the transformational processes that took place in Annette's baby's brain can be described as follows. First, the baby's brain was flooded with negative inner images of rejection, but as Gerald Hüther so expertly explains, the brain's plasticity always allows for change, so that new positive images can be superimposed. Before the integration of any new image can occur, however, the corresponding brain regions develop a state of *excitement* that spreads into the lower subcortical centers, and these function to alter the excitability of the higher cortical neurons via the release of neurotransmitters. This process generates a state of *focused attention* that allows the brain to integrate a new image into the brain's repertoire of inner images by superposing it on a former negative image. As more positive inner images reach the brain, the more stable and consolidated the neuronal pathways become (Strüber, 2016).

Over time, the structural pattern of neurons and dendrites forms a matrix with which all subsequent neurons and dendrites align. For Annette's baby this meant that



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the moment Annette started to convey positive images of herself as a caring and affectionate mother the former negative images of rejection faded away. Of course, it cannot be precluded that vestiges of these negative images will remain or that they may be triggered when a situation arises similar to the negative one that was first experienced. However, as the bonding process between baby and mother continues to build, it enables the baby to form long-lasting coping strategies for dealing with stressful situations on the basis of the earlier experienced acceptance, support, empathy, affection, and understanding (Hüther, 2008).

Today, Annette describes her 18-month-old daughter as a lively, easy-going, affectionate little girl who is very creative, eager to discover her surroundings, and appears quite self-contained. This case history, as well as the many other babies whose mothers have been accompanied by the bonding analysis, is the living proof that this method is an excellent tool that can help prevent the later onset of affective disorders such as anxiety or depression, amongst others.

Further Prenatal Traumas

There are two other instances of prenatal trauma that are worth mentioning, the first clearly being the birth process itself which every human being inevitably has to go through, and the second is an experience that can cause lifelong sadness and depression and concerns the loss of one or more siblings especially at the beginning of the intrauterine life.

Peter Bourquin, a specialist in family constellations, reports on the research of biologist and geneticist, Charles Boklage (see Bourquin & Cortés, 2016). Boklage shows that 12% of all fertilized eggs produce multiple pregnancies; of these, 76% dissolve completely, 22% end up in a single pregnancy, and about 2% lead to the birth of twins. This means that for every twin birth there are at least 10 babies that started their intrauterine life as a twin but were born as a singleton, having lost a brother or sister early in their intrauterine life (Bourquin & Cortés, 2016).

The most tragic part of that experience is that the withering away of one of the twins often happens during the first trimester of the pregnancy—that is to say at a time when the disappearance of one fetus goes mostly unnoticed by the pregnant woman. No-one else but the remaining baby suffers that loss, and that means losing the most important person in its life, a person that is even more important than the mother as scientists specializing in twin research have found.

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Every psychotherapist who has a long experience of treating adult patients suffering from depression of various degrees of intensity caused by the loss of a beloved person knows how devastating this loss can be. It does not take a lot of imagination to conceive the impact of such a loss on the prenate. Extremely strong feelings are being triggered, on one side feelings of utter loneliness, abandonment, yearning and mourning, but on the other side also, feelings of guilt (*Did I kill him/her?* or *Why couldn't I save him/her?*), fury (*Why was I left behind?*), and even the terror of dying too. All these strong feelings have a deep, formative impact on the neurogenesis of the limbic system that may lead to a state of shock-induced paralysis.

In his book, Raffai describes how pregnant women gained that kind of experience, actually receiving the image of their unborn baby crouched in the womb, often motionless, not able to react to the mother's trying to get into mental contact. In a number of cases the loss of a twin was represented in the womb by a black spot and the surviving baby avoided moving to that place (Raffai, 2015).

Obviously no research is possible on a prenate's brain's reaction to the loss of a twin, but by extrapolating the results of research carried out on the adult brain it can be assumed that identical processes take place in the unborn baby's brain, even with greater intensity, as the baby has not yet developed appropriate resilience and cognitive, emotional, and behavioral coping strategies to handle such a traumatic experience.

Research on adults' mourning has shown that the longer the mourning period goes on, eventually turning into a deep depression, the neurogenesis of the hippocampus comes to a standstill, and massive disorders arise in the same neuronal circuitry that also reacts to stress, the most important being the HPA axis. The hypothalamus produces too much corticotropin releasing factor (CRF), which in turn causes the pituitary gland to release adrenocorticotropic hormone (ACTH), which again stimulates the adrenal cortex to produce the stress hormone cortisol. So the same operating processes are going on in the prenate's brain, whether due to maternal stress or the loss of a twin brother or sister (Roth & Strüber, 2015).

If in the course of the bonding analysis sessions the bonding facilitator has indications that the pregnancy may have started as a twin or even as a multiple, the pregnant woman is invited to mentally visualize her uterus and to see whether she finds traces of a twin loss (often taking on the form of a dark spot as Raffai found in a number of cases). In this instance, Raffai's corresponding instructions are clear and quite simple. The mother-to-be is to explain to her baby that she

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has become aware of the loss and then she invites her baby to mourn with her. In many cases the baby reacts positively and Raffai actually experienced that babies had woken from their stupor-like state. The baby then gains the experience that its feelings of sorrow are perceived and mirrored. This process, made possible due to the brain's plasticity, contributes to building resilience and strengthens the acquisition of the coping capacities mentioned above (Raffai & Hidas, 2010).

With regard to the trauma of twin loss, the use of assisted reproductive technology may produce a large number of traumatized babies caused firstly by the conception that takes place in the totally sterile surroundings of a laboratory and then eventually by what is known as embryo selection. In these cases also, bonding analysis can similarly be used as a beneficial technique to offset the sequelae of these kinds of traumatic experience (Balkenhol-Wright & Karrasch, 2017).

Birth trauma is another broad topic that requires a comprehensive analysis and description. Suffice it to say here that the birth process elicits enormous fear, even mortal fear, especially if the umbilical cord happens to hamper the baby's progress through the birth canal. The most vital and most helpful part of Raffai's bonding analysis concerns the birth preparation sessions where mother and baby go through an intense and repetitive rehearsal of the birth procedure together. Birth thus becomes team work, giving the baby a strong feeling of security and support through constant contact with its mother (Raffai, 2015).

If for medical reasons a caesarean must be performed, mother and baby again prepare for this surgical intervention together, thus preventing the horror experience of the baby being abruptly extracted from the mother's womb. By the way, researchers have found out that the genetic expression of babies born naturally differs in some special respects from that of babies brought into the world via a caesarean operation (Hildebrandt, 2015).

Neurobiological Underpinnings of Bonding Analysis

Finally, this leads to the answer to the last question: What are the neurobiological underpinnings of bonding analysis?

The genetic program of the human genome determines the brain's structural blueprint. The function-related structuring, however, is primarily the result of the interaction of the prenate's cells with the maternal organism and her metabolites. The maturation process of

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the baby's organs is the result of the dialogue between fetal and maternal cells. The pregnant woman communicates with her environment, taking in countless substances and experiences that are transferred to the fetus through different channels. Especially the way a pregnant woman deals with stressful situations shapes the control functions of the prenatal brain and may consequently change the baby's gene expression.

Moreover, one of the most prominent features of the human brain is its plasticity (or neuroplasticity), which allows the brain to develop adaptive capacities under various environmental conditions. As already explained, the earliest bonding experiences are being memorized in the prenate's cells. One of the most striking scientific discoveries concerns what is known as cellular memory, or consciousness, which refers to a kind of preverbal memory contained within the physical body of experiences that babies gain in the womb and which are transmitted to them by their mothers via chemical and biological processes. All negative and positive feelings the mother-to-be goes through are transferred to the baby—stress, impacts of violence perpetrated against her, depression, but also feelings of joy, harmony, and strength.

Maternal care influences the formation of neurological structures in the prenate's brain, releasing endogenous neurotransmitters such as endorphins and oxytocin, considered the most efficient bonding hormone. The oxytocin system is the neurobiological mechanism responsible for the regulation of multifaceted social behavioral patterns and the bonding capacity. Higher doses of oxytocin, for example, reduce the quantity of stress hormones, increase social interactions, and enhance bonding behavior (Balkenhol-Wright & Karrasch, 2017).

To sum up, therefore—genes and the environment (that is to say, the intrauterine conditions) interact with each other; in other words, genes determine the effect of all experiences, and these experiences in turn determine which genes are activated. The prenate's overall learnings, its bonding experiences in particular, are the main prerequisites for an enhanced brain development and serve as a working model for successfully managing social interactions throughout life/in later life.

Bonding analysis can be considered a very effective and beneficial instrument that serves to enhance the healthy development of the fetal brain throughout the nine months of intrauterine life. It strengthens the bonding between mother and baby by fostering the pregnant woman's bonding capacity. It is also a preventive method in the sense that it allows for the baby's acquisition of strong coping skills, healthy behavioral patterns, and resilience mainly by promoting the creation of a great

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variety of neuronal pathways and synaptic connections in the brain.

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