Maturation of Habituation, Sleep-Wake Cycles Before and After Birth and Maternal Care

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Abstract: Fully human, personal, psychological, and relational life begins before birth, and constitutes the foundation for our basic feelings of security and trust. Two vital maturational/developmental processes begin before birth and continue thereafter: habituation and sleep-wake circadian cyclicity. These two processes, which are dependent on maternal-fetus/infant interaction, enable the fetus to adapt itself to extra-uterine life. Most habituation and circadian sleep-wake-rhythm studies have focused on physiological and biological characteristics. Insufficient attention has been devoted to the influence of maternal functioning on two of them before birth, at the time of birth, and in later life. This paper discusses the relationship between maternal care, mother-fetal/infant interaction, and the maturation of habituation and circadian-rhythm processes, as well as the influences on later life.

Keywords: maternal care, sleep-wake cycles, habituation

Awareness is increasing of the long-term impact of prenatal experience and bonding on both the infant and caregiver. Scientific observation has revealed a continuity of neurodevelopmental systems from life before to life after birth (Prechtl, 1984). Fully human, personal, psychological, and relational life begins before birth, and constitutes the foundation for our basic feelings of security and trust.

Habituation

Habituation is defined as a response decrement to repetitively present stimuli. It is assumed that the habituation reaction arises from the fact that the original stimulus becomes progressively less effective and loses its novelty (Stern, 1985). Habituation is the most elementary form of nonassociative learning and can be used to evaluate the maturation of the fetal CNS. The basic cognitive ability embodied in habituation is present in the fetus in the last trimester from about 30 weeks of gestation. Habituation is the most basic form of implicit learning and uses the same neuronal mechanisms as more complex learning forms, such as conditioning. An analysis of habituation is an important step in early detection of compromised fetal brain development, the long–term goal being to develop early therapeutic interventions (Muessinger et al. 2013).

Studies have shown that in the last trimester of pregnancy the fetus demonstrates a response decrement to repeated stimulation, as does the neonate after birth. Newborns show a strong response increment to dishabituation and a significant response decrement between the dishabituation and the re-presentation of the first stimulus. The ability to inhibit responses can be seen as an indicator of normal CNS development, and also indicates infant/fetal early learning.

Sleep-Wake Cycles

Human circadian systems develop during fetal life and continue to mature during the neonatal period (Mirmiran et al, 1992). The development of sleep-wake cycles is a maturational process and a sensitive indicator of neurobehavioral organization, as well as a vital process enabling the fetus to adapt to extra-uterine life (Reppert, 1995). The young infant enters the world well-equipped for ongoing cyclical development and eventual behavioral stability in a circadian-based world (Zuk, 1997).

In order to prepare itself for meeting the outside world and being able to cope with the changed environment, by mid-gestation the fetus begins to develop sleep-wake cycles (McGraw et al., 1999; Nijhuis et al., 1984). Research findings suggest that the fetal biological clock is an endogenous clock capable of generating circadian rhythms and responding to maternal entraining signals long before the moment of birth, and also that prenatal maternal entrainment extends into the postnatal period (Mirmiran & Ariagno, 2000; Reppert, Weaver, & Rivkees, 1988). Similar cycles of sleep and wakefulness are found in the young infant enabling continuation of developmental rhythms after birth

(Prechtl, 1992; Robertson et al., 1982). Studies have shown (Mirmiran & Lunshof, 1996) that preterm infants have circadian rhythms by 30 weeks of post-conceptual development. An important function of maternal entrainment during perinatal development may be to prepare the fetus's circadian timing system for later independent life (Mirmiran et al., 1992).

The young infant is well-equipped for ongoing cyclical development and eventual behavioral stability (quiet sleep, active sleep, quiet awake, active awake, and crying, the fifth state after birth) in a circadian-based world. With the continuing elucidation of circadian system development and its influences on human physiology and illness, it is anticipated that the consideration of circadian biology will become an increasingly important component of neonatal care (Rivkees, 2001; Zuk, 1997).

Disruption of fetal/infant-maternal interaction during gestation and after birth leads to disturbances of maternal and fetal circadian rhythms: the period is either too short, too long, or delayed, resulting in impaired maturation or even disappearance of the infant's circadian rhythms (Mirmiran & Lunshof, 1996). Interference with maternal entrainment may be responsible for the commonly observed sleep-wake and feeding-rhythm disturbances in preterm infants.

The Early Mother-Fetus/Infant Relationship

The caregiver's function is to bring the world to the baby while modifying and limiting the input in an appropriate manner for the baby's needs. Babies cannot exist alone, psychologically or physically, and need someone to take care of them from the start. According to Winnicott: "There is no such thing as an infant, meaning that whenever one finds an infant one finds maternal care, and without maternal care there would be no infant" (1965, p. 39). Particularly in the beginning, maternal care of the newborn infant is vitally important, and indeed it is a mother's task to protect her infant from complicated situations that he cannot yet understand (Winnicott, 1956).

The mother's role is to actively adapt to the needs of her newly born infant at the start of extra-uterine life. This ability to adapt is part of her prenatal preparation for taking care of her young infant. Winnicott (1956, pp. 300-305) refers to this special state in the mother at this early phase as "primary maternal preoccupation," which includes heightened sensitivity in the prenatal period.

With the care that it receives from its mother, infants are able to have a personal existence, and to begin to build up what may be called a "continuity of being." On the basis of this continuity, the inherited potential gradually helps the infant to develop into an individual (Winnicott, 1965, pp. 37-55). According to Stern (1985) infants are predesigned to seek out and engage in learning opportunities. He suggests that the infant can experience the process of an emerging organization, which he calls the "emergent sense of self." The first organization relates to the body: its coherence, its actions, its inner feeling states, and the memory of all these. Infants have an innate general capacity, which can be called amodal perception, to take information received in one sensory modality and translate it into another sensory modality.

Humans are born with preferences or tendencies to be attentive to specific features and strategies that have their own maturational unfolding. Infant experience is more unified and global. The global subjective world of emerging organization is and remains the fundamental domain of human subjectivity. It operates out of awareness as the experiential matrix from which thoughts and perceived forms and identifiable acts and verbalized feelings will later arise. All learning and all creative acts begin at the domain of emergent relatedness. This domain alone is concerned with the coming-into-being of an organization that is at the heart of creating and learning (Stern, 1985).

The first, unavoidable task of motherhood is to keep the baby alive. The mother tries to reduce complications to a level that the infant can understand, and in particular she tries to insulate her baby from any incidents and other phenomena that are beyond the infant's ability to comprehend. Good-enough environmental provision in the earliest phase enables the infant to begin to exist, to experience, to build a personal ego, to control instincts and to meet with all of life's inherent difficulties. The environmental factors are held constant until the individual is able to base them upon personal experience (Stern & Bruschweiler-Stern, 1998).

Living with the new baby, the mother constantly faces the realization that a fragile life depends on her, and wonders whether she will be able not only to keep the baby alive but also help in the development of this new individual's own rhythmic constellation.

Habituation, Circadian Rhythms and the Role of Maternal Care

Postnatally, by actively adapting to the infant's needs, the mother enables undisturbed functioning as the infant makes spontaneous movements and discovers the environment (Prechtl 1997; Winnicott, 1971). The function of the infant-mother relationship during the prenatal, perinatal, and postnatal periods is to bear in mind the baby's skin sensitivity, auditory sensitivity, and visual sensitivity. The mother also needs to pay attention and protect the child's habituation and sleep-wake cycles before and after birth. Habituation, the most basic form of learning, and the sleep-wake cycle are innate and vital neurodevelopmental processes that enable the fetus to adapt to extra-uterine life and prepare for confronting the outside world.

Failure of active environmental adaptation on the part of the fetus/infant could lead to impingement by the mother (her environmental preferences), pushing the infant into the role of reactor and resulting in ego-weakening (Winnicott, 1965, p. 52). Such mother thinks that she knows the child's needs in advance, and will do all the "right" things at the "right" time without taking into account the infant's own capacities and needs. This kind of failure could interfere with the infant's capacity to use habituation and the circadian rhythms, which may in turn influence post-natal maturation.

Maternal care should foster a healthy, creative, and meaningful life that will give the infant the feeling that: "I have a sense of existing as a person, that in my mind I feel my existence has been proved" (Winnicott, 1986, p.57).

Case Study: A six-year-old boy born through IVF to a single-parent mother

The child was born in the 42nd week of a normal pregnancy by a vacuum extraction. According to the mother the baby was very "easy" and quiet, he slept through the night after two weeks. The mother noted that she found it difficult to connect with the non-verbal baby, and did all that was necessary without empathy, and without taking him and the pace of his development into consideration. She remained at home with the baby for a year. The boy started speaking early and acquired a large vocabulary, but only started walking at 20 months. The physiotherapist who examined him did not discern any physical problem, but felt that the reason for the difficulty in walking was emotional; he probably had no wish to hurry and create distance from his mother. According to the mother, he is a clever, sensitive, and shy child who is able to accept limits, has a regular routine, is very meticulous, knows how to occupy himself, and has difficulty coping with unfamiliar surroundings. Recently she became concerned by how serious he seems and that he shows no signs of joy, and decided to seek consultation.

The consultation showed him to be obedient, to follow instructions closely, and reluctant to express his feelings. He is very level-headed child, lacks spontaneity, and sometimes shows a lack of confidence as well as anxiety. His restrained reactions seem to inhibit his ability to express his innate creativity, and he also seems to have difficulty in expressing enthusiasm and self-feeling. His drawings are very schematic and empty. From the mother's account it would seem that she was unaware of the child's needs and his abilities, and responded only to his physical needs without taking his wishes into account, and did not adapt herself at all to his pace of development. He obediently fulfilled what was required of him, without genuine, existential self-feeling. This is a talented and sensitive child who was not given an opportunity to make use of his innate capabilities and to develop at an appropriate pace for him, the result being that he slowly withdrew into a joyless shell, complying with the demands of his surroundings.

Conclusion

Recent prenatal and perinatal research on individual psychology highlights the importance of experiences at this early stage of life. In-utero development of rhythmic physiological patterns is also regarded as being significant for the infant's well-being. Dialogue between parents and child begins at conception and continues throughout life.

Habituation and sleep-wake cycles, which are dependent on maternal-fetus/infant interaction, are essential developmental processes and together constitute the cornerstones that enable the fetus to adapt himself to extra-uterine life. The young infant is well equipped to deal with what for him are preferable and non-preferable stimuli, and for adjusting to cyclical development leading ultimately to behavioral stability in a circadian-based world. The ongoing elucidation of these processes will influence the child's development and the various components of neonatal care (Rivkees, 2001).

It is emphasized the mother's vital role in adapting to the needs of her young infant at the start of extra-uterine life. Maternal care, especially in the holding phase, encompasses the complete routine of care and meeting the infant's developmental needs, and requires her empathy and her ability to respect his innate capacities (Winnicott, 1965, pp. 48-52).

In light of the above, society should provide the future mother (parents) with support during pregnancy and after birth. A better understanding of the issues discussed here may result in timely intervention and better infant care. Future parents should be given the necessary support to help them provide their child what is necessary for his or her development (Janus, 2002).

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