

Breastfeeding and Beyond

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Abstract: This paper draws on the last chapter of my forthcoming book *Window to The Womb. How Prenatal Life Shapes a Baby's Development*, which is an unprecedented dialogue between scientific research and maternal subjective experience. It highly acknowledges the supreme importance of the woman's healthy nutrition and emotional nurturing to create an optimal womb environment and transmit a positive attitude to nutrition – and to life in general – to the child. In particular, breastfeeding may reinforce this attitude and allow for the baby's smooth transition from the flavours of the amniotic fluid, introduced by the mother's healthy food, to those present in the breast milk, which the baby recognises as familiar. Therefore, the benefits of breastfeeding are not limited to its nutrients but extend to the reassuring experience of continuity from the womb life, building the foundations of the baby's emotional security.

Keywords: Scientific, subjective, nutrition, emotional nurturing, attitude to nutrition, amniotic flavours, memory, emotional security.

INTRODUCTION

It was through my experience of pregnancy and mothering, engaging with some of my echoing psychological and research background, that I became more deeply aware of the paramount importance of the maternal subjective experience in shaping a baby's development. This paper is savoured by a mother's and baby's own experience of breastfeeding. I suggest scientific research, especially in pre and perinatal development, needs to give more space to maternal emotions, thoughts, consciousness, dreams, in order to provide a whole picture of child's development and health. Recent technological innovations have allowed scientists to examine the 'biochemical' basis of the emotions. Neuroscientist Candace Pert in her book *Molecules of Emotion* provides an understanding of how inextricably united the body and the mind really are, and the role the emotions play in health and disease [1].

Today neuroscience is focusing on the fundamental role played by emotion, relationship and experience in child's brain development, and nutrition science cannot ignore the importance of emotional nurturing. On the other hand, nurturing has to embrace the extraordinary benefits of healthy nutrition on the child's brain. The brain is nurtured in two ways: nutrition and emotional nurturing, and the nutritional benefits are optimised by the child's positive emotional experiences.

Loving, consistent, positive relationships help build healthy brains and protect a baby's brain from the negative effects of stress [2, 3]. This process starts during pregnancy and continues through childhood to early adulthood. And like a building, it needs a strong foundation. Everyday experiences – from the daily routines to the people the baby comes in contact with – help shape a baby's brain through the formation of new neural networks. Babies need to live and play in healthy environments with opportunity to learn and grow. They need parents and caregivers able to recognize when they are tired, or hungry, or stressed or that they want a cuddle for comfort.

Responding warmly and predictably to babies and creating routines help them feel safe. It teaches them that they can rely on their parents when they are sick, upset or distressed, and that they can meet their needs. By having their feelings listened, children learn to understand others' feelings, thus they learn empathy. They also learn to trust the world. Daily activities such as talking, exchanging facial expressions, reading, and singing to the baby are all fun and easy ways to nurture her/his brain. So are simple games such as getting down on the floor with some tummy time with the baby, or playing peek-a-boo with a 5-month-old. Babies need to actively interact with their parents or caregivers and other people in their lives, and explore the world in order for their brains to develop healthily.

We all know that breast milk is the best food a mother can give her baby for the first 6 months of life – and well beyond, with complementary food. But we need to think of feeding time as a brain-building time

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too, for its nutrients as well as the mother-baby communication: making eye-contact, smiling, talking with a loving tone of voice, and having skin contact – expressions of a mother's enjoyment of her baby – are all positive experiences. The little tiny things that happen between the mother and baby at the beginning are significant. In the little world of the baby tremendous things happen. What I wish to say has to do with the tremendous richness that belongs to the feeding experience, as a great deal of the baby's life at first has to do with feeding; the baby is awake and alive and the whole of the emerging personality is engaged. We have to think of a baby's breastfeeding experience in terms of the richness of the experience and the involvement of the brain development, thus of the total personality.

THE PSYCHOPHYSIOLOGICAL SYNCHRONY. A FUNDAMENTAL PROCESS THAT MEDIATES BREASTFEEDING AND ATTACHMENT FORMATION

To offer a vivid picture of the vital importance of the early loving interactions between a mother and her newborn baby, I describe my experience of breastfeeding from the very first moments after birth. I am thankful to Prof Michael Crawford for asking me to submit it for publication. This is unusual of a representative of the scientific world and promising to a needed integrative approach to pre- and perinatal health.

I felt self-fulfilled and proud of having delivered my baby naturally and safely. I point this out because the outcome of labour and birth and the mother's feelings about it – certainly not independent of the quality of her pregnancy – have an impact on the smooth unfolding of breastfeeding, which the scientific world often considers a physiological activity. Yet, it is far more than that, at least in humans. Our evolved mammal brain implies that human breastfeeding reflects the integrated functioning of our most primal animal brain (deepest areas) and the higher brain involved in regulating emotions, language, and abstract thought.

When I heard her father's voice and saw him next to my bed, she was lying on my breast with wide open and alert eyes, while I was helping her initiate breastfeeding. I was too focused on her to pick up and memorise David's expression and feeling. She didn't start sucking immediately, probably because still slightly disoriented in the new world, and also because of the 'milking-let-down' reflex not unfolding yet. A cocktail of hormones was going to foster it shortly. It

was a wonderful feeling just being able to hold her so close and feel her warm and soft body on my skin. At first she looked quite funny while protruding her lips and tongue before triumphantly grasping the nipple. It didn't take long though to learn – better to say 'remember' – how to do it and after 20 minutes or so she became a very skilled sucker. All the sucking practice in the womb served for this magical moment. This behaviour so crucial at this stage of her development had been practised prior to this time to ensure it functioned efficiently when needed [4].

But this behaviour is not just the result of a reflex serving a direct physiological need, but also of a more complex psychological function: memory. Gisele's ability to recognise my diet flavours that had been present in the amniotic fluid and now were in the colostrums as familiar was very important for the successful establishment of breastfeeding. Prenatal familiarity enhances the baby's willingness to suck and succeed in doing it. The unborn baby may learn about the flavours of the amniotic fluid *via* her swallowing of this fluid which begins by the end of the first trimester [5]. Therefore, from the very beginning breastfeeding impacts on the baby's cognitive development, in particular on memory and learning.

A study shows that human foetuses even learn odours from their pregnant mother's diet. Olfactory responsiveness was assessed in 24 newborns born to mothers who had or had not consumed anise flavour during pregnancy. Infants born to anise-consuming mothers evinced a stable preference for anise odour, whereas those born to anise non-consuming mothers displayed aversion or neutral responses. This study shows that through their diet human mothers influence their newborns' olfactory preferences. These findings have potential implications for the early mother-to-infant transmission of chemosensory information relative to food and addictive products [6]. This early learning suggests the formation of chemosensory neural networks and indicates a certain level of brain processing.

Having her father next to me, staring at her, cooing and talking to her was an invaluable source of support for both of us. The fact that he was present during labour showed that he was absorbed and interested in such a crucial phenomenon of my womanhood. Research provides significant evidence of improved outcomes for mothers and babies when mothers are emotionally supported in labour. These outcomes include, but are not limited to: lower rates of analgesia

and anaesthesia use, lower operative birth rates, shorter labour, as well as increased maternal satisfaction with the birthing process and their baby [7]. No doubt the mother's positive feelings facilitate breast milk production and the whole experience of breastfeeding. I am sure that because David shared with me almost all the moments of labour and her journey to birth and was able to see her immediately after birth and establish an early contact, he was enabled to bond with her straightaway. He was very interested in her, eager to touch and hold her.

I appreciated the midwife's gesture to gently place her on my chest straight after birth. The baby senses gentle and caring touch and responds to it as she senses and responds a very different way to the bright lights, impersonal atmosphere that are so often aspects of a medical birth. Why must a baby emerge from the quiet darkness of the warm womb into a blaze of blinding light and loud voices? Why must an infant take his/her first breathe in terror? Dr Frederick Laboyer shows in his book how we can create an environment of tranquillity for the mother and baby in which to welcome our babies through a smooth transition from the womb environment [8].

The gentle touch of the midwife was immediately followed by the most significant source of reassurance: my body and mindful touch. My baby instantly stopped crying as she felt the warmth of my chest and hand and recognised the smell of my skin and the tone of my voice. On the other hand, seeing the midwife sensitively handling with her and meeting our mutual need of closeness was of great comfort for me. It would be so for every new mother. I had a sense of gratitude to my healthy pregnancy and birth circumstances for making breastfeeding unfold smoothly.

I'm thinking of those babies who are whisked away from their mothers for medical complications and deprived of their most important source of reassurance. Several studies have shown women who have the opportunity to bond straight after birth are likely to become better mothers and their babies are usually physically healthier, emotionally more stable and intellectually sharper than infants taken from their mothers straight after birth [9, 10]. Bonding pioneer Dr John Kennell and his team emphasise the importance of skin and eye contact in the first hour and extended hospital stay for the infant's healthy development as well as for the mother's well-being. Premature and prolonged deprivation of physical loving contact can thus have harmful effects on the primary relationship

and on the child's development [11]. Sensitive interactions are therefore the most important triggers for attachment and bonding, thus for breastfeeding as well. This means that what a mother does with her love is exquisitely scientific as it shapes her baby's psychophysiological development.

We were lucky that our reciprocal behaviours – cooing, stroking, hugging and looking – could unfold undisturbed and be biologically regulated to nurture and protect her. Seeing this purposefulness in nature with my inquisitive human mind rendered my whole experience more meaningful and inspiring, which enhanced my driving force of passion and enthusiasm. Experiments with the body chemistry of female rats showed that the maternal instincts were dependent on the flow of a certain specific hormone [12]. It appeared in their bodies towards the end of pregnancy and remained as long as the rat pups were present, making them ideal mothers. It was discovered that if the pups were taken away immediately after birth, the hormone vanished from the mother's body. Interestingly, also the maternal instinct vanished. In the mammal world, and not just in this, mother's and baby's presence are biologically necessary to each other. But the human mind can add a more complex emotional and spiritual dimension to this biological reality, creating meanings and purposes, and raising and answering important philosophical questions.

An example of this beautiful biological synchronisation is the baby's crying at birth stimulating the production of breast milk. Or when his/her skin is against the mother's breast or he licks the nipple, this leads to oxytocin release in the mother, which hastens uterine contractions and reduces post delivery bleeding. The sucking calms the mother and strengthens the bond between mother and baby [13]. Neuroscientist Jaak Panksepp deems that oxytocin, a feel-good biochemical, mediates maternal behaviour and ensures that the baby becomes attached to a caregiver. It is released by pleasurable touch and positive social interactions, and helps us to feel relaxed and at peace [14]. The developmental psychologist Seth Pollak suggests that the baby who is securely attached, thus receives pleasurable interactions, as an adult will search for people able to love him and provide him with pleasurable feelings, while babies who lack cuddles may never trust others and avoid close relationships [15]. His research found that love and affects from parents and carers are vital to developing brain pathways associated with handling stress and forming social bonds.

From the very beginning of pregnancy the hormonal changes render a woman's brain more plastic and equipped with a new intuitive intelligence and cognitive skills, which prepare her to sensitively understand her baby's needs. Nature is an intelligent provider. In my view, a diet meeting the pregnant woman's as well as developing baby's needs, therefore including sufficient fatty acids, boosts this hormonal bonus. This is consistent with studies on depression, suicide and aggression showing that fish is a food with psychotropic properties because it is rich in long chain omega-3 fatty acids that improve mental well-being that is, change emotional states [16].

While the mother prepares for sensitively and mentally connecting with the baby, the baby's physical contact with the mother's breast is likely to release her maternal instinct and all its loving expressions. To thrive emotionally, intellectually and physically a baby needs a loving, protective response that only bonding can elicit in his/her mother. As eminent Dr Verny puts it, love is not only an emotional requirement but also a biological necessity for a baby [17]. Without all its expressions such as stroking and cuddling, an infant can literally die or be neurologically and psychologically damaged, as documented in orphanages by Spits over half a century ago [18], or more recently in Romania. In particular the orbitofrontal area of the brain, which plays a key role in social behaviour, was seen as a 'black hole' in severely deprived orphans [19].

Gisele looked so tiny in her father's big hands (a normal-size baby girl: kg 3.250) when the midwife handed her to him before putting her into a cot. Forty minutes or so after her birth she was in a cot under a bright light to be weighed, have her length measured and her reflexes tested – a hospital procedure. That bright light must have been overwhelming for her – she had just come out of the dark. I was looking forward to her being removed from that cold cot and returning onto my chest. Yet, she was not crying. Her first physical contact with the breast, an extension of our prenatal connection, had certainly reassured her and enabled her to cope with the impact of those impersonal lights and cot.

I was looking forward to holding her again for unrestricted time. I found almost amazing and incredible that she was out, born safely, and I was fine, though exhausted after hours of pain. I was happy that all had happened absolutely naturally, using my resources and strength. And she did well, as she had actively contributed to this blissful outcome.

Amazingly, although I hadn't slept at all, I was so excited I didn't even feel tired. The exhaustion following birth didn't last long. Soon it was replaced by a state of elation, curiosity and pure joy. I'm sure a cocktail of hormones was playing its role to facilitate bonding, but the key thing was my passion for this baby, my exhilaration and sense of fulfilment. But also the awareness of having been the master of my pregnancy, labour and birth outcome. The great teachers of the ancient East developed a philosophy called *Kaizen*, a Japanese word which means self-mastery, self-improvement, working hard to improve. They thought that when we have taken the time to build a strong character full of discipline, energy, power and optimism, we can have everything and do everything we want in our outer world. When passion is lacking, as it is often the case in our Western work-centred society, where people do things because they feel they have to, and not because they love to do them, this brings misery in many life circumstances, included conception, pregnancy, labour and birth. Often breastfeeding is hindered. What mothers need, from conception throughout pregnancy and beyond, is an environmental provision which fosters the mother's belief in herself and self-fulfilment. In my view, these are requirements, and not doctors and nurses' often-non empathetic advice, of the mother's ability to provide emotional nurturing to the unborn baby and future child.

HEALTHY NUTRITION TO NURTURE THE MOTHER'S MIND

Maternal healthy nutrition contributes enormously to such vital environmental provision to the mother as well as the baby. In particular, lipids are the major structural material of the brain and require specific essential fatty acids that have been eroded in the food chain by the enthusiasm for production and the consequent change in food chemistry. These essential fatty acids, of which a great source are fish, seafood and micro-algae, are especially important in prenatal development of the brain and are dependent on efficient blood supply. Prof Michael Crawford deems that the damage to the arteries caused by the new processed food and the sedentary life consequent to a work-centred life style have contributed to poor blood circulation, especially in pregnancy when a good supply from the mother to the baby's brain is extremely important. My healthy pregnancy, positive outcome of birth and smoothly unfolding of breastfeeding have continuously reminded me the determinant influence of eating oily fish 2-3 times a week and a diet based on whole grains,

legumes, soya, nuts, vegetables and fruits, of regular exercise, meditative practice and yoga.

The rise in brain/mental disorders, especially amongst children, is linked to maternal poor health and nutrition before and during pregnancy, as maternal health determines the growth and function of the brain, which is largely determined before birth [20]. A womb poorly nurtured by maternal love and nutrition threatens the very essence of what makes us human. The mother then needs a good supply of DHA (omega-3 fatty acids) to meet the need of her unborn baby's brain for healthy growth and functioning. But the baby's brain continues to be particularly vulnerable during the months when he is fed and emotionally nourished at the breast of the mother, and breast milk is an optimal source of DHA, which is dependent on the mother's diet. A poor diet has detrimental effects also on the mother's supply of emotional nurturing. It drains her mentally and physically. It affects her moods and feelings and it hampers the clarity of her mind.

During the third trimester, the unborn baby's already large brain grows at double-speed, making huge demands on the mother's supply. If she is short, the foetus robs the mother's own cells, for instance of DHA, which should form over 10% of the brain [21]. Deprived of DHA, the mother will be prone to depression and her child's development compromised. A cross-nations study showed a close correlation of postnatal depression with low food consumption [22]. We must remember that depression is likely to hinder breastfeeding and bonding, vital sources of a baby's brain development.

Studies indicate that the development of the HPA (Hypothalamic-Pituitary-Adrenocortical) axis, the limbic system and the prefrontal cortex are likely to be affected by antenatal maternal stress and anxiety [23]. Stress hormone cortisol appears to cross the placenta barrier and thus may affect the foetus and disturb ongoing developmental processes. The magnitude of the long-term effect of antenatal maternal stress/depression and poor nutrition on the child is substantial. Therefore, programs to reduce maternal stress in pregnancy and induce states of sound emotional and nutritional health – flooded with feel-good hormones such as endorphins – are of paramount importance for the baby to thrive in her/his full potential.

Through a healthy nutrition including omega-3 fatty acids a prospective mother nourishes her mind and is

more likely to enjoy her pregnancy and breastfeeding, thus nurture her baby with her positive emotions. We can say that healthy nutrition is also about self-nurturing and positive thinking.

TIRED OR KEEN TO EXPLORE EACH OTHER?

I kept gazing into the crib, where they had put Gisele while transferring me to the Maternity ward. She didn't look comfortable in there and so I decided to hold her as much as possible during these early hours of her postnatal life. I breastfed her on and off all night long and she seemed to know what to do - all the sucking good practice in the womb. It was me who for a moment wasn't sure if I was doing it right. One of the midwives came and helped me to get her latched onto the breast (even that was part of the hospital procedure) and, after taking possession of it, she sucked contentedly for a while. I was really keen on giving her my breast milk for as long as we would enjoy the whole experience of it. This is because of all the goodness of the breast milk: breast milk strengthens the baby's immune system, as infections and gastrointestinal illness are less frequent. A bottle-fed baby who is generally prone to allergies will become allergic six months earlier than her solely breastfed siblings. Moreover, respiratory illnesses are thirty per cent lower. But more importantly, I was keen to do it for the special bonding established during breastfeeding.

I sat up on the bed for a while just holding her and watching every little movement she made while sleeping. I stared at her perfectly designed tiny hands with long fingers. For a moment it felt so unreal and I think many mothers, especially first-time mothers, experience such a feeling during the first hours after their baby's birth and even for a longer period. I was a mother. And she was my little baby. I have been in a state of alternating excitement, bliss and enlightenment for several hours now. By the end of the day I was not feeling tired yet, and was wondering how that could be possible. I have memories of friends whom I visited a few hours or a day after delivery feeling very tired and of their babies sleeping in a hospital cot next to them for hours as if they were sedated. I remember the baby of a friend of mine delivered by caesarean after a very long labour sleeping all day after birth. Unfortunately there are still midwives and obstetricians who argue that separation of mother and child immediately after birth is necessary because they need a lot of rest after the hard work of labour and birth. And the midwife visiting me at regular intervals did suggest a few times I

give the baby and myself a break from our close physical contact and put her in the cot.

But studies on mother-infant bonding show that what mother and baby need and want in the first minutes and hours is not sleep but stroke, looking and listening to each other [24]. Breastfeeding is a special manifestation of this mutual love. It is actually triggered by these earliest exchanges. They are keen to explore each other, they are curious. In fact, Gisele didn't look tired at all after birth, but longing to feel and smell my skin, make eye contact and take possession of my breast. As soon as she was put on my stomach she eagerly begun inching up towards my breast, probably attracted by the familiar milk odour. Her eyes were bright and alert, and she was curious to get to know me better. As I softly spoke to her, she turned her head towards the source of my voice and her body made some tiny movements almost in rhythm with my voice. It was evident that my voice was familiar to her – we were old acquaintances. There was plenty of energy and drive in her behaviour, far from exhaustion. And so was there in me. Had I transmitted her my passion, elation and zest during pregnancy?

I tried to keep her in the crib just for a while to watch her at a distance and study her features, but she evidently didn't like staying in that cold impersonal thing. So I let her sleep next to me. She slept next to me all night and benefited from all the bodily cues she had got used to, thus so familiar to her – my heartbeat, breathing, smell, warmth and our skin contact. They were regulating her own breathing, heart rate and body temperature and at the same time reassuring her. And I benefited too. I felt relaxed and profoundly at peace. I realised that not only was her sensory system particularly strong, but I had also developed sophisticated sensory capacities. It was early in my pregnancy that I noticed my olfactory sense getting stronger. I would recognise her smell (it has an affinity with mine) and the feel of her skin among other babies. We were just one mother-baby case of a universal human adaptive system – involving primate animals as well - which I'm willing to let unfold. Several studies have found that a mother can recognize her baby among other babies through smell and touch from the very first day after birth [25, 26], just as babies can recognize the smell of the mother's breast milk and distinguish it from other mothers' milk [27].

I breastfed her frequently in order to let breastfeeding settle and us enjoy our contact. I couldn't stop watching her and was awake all night. I didn't

want to miss any movement or expression, while a stream of thoughts was crossing my mind. I was really amazed at not feeling any tired. I was having a first hand experience that the most critical period of extrauterine bonding is the hours and days immediately after birth. But also, that postnatal bonding is just a continuation of intrauterine bonding.

Gisele had shared with me the experience of labour to be born. When the contractions of the uterus pushed her downwards with inexorable rhythms and pulled her away from her warm blissful world, she probably felt birth to be a threat to life: her first cry was her primal fear and at the same time her immense long for life. But when I tenderly welcome her onto my breast she relaxed her tense body: she recognized the familiar heartbeat and breathing and begun to trust again. Then she smoothed her wrinkles and released her clenched fist: she was experiencing a new happiness.

From then on she was to be a new discovery for us every day. But she had known us for longer than we had known her. During nine months of intimate communication she had sensed, felt and heard us. My voice soothed her instantly as it sounded familiar. As soon as she was born her eyes showed a profound need of my company and love, irreplaceable nourishment for her.

She looked so at peace, like a little Buddha, though with a drive to feel and smell my skin, even before crawling over my breast in search of the nipple, which she found straightaway – obviously lead by the smell, not her sight. How could she know everything? She obviously drew on a synchronised communication system established during her intrauterine life.

Her facial expression didn't show any significant sign of pain experienced by being thrust into the birth canal. Her cry lasted a few minutes, perhaps seconds. She didn't look tired either, as I would have expected. And a baby must feel considerable pain while being squeezed and pushed by the uterus contractions. Though, as according to Dr Thomas Verny's intuition, a baby also experiences moments of intense sensual pleasure while passing down the birth canal, when she is washed by the mother's warm fluids and massaged by her muscles [16]. I believe that these alternating feelings of pain or fear and pleasure are designed to make the baby stronger and prepare her or him for the challenges of a new life outside the womb. Those moments of sensual pleasure had provided my baby with a crucial physical contact, which made this our first

contact and breastfeeding straight after birth happen so smoothly. It wouldn't have probably been exactly the same if she had been born by caesarean depriving her from this experience of pleasure and massage on her skin.

Her curiosity and interest in feeling and smelling my skin and latching on my breast had taken over any feeling of pain experienced during the descent. I was sharing with her the same drive to feel her on my chest, look directly into her eyes, hold and stroke her. A combination of hormones – the oxytocin released during labour has an amnesic effect – and mental connection between us had put the pain experienced by both of us in a remote corner of our brain. Our presence was so biologically critical for each other, and our reciprocal interest and behaviour really were regulated biologically, just as they were when she was in the womb.

My sense of self-fulfilment linked up with the fact that I had not been given any drugs during labour and could bond with my baby straightaway. We both needed to be fully aware of each other. Studies suggest that drugs given in analgesia can delay bonding with the baby, and the baby's successful nursing [28], and that infants whose mothers have had anaesthesia during delivery tend initially to be more sluggish and have less motor coordination [29]. These manifestations may persist several years after birth.

BREASTFEEDING ENHANCES MEMORY, COGNITIVE DEVELOPMENT AND EMPATHY

I spent the first few days at home most of the time lying down in bed next to her and staring at her, almost enchanted by her presence. I couldn't recall any experience from my adult life comparable to this feeling of enchantment and enlightenment. Perhaps, it is similar to the feelings and consciousness I experienced as a child, when I created something new with my own imagination or made a new discovery. My brain/mind must have gone through important changes enabling me to understand the meaningfulness, significance and profoundness of being a baby. I view these changes preparatory for mothering. In other words, I felt my mind closer to her extremely imaginative, absorbing brain and with a similar openness to learning from her own experiences and behaviours.

I had been wondering how her brain was absorbing the new sensations of this new life outside the womb. Learning can be defined as the integration of new

knowledge or skills with the knowledge or skills we already possess. And she already possessed a rudimentary knowledge acquired during her prenatal life. So it was important to keep her pre-existing knowledge alive by offering her a smooth transition so that she could relate new information to what she already knew. In other terms, what is important about human nature in general, and individual personality, is in place at birth.

Babies' brains seem to have extraordinary qualities that make them so imaginative and open to learning. Babies' brains benefit from far more neural connections than adult brains. Important wires are already present at birth, which means they formed prior to birth. As we grow older and experience more, our brains tend to weaken the less used pathways and strengthen the ones that are used more often. This connectivity makes babies' brains much more plastic and flexible, more open to change. But the hormonal changes involved in pregnancy and maternity seem to also potentially make a woman's brain more plastic and creative. Research shows that pregnancy may deliver improved brainpower [30]. In this way, Nature seems to equip a mother with the adapted mental tool to communicate with and understand her baby, therefore to share her baby's experiences.

My new inquisitive mind seemed to better put me in touch with my baby. Thinking of her and watching her was helping me answering fundamental questions about creativity, consciousness, love, identity, empathy, truth and morality in a new way. And not just about philosophical issues, but also scientific ones, such as prenatal memory and emotions, and prenatal brain development. Did she suffer a lot during birth? In my evolutionary view, this suffering prepares a baby to cope with the difficulties she will encounter in her life outside the womb. I had been stroking her head gently and constantly to help her forget the squeezing through the birth canal. I had fallen in love with her from the first moments of conception – actually beforehand - and wanted to continue to convey all my love to her. Gisele appeared to enjoy having her head stroked and very often fell asleep. One day I watched her rolling her pupils and making some sounds while asleep. Was she dreaming? And if she was, of what? Probably of life in her first home, the only one she knew. Or was she dreaming of her hard journey into this new world, of which she had heard and felt its resonant vibrations? Was she dreaming of me and our first encounter after birth?

I was amazed by her bright eyes and conscious awareness and this made me think of our communication during pregnancy, the music I had regularly played for us, the rhyme I had regularly sung, and the epistolary book I had been writing on her prenatal development. It goes without saying that all these activities had nurtured her brain, her *primal self* and *conscious awareness*. Dr Dennis Stott in the early 1970s reasoned that a baby's physical and emotional state at birth and in the years immediately following would be indicative of the kind of communications she/he received in the womb [31].

At night, before putting her in the Moses basket next to our bed I breastfed while lying on my side, and we often both fell asleep. We slept together for an hour or so and then I gently laid her in the basket. Very often I kept sleeping next to her until she woke me up with her sounds and body movements for next feed. I found breastfeeding at night a blissful and soothing experience. With the sound silence and the faint light I could only hear her rhythmic sucking, a song that was like a lullaby for me. Breastfeeding relaxed me as no another experience had ever done before. And it made me sleep soundly, although I was awoken by any relevant sign coming from her body and trying to convey something to me. We were so privileged that she had already a sleeping pattern. This was also the soothing effect of breastfeeding, which turns off the baby's stress system by producing the hormones oxytocin and prolactin. My suggestion is that her sleeping pattern was also an effect of her synchronism to my day-night rhythms during pregnancy, which was in turn a reflection of our attuned communications.

Sleeping with the baby or next to her cradle makes feeding easier. In the calm of the night, with nothing to distract the mother from breastfeeding, it can be easier to recognize the baby's need as she sniffs and snuggles up [32]. She does not need to get out of the bed for each feed. In a wake-sleep state, when the rational side of her personality is dozing off and thoughts are banished from her mind, the breast milk can flow undisturbed and her sensory experience can be more intense.

One of the benefits of breastfeeding is that encourages mothers to spend long stretches of time attentively observing their baby, getting to know their body language, rewarding them with the production of the feeling-good hormones. Oxytocin stimulates milk production and produces the "let-down reflex" (when the milk comes to the nipple). This hormone, like

others, is closely linked with the mother's emotional state. The baby's cry or just the physical contact with the mother stimulates the oxytocin release and the 'let-down reflex' [33]. This demonstrates the psychophysiological synchrony between mother and baby, a fundamental process that mediates attachment formation.

Oxytocin is also the hormone released after sexual intercourse, which provides a feeling of gratification and lack of motivation to go anywhere or do anything. These feeling-good hormones also make mothers more responsive to their baby's cues or cry. In fact, I picked up Gisele's bodily cues (moving her body and making sounds with her mouth) and promptly responded to them far before these escalated into cry. Certainly bottle-fed babies and adopted babies can all receive sensitive loving attention, and if a mother struggles to make her breast work because of personal difficulties or conflicts, breastfeeding should not be persisted. The mother suffers and the baby suffers. Yet we have to acknowledge that nature has equipped us with tools to receive these specific physiological rewards and build a mother-baby relationship on the base of a physiological synchronism [34].

During a period of intense dependency, when the baby's ability to regulate or comfort herself or himself is very limited, so he is very vulnerable to both physiological and emotional stress, breastfeeding also helps the baby's brain to develop a balanced stress response and a capacity for self-control and empathy for others. The mammalian brain encodes experience in the form of neural pathways. Many important areas of the brain, such as the amygdala, respond to our perception of social events through the release of biochemicals called neurotransmitters and hormones – biochemical which Candace Pert has called 'molecules of emotions' [1]. These molecules help cells to communicate with each other, and to transmit information *via* the neural pathways. This information can in turn activate the autonomic nervous system, affecting heart rate, breathing, body temperature and so on, to help us react to circumstance.

Breastfeeding plays a vital role in the development of this mammalian emotion system. The fatty acids contained in breast milk nourish the biochemical pathways of serotonin, dopamine and adrenaline, while early stress and stress hormone cortisol can damage them. Moreover, the act of breastfeeding soothes the baby and, by producing the hormone oxytocin, turns off his/her stress system. In short, breastfed babies get

more of the nutrients and emotional experience they need for the brain to reach an optimal development. Research shows that breastfed babies, compared to bottle-fed babies, are more emotionally resilient and better able to cope with stress [35].

It is clear that breastfeeding immediately after birth provides the newborn baby with an experience of continuity from the womb life, as it gives the baby the opportunity to recognize the colostrums as familiar due to the presence of the same tastes that have been present in the amniotic fluid. Breastfeeding thus nurtures the baby's memory of her womb experiences and by stimulating her memory it may influence her cognitive development. Formula milk has an impersonal flavour, cognitively unstimulating. Moreover, while the unborn baby was used to a beneficial variety of maternal diet's flavours, with formula milk his prenatal capacity to learn tastes is wasted. She or he will get used to the unchanged flavour of formula milk and may find more difficult to accept the variety of food when at around 6 months it will be introduced. First, she or he will not recognize its flavours experienced prenatally, secondly, she will have got used to the same flavour of formula milk. Flavours soon become in a baby's mind important cognitive stimuli. Long-term breastfed Gisele constantly reminded me this with her remarkable early memory and learning capacities.

The baby's sense of taste becomes stronger during breastfeeding, as the mother's milk changes to meet her baby's changing nutritional needs and provides easily digestible proteins that rarely upset a baby's sensitive tummy, whereas a bottle-fed baby gets used to the same taste of food.

Evidence suggests that the unborn baby can learn tastes experienced only prenatally [36] and through such learning acquires a preference for these tastes [37]. Moreover, Hepper's observations at his laboratory indicate that mothers who experience the greatest change in diet between before and after birth have the greatest difficulty in establishing breastfeeding [4]. Breastfeeding even eases the introduction of solid food, if this is the same as that the mother has been eating and the baby has received through breastfeeding. When I introduced solid food a week before Gisele turned 6 months, the flavours were already familiar to her taste as well as her digestive system.

FEEDING MEANINGS

ACQUIRES

PSYCHOLOGICAL

From the very beginning, breastfeeding and food acquires important psychological meanings for the baby. I suggest that even in intrauterine life, the baby may sense the mother's attitude towards nutrition, her good or bad feelings about it and herself and learn to associate a positive or negative experience to food. Because I felt very good about myself and breastfeeding, presumably Gisele was likely to develop a positive attitude towards food. But she had learned my self-love and love of healthy nutrition already during pregnancy. Reached by some physiological cues from my body/brain, she used to produce some movements before I approached my food, thus anticipating my eating. A sort of conditioned response may have been at play.

How often she was breastfed – for the first months on demand – the quality of breast milk, thus of the food I ate, and the care with which she was breastfed, all acquired psychological meanings that were to influence her attitude towards food later. Breastfeeding is much more than a physiological act and the mother's milk does not flow like an excretion. It is a response to a variety of elements: the sight, smell, feeling, and thinking of the baby. Bion referred to the breast as the "thinking breast" [38]. I was having a vivid experience that the periodic feeding does develop as a communication between mother and baby based on a rhythmical exchange of cues, a song without words, or a dance, in which the infant needs to be fed and comforted are both met.

Breastfeeding, like food later, comes to be associated in the baby's mind with love, security and tranquillity. This occurs through a process called "projective identification". Through breastfeeding and any experience of contact with the mother, the baby introjects the experience of being fed and nurtured, which strengthens her sense of security. This is a physiological process. By introjecting a containing object - mother, breast, and all the sensual experiences with her – the baby cements an internal space and identifies with that object and with the experience it provides [39]. Then the baby projects her positive embodied feeling back to her mother, providing her with a far more rewarding experience. This is how breastfeeding, weaning and introduction to food, by providing a nurturing emotional experience and becoming a source of security, produce a child's attitude to nutrition.

The mother then transmits the sensuous experience of breastfeeding enriched with meanings. In some mothers, this sensuous experience may arouse uneasy or difficult emotions, with the risk of their unconscious projection on to the baby. Their concerns, conflicts and anxieties (mental states) may obstruct the milk flow and affect the infant's feeding pattern, the mother-infant relationship and the infant's health.

I wish to point out that although the physiological and psychological benefits of breastfeeding are unquestionable, a woman who for some reasons is unable to breastfeed has no reason to feel guilty. Her guilt could only impair the relationship with her baby. She can still provide her baby with sensitive loving interactions, which are vital for her/his emotional, intellectual and physical development.

DISCUSSION

In our Western work-centred societies pregnancy, childbirth and breastfeeding have lost their naturalness and become difficult and sometimes a source of stress and depression rather than enjoyment, as they still are in traditional societies. I believe that the human's loss of connection with the environment, both natural and social, is at the base of this dramatic change. One consequence of the human's loss of being part of the ecosystem is the change of food chemistry in recent time. Lipids are the major structural material of the brain and require specific essential fatty acids that have been eroded in the food chain by the enthusiasm for production. These essential fatty acids, of which a great source is fish, seafood and micro-algae – and breast milk, which is dependent on the mother's diet – are especially important in prenatal and perinatal development of the brain.

Prof Michael Crawford associates the rise in brain/mental disorders, especially amongst children, to maternal poor health and nutrition before and during pregnancy, as maternal health determines the growth and function of the brain, which is largely determined before birth. Of course, nutrient deficiency is one aspect of brain disorders. Another important aspect is the lifelong biochemical effects on the child and adult, thus on society, of emotional deprivation caused by our industrialised societies. In my view, the psychosocial factors are as much important as the nutritional factors in pregnancy and birth outcomes and success of breastfeeding, and are closely linked. This paper presents through my maternal experience the shift towards nutrition and emotional nurturing. I firmly believe that it is only by expanding our consciousness

of the importance of prenatal and perinatal life – and a great deal of a baby's life at first has to do with feeding – in shaping brain development that we can truly create the path to health, happiness and social cohesion. These are foundation of humanness and a well-functioning society. A womb poorly nurtured by maternal love and nutrition threatens the very essence of what makes us human.

In regard to breastfeeding, breast milk production can be lessened by persistent worries about the infant's health or milk intake, obsession with routines, conflicts in personal relationships or related to the mother's own experience as an infant, or failure to get helpful support to work out feeding problems [40] – all undermining maternal nurturing capacity. This latter anxiety is nowadays on the increase, as the majority of advice comes from professionals who have an impersonal relationship with the mother and no clue about the impact of maternal subjective experience. Paediatrician Donald Winnicott [41] noticed that unfortunately mothers have this terrible belief in doctors and nurses, and they think that because the doctor knows what to do if things go wrong, therefore the doctor knows how to get a mother a baby into relationship with each other. Usually he has no understanding whatever of this which is a matter of intimacy between mother and baby.

Doctors are not specialists in the matters of intimacy that are vital to both the mother and the baby. If they try to give advice about intimacy, they are on dangerous ground because neither the mother nor the baby needs advice. By doing so they interfere with delicate dynamics and may cause distress in the mothers rather than being helpful. What mother and baby need is an environment which fosters the mother's belief in herself and self-fulfilment. Parents need to know and be self-conscious about their own needs at this very early stage. In traditional societies, however, most help and encouragement come from an experienced supporter, relative, friend or mother, who is able to offer emotional support rather than technical advice.

Motherhood is a fundamental experience that brings up deep-seated insecurities and long-buried emotions, which may be so devastating that they can undermine breastfeeding and the bonding with the baby. All the intricate interactions involving the baby's sucking, which affect the mother's hormones, activate a milk response, enhance maternal feelings, deepen receptiveness, perpetuate and shape an age-old human cycle. My experience shows that this exquisite psychophysiological synchrony was facilitated by my

self-belief, enjoyment and fulfilment throughout pregnancy, labour and during breastfeeding. These were important determinants in my outcome of birth and earliest unfolding of breastfeeding. Sadly, in our work-centred society many have lost passion – if not interest – in such important events, and positive feelings have been replaced by fears and anxieties.

One can say that many of the important features of the breastfeeding situation can be seen to be there when the bottle is used. For instance, the baby and the mother looking into each other's eyes, which is feature at the early stage, does not absolutely depend on the use of the actual breast. Nevertheless, on the whole the taste and smell and sensuous experience of breastfeeding are something that is absent when the baby engages with a rubber teat. The baby's experiences are richer when the breast is being used than with a bottle, simply because the mother herself 'feels' and 'experiences', and thus transmits the baby all the values of this experience. She creates the ingredients the baby needs for growing not just with the nutrients but also with her feelings, as these are indeed embodied and part of her physiology.

Babies also like to play with the breast when their hunger is satisfied: grab the nipples with their mouth, lick it, touch the breast with their hands and sniff. This playfulness is also essential to their development. The baby establishes a relationship with the breast, which represents the relationship with the mother. It is important that feeding be fun for both parent and baby in order to develop a tension-free, enjoyable attitude to food. The mother's facial expressions while feeding the baby are important mirror images.

In my evolutionary view, the woman's ability to use part of her own body with 'satisfaction' links up with her own experience when she was a baby, and the whole thing goes back to the beginning of time when human beings had scarcely moved from the position of mammalian animal life.

Events such as pregnancy, birth and breastfeeding and weaning are not just physiological events, but produce long-lasting effects on the personality of the child. However, life is a continuum from conception to death and no one factor, such as womb life or birth can solely shape a child's development. Prenatal and postnatal experiences form positive or negative predispositions, which can be strengthened or weakened by later life experiences, as neuroplasticity is a human brain feature throughout life. Yet Gisele's early emotional experiences, at first mostly linked with breastfeeding, will always be foundation in her life and

creatively pilot her future experiences. The embodied memory of a loving mother and father, and a nurturing environment which has provided healthy food, warmth and comfort, will be a rock in times of distress and failure. Failure will be felt as the route to learning and personal growth. The memory of love and protection becomes a working model in a child's mind, but also a primal *visceral* or *bodily* memory.

I breastfed Gisele and her younger sister for 5 years, with a four months gap between them. I was nearly 5 months pregnant with Sahara when 2-year old Gisele came off the breast, probably because the milk flavour had changed or the milk was going. Again, Nature was showing its intelligence. Four months later I started breastfeeding Sahara and she benefited from it for over 3 years. Two months after their births I was back to exercising, despite old prejudices and some doctors' advice discouraging doing it, and a few days after birth I was enjoying long walks with my baby in the carrier benefitting from our physical contact.

In the UK and the USA, babies are rarely breastfed for long, are frequently left to cry alone for some time and even long periods of time in their cots to teach them to settle to sleep without help. These practices teach babies to manage their feelings alone and repress them, rather than acknowledging them through the parents' responding to them. In the West independence is promoted virtually. The need for separating the baby in order to re-establish the parents' routines and intimacy is almost obsessive. In traditional cultures, in which mothers are far closer to their babies, this is considered close to abuse.

My girls are now 7 and 5 and so far their personalities and behaviours have been telling us that they both have benefited tremendously from prolonged breastfeeding and the needed attentions in their most crucial years of their life, and that I've tried to consistently respond to their bodily cues and give significance to their experiences. Their kind and caring nature really seems to mirror what they have received from us as parents: sensitive love most importantly. And lots of listening and watching. They have never been given antibiotics and had flu a couple of times in their lives - in a very mild form - thank to my antibodies they received through breastfeeding. But very importantly, thank to the richness of the emotional experience of breastfeeding.

By paying attentions at their feelings and offering them the richness of breastfeeding, I taught Gisele and Sahara empathy and compassion. The fatty acids they received through the breast milk may have contributed

to mould their unaggressive personalities. This is in agreement with numerous studies, already quoted, on depression, suicide and aggression, showing the positive effects of long chain omega-3 fatty acids, of which fish and seafood are a major source, on emotions.

Joseph Hibbeln reminds us that, interestingly, traditional medical practices and religious symbolism may reflect the ability of omega-3 fatty acids in fish and seafood to moderate aggressive, impulsive and violent behaviour [42]. Symbol of fish may have been associated with the healing of mental illness and improvement of emotional well-being. Symbol of fish is also recurrent in artistic paintings. In traditional Chinese medicine, seafood is used to calm excessive aggression. In Buddhism, Hinduism, Christianity and other religions fish is symbolically associated with faith and healing.

Empathy and affectivity are essential to development. From Gisele's and Sahara's kind and caring behaviour towards others I can see that their moral behaviour has been shaped by their earliest empathic and affective relationship. On the base of evidence, we can say that the combination of healthy nutrients, in particular omega 3 fatty acids, and emotional nurturing prevent aggressiveness and violence. A deficiency of these important sources of healthy development has the most serious implications for social stability, peace, and humanness.

Moral behaviour then resides in the parents' observation and reflection upon human nature, rather than merely on theoretical principles or religious teaching, and has its roots in the earliest mother-infant psychophysiological synchrony. My maternal biological behaviour has much been influenced by my cultural heritage, included Eastern teaching. Buddhist teaching has much in common with latest neuropsychology of child development, as it bases ethical behaviour on a real appreciation of the brain and its nutritional and emotional needs, thus of human nature, which is interdependent and intersubjective. In my view this appreciation has to embrace prenatal and perinatal life, as well as spirituality and science, for a true understanding of the origins of human nature. Love, like food, is a biological need and relationship, like healthy nutrients, is fundamental for health and happiness, especially in early development.

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DECLARATION

The author has no conflicts of interest to declare.

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