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Oxytocin: Love, Birth and Bulldogs

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Often, our hormones are viewed as a torment, they shoulder the blame for mood swings, irritability, aggression, forgetfulness, anxiety, weight gain and a host of other issues. It would seem that the more affluent and advanced the culture, the more our hormones are viewed as an interference, particularly where work and productivity may be hampered by our errant bio-chemical messengers. Historically women have been censured for hormonal hysteria, the medical profession were on hand to mollify the middle and upper classes with various tonics and bed rest, however working class women, who couldn't afford large medical bills, did not appear to suffer in quite the same way but were just as likely to encounter fear and ignorance around 'women's problems'. Unfortunately in the worst case scenarios women suffered incarceration and even surgical procedures such as hysterectomy (removal of the uterus) to treat female hysteria, to aid recovery from their hormonal maladies.[1]

More recently, our hormones, in particular oxytocin, have been subject to investigation and studies which have quadrupled in number in the last decade.

Pregnancy and birth create the foundation of all human relationships and connectedness. Oxytocin is no lone wolf, it works closely with other hormonal peptides and neuro-transmitters to bring about the necessary changes to facilitate successful reproduction[2, 3] and for the propagation of our species.

For millennia, *Homo Sapiens* were, and still are, dependent on cohesive social groups to function and survive in hostile environments, we learn whom we can trust and whom we cannot and our neural pathways serve to remind us of potential dangers and what makes us feel safe. Our hormones are

responsible for our version of reality and how we behave in that reality.[3, 4]

Oxytocin – the name is derived from Greek, meaning rapid-birth[5] - is believed to have been around as long as the mammals it serves, approximately 100 million years.

Oxytocin is produced in the posterior pituitary gland along with vasopressin (the word vasopressin is derived from Latin meaning *Vessel Pressure).*[5] Oxytocin and vasopressin are produced and work together and both have several essential jobs maintaining homeostasis. Homeostasis is our body's way of maintaining equilibrium and applies to all of our anatomical systems.

The ways that both oxytocin and vasopressin work are both capable of being epigenetically altered through human experiences and interactions. Both influence adaptations and behavioural responses to external stimuli and 'cement' good or bad experiences into our psyche. Experiences in utero, and, critically, in the 1001 days after birth, develop our neural pathways and impact on us into adulthood.[3, 6, 8]

Oxytocin is released during pregnancy in pulses via the cardio-vascular system and also in the maternal brain. The pulses become longer, stronger and increasingly frequent towards the last few weeks of pregnancy. In addition, the amount of oxytocin receptors found in the smooth muscular tissue of the uterus rise exponentially from the second (11 f mol/mgDNA) to the third trimester (1140 f mol/mg DNA) and increase in labour to 3550 fmol/mg DNA.[3] Although it is not yet confirmed what specifically triggers labour, it is known that a number of hormonal changes occur simultaneously in baby and mother. Melatonin, a hormone released to aid sleep and circadian rhythms (sleep and wakefulness programming), appears to stimulate oxytocin production as well as prolactin, which works with oxytocin to provide breastmilk. Prolactin, which drives 'nesting' instincts, triples in production from approximately 38 to 41 weeks.[3, 8]

Oxytocin receptors in the uterus are primed for the interplay of hormones that initiate labour, oestrogen levels begin to rise and in turn stimulate prostaglandins softening the cervix in preparation for dilatation and progesterone levels begin to fall. Progesterone has secured the foetus within the uterus throughout pregnancy, and as birth approaches the uterus must change its composition and function to allow the baby to pass through the cervix and into the birth canal. Oxytocin receptors recognise increasing maternal oxytocin levels in the blood stream, a 'lock and key' mechanism ensures that oxytocin and oxytocin receptors bind together to act on the powerful uterine muscle. Hormonal communication initiates a positive feedback loop that will not end until the baby is born.[3, 8]

The many hormones of birth

Hormones which inhibit the action of oxytocin are our 'flight or fight' hormones: Adrenaline, cortisol and catecholamines. However, they also have vital roles in the birth journey, such as helping the baby's lungs to mature, protecting the baby's brain from hypoxia during birth and promoting alertness of the newborn for eye contact and bonding after birth. These hormones can co-exist and function together with oxytocin, but if perceived threat or fear take over, oxytocin beats a hasty retreat. It is often noted that

women who no longer feel safe in labour will experience diminishing contractions as result of the reduction of oxytocin circulating in the blood stream.[2, 3, 8] For some women, just leaving their home or arriving at hospital is enough to stop contractions.

Endogenous oxytocin (that is, oxytocin made within our body) is released in pulses at around three in every ten minutes, usually coinciding with the frequency of surges in an active labour. However recent research indicates that there is a possibility that other hormones also have a role in labour surges as pulses may not necessarily coincide with surges.[8] Oxytocin pulses peak at the moment of birth and when the placenta is expelled. Oxytocin is an effective endogenous uterotonic (helps the uterus to contract effectively) and prevents sustained and heavy blood loss, particularly if the mother has experienced a physiological birth or one with minimal intervention.[3, 6, 8]

If the mother is truly undisturbed, with skin to skin and eye to eye contact with her newborn, a series of biological, emotional and behavioural events are likely to take place[2]. The mother will want to hold her baby close and may be overwhelmed with feelings of love and euphoria. Endorphins are triggered by the sensations of labour and alleviate discomfort. Dopamine (reward and motivation) and serotonin (belonging and happiness) are circulating to adapt maternal feelings and behaviours to care for and be near to her baby.[2, 6]

Vasopressin influences protective and defensive behaviours of those who are bonded socially, in addition to maintaining blood pressure. Oxytocin gives way to vasopressin when there is a perceived or real threat – to give an example of a You Tube video that went viral, 'The Battle at Kruger' demonstrates this mammalian behaviour perfectly, a buffalo calf faces certain death as it is encircled and attacked by lions. The maternal bond in this case defied almost certain death, and once the danger is over, oxytocin returns and mother and calf stay close. Transposing this example of the mother-baby bond and protection to a woman and her newborn, interference during this crucial process is something that could seriously impact this vital bond and should therefore be avoided in any situation other than a medical emergency.

Oxytocin is a mild amnesiac, and women and birth workers will recognise how quickly after the birth the woman will forget her discomfort and doubts experienced during labour when she holds her baby for the first time!

The mother will be focused on her baby, picking up on non- verbal cues and cries becoming 'tuned in'. Indeed 'baby brain' is no misnomer, it is a primal function to ensure protection and survival, the mother subconsciously bypasses insignificant stimulus, instead, concentrating on the physical and emotional needs of her new-born.[10]

Oxytocin and prolactin play a central role in the production of breastmilk. Mother and baby working in tandem to create the optimal behavioural prompts and the appropriate hormonal responses to provide nutrition that is adaptable to her baby's changing requirements.[2, 3, 6, 8]

Oxytocin has a direct influence on positive maternal behaviours. The formation of secure attachments governs a future blueprint, impacting on both mother and baby, determining their ability to cope with

stressful and novel situations. Conversely, its absence may have medium and long term negative effects on the mental and emotional health of both mother and baby.[6] Could this have implications in the rising numbers of reported maternal mental health problems which are now recognised as a major public health issue, with a long term cost to society of £8.1 billion for each annual group of births in the U.K.?[11]

Interestingly, oxytocin is present in significant levels of those who are in proximity during birth or shortly afterwards. Skin to skin contact between the baby and the mother's birth partners initiates oxytocin release and creates new neurological pathways, strengthening bonding and promoting caring behaviours. Grandparents and other family members can be under the influence of oxytocin, prompting adaptive behaviours that protect and nurture the whole family dynamic and serve to promote various physical and emotional health benefits throughout the ageing process.[12] In a much wider social context, oxytocin promotes characteristics such as empathy, generosity, altruism, trustfulness and trustworthiness. Currently, Neuro Economists are studying the role of oxytocin and its applications in the world of politics, industry and commerce.[13]

Oxytocin and Induction

Endogenous oxytocin has a plethora of holistic health and well-being benefits for mothers, babies and our wider social relationships, yet in current maternity systems the support needed to encourage our endogenous hormones to flourish appears to be overlooked in favour of the use of synthetic oxytocin and other medical interventions.[3, 14] Given our knowledge of the importance of our natural hormonal systems, what inadvertent harm are we causing women and their babies when we intervene unnecessarily in birth?

In the U.K., inductions of labour have increased to 33% (2018/2019) from 20.4 % (2007/8).[15] Some women, or their babies, may benefit from induction of labour however *all* women who are exposed to this intervention are at higher risk of the negative effects of synthetic oxytocin and other interventions that may follow. Worsening maternal mental health and depression within the first year of birth increases by 32% (an additional 2 in every 100 woman) compared to those who were not exposed to synthetic oxytocin, despite no previous history of depressive symptoms.[16] Suboptimal mother- baby bonding, feeding issues and the preparedness of the baby to be born are just some of the other concerns.[3, 17] With many women reporting coercive and negative language used by clinicians to persuade or even bully women into interventions,[18] it is no wonder that women have diminishing faith in their own bodies' ability to birth without interventions.[19] A recent perspective in the BJOG has put forward the case for all women to be induced at term,[20] however this medicalised point of view has been challenged with evidence that women who have continuous support in labour are less likely to have interventions and are more likely to report a positive birth experience.

Michel Odent has spoken about the case of bulldogs. Because of a desire to genetically alter the bulldogs' physiology and produce a large head, required by breed standards, vaginal birth became problematic, often resulting in death of the pups and the mother through dystocia. Veterinary assistance helped with artificial insemination and caesarean sections to decrease mortality rates. As dogs are able to reproduce

quickly, the longitudinal effects of this intervention have become apparent, bulldog mothers have largely become incapable of giving birth without veterinary assistance by caesarean section. It seems intervention and the inevitable manipulation of hormones has decreased the presence of oxytocin and oxytocin receptors in female bulldogs. But, interruption of oxytocin functionality may disturb more than physiological systems. According to a longitudinal study between 1979 and 2009,*Psychology* graduates in the United States were found to be 40% less empathic than participants studied just a few decades ago.[21] While we don't have the evidence to say that this is caused by the increase in induction, enough is now known about these essential complex hormonal systems to understand that unnecessary hindrance could have unpredictable consequences for future generations[2,6]

Oxytocin: Use it or Lose it

The phrase 'use it or lose it' comes to mind when exploring the debate for safely promoting the physiology of childbirth and protecting our endogenous hormones, the same ones that have precipitated our evolution and protected us as a race for millennia. These hormones deserve recognition and respect. They are becoming vulnerable in the face of increasing interventions and medicalisation of birth. Awareness of the importance and complexity of our hormonal systems is continuously growing through the wonderful dedication of researchers and authors referenced in this article. Pregnant and birthing women need accessible information on their hormonal alchemy, these complex hormonal helpers have surprisingly simple and inexpensive requirements to perform their valuable work during birth: a space that feels safe to the birthing woman, and birth attendants who she knows and trusts.

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