



The Biology of Attachment Formation

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Abstract

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Last month we talked about the neuroscience of attachment styles. This time, we are extending on those insights to dive into the biology underlying the actual process of attachment formation between caregiver and child.

We will cover the following topics:

- The biological process of attachment formation
- The biological factors influencing the quality of a parent's and a child's attachment

A not so surprising piece of news: the majority, if not all, of the studies on the biology of attachment formation between a child and caregiver focus on mothers and their infants or young toddlers. That means that the research we will discuss here has not been empirically validated in, for example, father-child dyads or caregivers that foster or adopt older children. However, as was the case for the many other topics that suffered under the same scarcity of research, I believe it is reasonable to expect that the science we discuss here extends to these populations as well. In the end, what it comes down to is that it is an adult who is personally invested in the wellbeing of a child. While there may be some innate hormonal differences, we all have the capacity to form strong attachments and we know that one of the hormones that are critical for forming attachments, oxytocin, is present in both males and females. In fact, this hormone plays a role not only in caregiver-child attachments, but also romantic relationships. We will dive into the latter topic in this month's Mental Health newsletter on the neuroscience of romantic relationships and the role these types of relations have in your mental health.

Let's start!

The biological process of attachment formation between caregiver and child

When the mother-to-be is pregnant: Attachments between mothers and infants appear, from what I have been told (I do not have any children), instantaneously after the birth of the child. We know from research that a pregnant female already presents with large changes in her hormonal profile that may not just be an adaptation to the physical changes induced by the pregnancy (Figure 1). In fact, oxytocin, often referred to as a 'love' hormone, increases 3-4 fold over the course of pregnancy (Uvnäs-Moberg et al., 2019). One study found that this



pregnancy-induced increase in oxytocin, correlates with the strength of the mother-infant attachment upon birth (Levine et al., 2007).

The woman's brain may also change over the course of pregnancy. One study that received a lot of attention compared the brains of women a few months before they became pregnant to shortly after they gave birth (Hoekzema et al., 2017). Like other studies, the researchers found that after pregnancy, the women displayed significant reductions in gray matter volume. What does that mean? It means that the parts of the brain that is not covered in myelin (see the [Intro to Your Brain](#) document!), shrunk during pregnancy, for example the number or size of cell bodies and the branching of dendrites. This shrinkage may sound terrifying: do I become less intelligent by being pregnant? If I have multiple pregnancies, will my brain become smaller and smaller? No and no! First, let's break the myth of brain size and intelligence: brain size has nothing to do with intelligence. We just have to look at [Einstein's tiny brain](#) to make that clear. Secondly, women that have undergone multiple pregnancies do not display smaller brain sizes than first-time pregnant women (Checko et al., 2022).

Now, here is the golden question: why in the world does your gray matter shrink during pregnancy? The researchers do not know yet, but it may have to do with the attachment formation process. Some, but not all, studies find that the reductions in gray matter volume correlate with the subsequent attachment strength between mother and child (Hoekzema et al., 2017; Martínez-García et al., 2021; but see Checko et al., 2022 for opposite results). Interestingly, it appears that the reductions in brain volume persists up to at least six years after pregnancy (Martínez-García et al., 2021), implying that these changes are important for not only establishing but also maintaining mother-child attachments.

Now, there is a big **but** with these studies: we do not actually know if the reductions in gray matter volume happen during pregnancy or upon giving birth (or shortly thereafter). Due to health risks, it is complicated to measure the brain volume of women during pregnancy with modern imaging techniques. Given the large-scale changes observed, it seems likely that the reductions in gray matter volume occur over a longer time-period, but it remains to be studied if this is truly the case. Likewise, it will be important to study whether women who carry an unwanted pregnancy display any measurable reductions in brain volume as well. If they do, it could suggest that the changes in brain size are more about the physical changes of the pregnancy and less about the attachment formation process. I will make sure to



comment on this as new research is published. Now, we know much more about the biology of attachment formation between child and caregiver after birth.

The **biological timeline** of how attachments are established between the pregnant person and the child

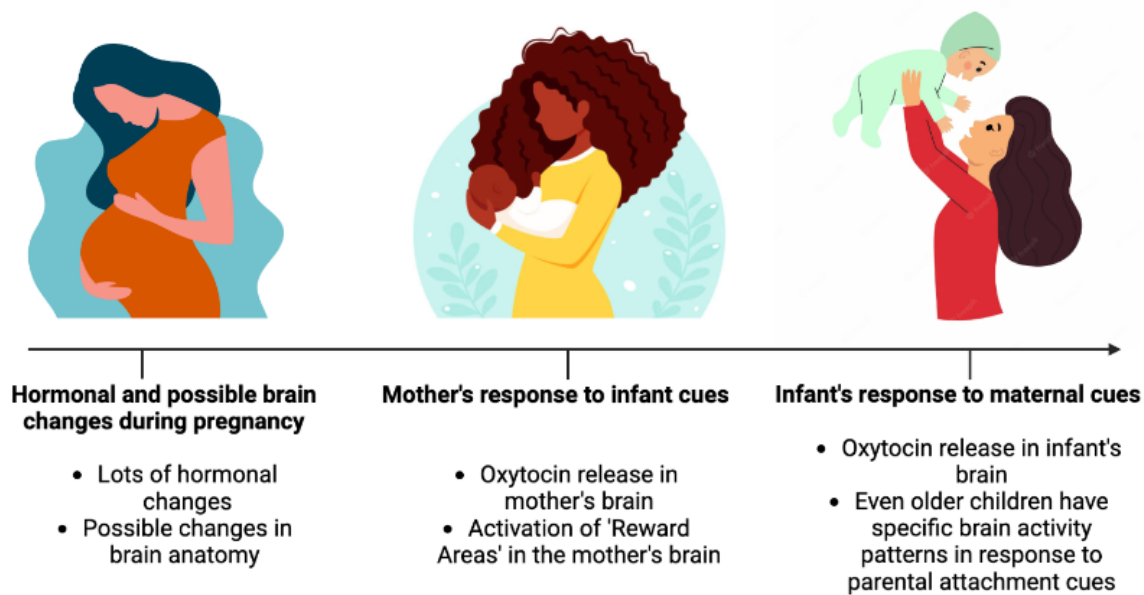


Figure 1: Attachment formation between mother and child may start already before birth due to changes in hormones and even brain anatomy. Upon birth, a huge surge in oxytocin is important for triggering fast changes in the body and brain that facilitate attachment formation both in the short and in the long-term. Most studies have focused on the immediate changes in the brain and body of the caregiver, but the infant also displays attachment behaviors and hormone responses early on that reflect the process of attachment formation.

When the birth has started: We already talked about oxytocin, and its popularly known role as a “love hormone”. But oxytocin does so much more (see Figure 3 for a more comprehensive overview of how oxytocin affects the body). Together with changes in several other hormones (for example, estrogen and progesterone), a rise in oxytocin in the bloodstream drives contractions and induces labor (Walter et al., 2021). In fact, oxytocin injections are used to stimulate labor contractions. As a part of this process, oxytocin also reduces the pain and stress/anxiety associated with giving birth (thanks, oxytocin!!). Oxytocin levels continue to increase during labor, and reach their peak levels around 15 minutes post-birth as a result of nipple stimulation as the infant breastfeeds for the first time. Oxytocin release is important



for successful breastfeeding, but this release is not only triggered by the infant suckling on the nipple but also by other external factors such as when an infant cries or in anticipation of the infant breastfeeding. The diverse ways in which oxytocin release can be activated demonstrates its important role in supporting and maintaining the bond between infant and mother.

This oxytocin-mediated bond is not just a “survival-bond”, i.e. a hormonal bond that ensures the infant is fed and warm. The oxytocin release also ensures that the mother develops an affectionate attachment with the child. Oxytocin is the first, fast route to establishing this affective bond, but it also induces changes in the mother’s brain that lead the mother to develop long-lasting changes in her behavior towards her child. Which brain regions are modified during this attachment formation process? Several, but the most notable for the purpose of this article is the amygdala, the hypothalamus, and the stria terminalis.

All these three regions connect with the dopaminergic reward system, and this is one of the major pathway systems in the brain that drive maternal motivation to not only take care of one’s child, but also to love them. In fact, when researchers administered exogenous (meaning providing oxytocin through external routes) oxytocin through a nasal spray to women without children, it led to reduced irritation and reduced amygdala activity when hearing an infant cry (Riem et al., 2016). This data indicates that oxytocin helps people feel less distressed by infant cries, and perhaps more likely to help the infant, in part by reducing the “fear response” generated by amygdala activity. Interestingly, women that were rated as having more insecure attachment styles benefitted more from the intranasal oxytocin injections. As we will talk about shortly, levels of oxytocin in a parent can partly predict an infant’s future attachments style (Figure 2).

When the mother looks at her new child: When a mother sees a picture of her own child (compared to another, similar looking child), it led to increased activation of similar brain regions that we know are important for emotion identification, regulation, and motivation (Gholampour et al., 2020). These results imply that a mother’s brain changes in ways that lead her to recognize and respond uniquely to her own child. An outstanding question is whether a similar “activation profile” develops in caregivers after they have adopted a child – my prediction is, yes. What we know less about, at the moment, is how the process of forming a caregiver-child attachment changes the anatomy of the brain. As mentioned earlier, we know that the gray matter volume changes after giving birth, and this likely has implications for



the anatomical structure of one or more brain regions. It may be that the synaptic connections between brain regions are changed (read more about synapses and plasticity in the [Intro to the Brain](#) document), which underlies the differences in the brain activity profile. More research is needed before we can speak on that with confidence.

When the infant looks at their mother: Studies on very young children (i.e. only a few days old) are usually limited to behavioral observation due to the adverse effects of for example drawing blood or putting them in a big machine to measure their brain activity. However, more studies have been done on infants that are a few months old. At this timepoint, the child is usually reciprocating the caregiver's social behavior, for example by smiling, keeping eye contact, and arm reaching. At this age, researchers have found elevated oxytocin levels in infants in response to social cues from their mother (Feldman et al., 2013), a phenomenon that was first observed in animal studies (Nagasawa et al., 2012). From other research publications, we know the oxytocin release elicited in the mother-child dyad predicts a child's attachment style and behavior later in life (Kohlhoff et al., 2021; Kroll et al., 2019a,b; Feldman et al., 2013). From this data, we can infer that the oxytocin response has important implications for a child's brain development, but exactly how and when these effects occur are not yet clear. It is likely that the mother-child elicited oxytocin response plays a particularly important role during "critical periods" – a period of brain development we will talk more about in future newsletters, but you can get a peek into it [here](#).

One study found that, just like mothers display a unique brain response to their own children, older children (age 11) also demonstrate a unique brain activity profile when seeing pictures of their own mother compared to other similar looking adults (Pratt et al., 2018). Does this unique brain response to your parent persist throughout life? Does it change if the parent becomes abusive towards the child later in life? These questions cannot yet be answered by science, but based on personal experiences my qualified guess is that this unique brain activity profile deteriorates if the quality of the attachment is compromised. I would also go so far to guess that the brain activity profile can be reestablished later in life with the same or a different caregiver.

How important is it that a child displays oxytocin responses and unique brain activity patterns towards their caregiver? Research suggests it might be imperative for how they develop relationships later in life. As we will discuss shortly, the



mother's oxytocin response predicts the attachment quality with the child (Feldman et al. 2013) and the child's attachment style (Kohlhoff et al., 2021). Interestingly, and perhaps not so surprisingly, the quality of the child's friendships later in life correlate with the child's and mother's oxytocin levels as well as the social reciprocity in the mother-child dyad (social reciprocity refers to when people reliably respond to each other's non-/verbal cues) (Feldman et al., 2013).

In summary, attachments between mothers and children likely start forming already before birth. Upon birth, oxytocin plays a major role in facilitating the attachment bond between mother and child, likely by triggering major changes in brain anatomy and activity in the mother. This biological basis of attachment is also seen in the child at the level of their oxytocin responses as well as their brain activity. Biologically, there is also a correlation between the mother-child attachment and the child's friendships later in life. In all, this research implies that **attachments have a strong biological basis** and that they **play a significant role in shaping the child's social skills later in life.**

The factors influencing the quality of the attachment formations

We know that the attachment style a child develops is in large part a consequence of how the caregiver interacts with the infant. But what determines how the caregiver treats the child? Last month we talked about the [intergenerational cycles of attachment styles](#) – **how is that manifested biologically?** That's what we will address now. Check out Figure 2 for a quick overview of the factors that can influence both the caregiver and the child in the process of attachment formation.

A general take away is that each of the factors we discuss below modify the oxytocin profile of either the child or parent (or, in some cases, both). Basically, if a behavior, event, or gene changes oxytocin activity, it most likely also influences attachment formation between caregiver and child.



Keep in mind when reading this, that all this research speaks about averages and general trends (that sometimes are significant, meaning likely to be meaningful and trustworthy for the general public). However, there are always outliers. If you find yourself in a category that predicts you would have challenges with establishing attachments with a child, be aware that you can change – maybe you already did. Your past does not have to dictate your present or future. If you have any thoughts or concerns about this, I would highly encourage you to speak to a therapist (or other form of advisor), or contact me and we can discuss the best steps for you moving forward.

The factors influencing the mother's oxytocin response and thus attachment formation process with the infant:

1. The mother's attachment style predicts her oxytocin response when interacting with her infant. Mothers with secure attachment styles displayed higher oxytocin response after interacting with their infant compared to mothers with insecure attachments (Strathearn et al., 2009). This “maternal” oxytocin response has important implications for how the mother emotionally interacts with her child. If the mother has a low, or even average, maternal oxytocin response to her infant, she will be more likely to avert the gaze of her distressed infant (Kim et al., 2014). In contrast, a high maternal oxytocin response leads the mother to look more at her distressed infant's face. This research is important because it uncovers some of the biological underpinnings of maternal engagement and responsiveness, which are important for forming the foundation of the infant's socio-emotional skills.

2. The mother's temperament also correlates with her oxytocin response towards the infant. Two temperament measures were most highly correlated with a mother's oxytocin response: orienting sensitivity and effortful control (Strathearn et al., 2012). Effortful control refers to one's tendency to plan and maintain focus on executing these. Effortful control was negatively correlated with the mother's oxytocin response implying that mothers that focus more on their performance and what they need to get done, are less sensitive to the infant's cues, ultimately resulting in lower maternal oxytocin release. Orienting sensitivity is the complete opposite: instead of focusing on what needs to get done, orienting sensitivity refers to a mother's responsiveness to the infant's verbal and non-verbal cues, as well as their own internal cues (I think it is interesting to consider the role of [self-awareness](#) in this perspective as well). If a mother had higher scores on orienting sensitivity,



then she was more likely to elicit a large oxytocin response when interacting with her infant. Obviously, making and executing plans is essential when taking care of a child. The main take-away from this study is that mothers that tend to focus more on the child and less on how the day is planned, may be better equipped at building stronger attachments.

3. The mother's genetic profile correlates with her oxytocin levels (measured in the blood) (Feldman et al., 2012; Feldman et al., 2013). Likewise, certain genetic variants within the oxytocin receptor gene as well as in another gene called CD38, which is known to regulate oxytocin release, correlate with differences in parental behavior, such as how much they touch their infant and whether they synchronize their attention (which means that the parent and infant pay attention to each other and what they are each looking at) (Feldman et al., 2012). In sum, this means that genetic differences may, in part, determine a parent's oxytocin levels and thereby the social interactions with their infants. An interesting, and very important, aspect of these results is that the effect of oxytocin levels and parental touch and synchronized attention towards the infant is bidirectional: parents with higher oxytocin interact more with their infant, but at the same time, parent-child interactions trigger increased oxytocin levels in the parent. This could lead to a positive cycle of reinforcement for the parent to continue to engage with their infant. An interesting, but unanswered, question is whether social interactions between parent and infant can lead to epigenetic changes in the parent's oxytocin gene that may buffer for genetic variants that normally would reduce a parent's interaction with their infant. This is particularly relevant in the context of evidence-based therapy strategies that help mothers create secure attachments with their infants (read about this interesting topic in [this recent newsletter!](#)).

4. If a mother is stressed it can reduce her interactions with her child. Cortisol, the major stress hormone in the body, likely inhibits the normally anxiety-relieving effects of oxytocin (Walter et al., 2021). Thus, a parent's stress levels can modify their oxytocin response to their child ultimately causing reduced interactions and consequently impair their attachment.

Combined, these four factors enable researcher to predict a parent's oxytocin response when they interact with their child. This is important because



- The parent's oxytocin response will affect **how they interact with their child** which will influence the attachment style the child forms (more on that below!)
- The more we know about how oxytocin is associated with parent-child behavior, the better we can **develop strategies to improve the relationship and long-term mental health** for both children and parents

Factors that influence the attachment between mother and child

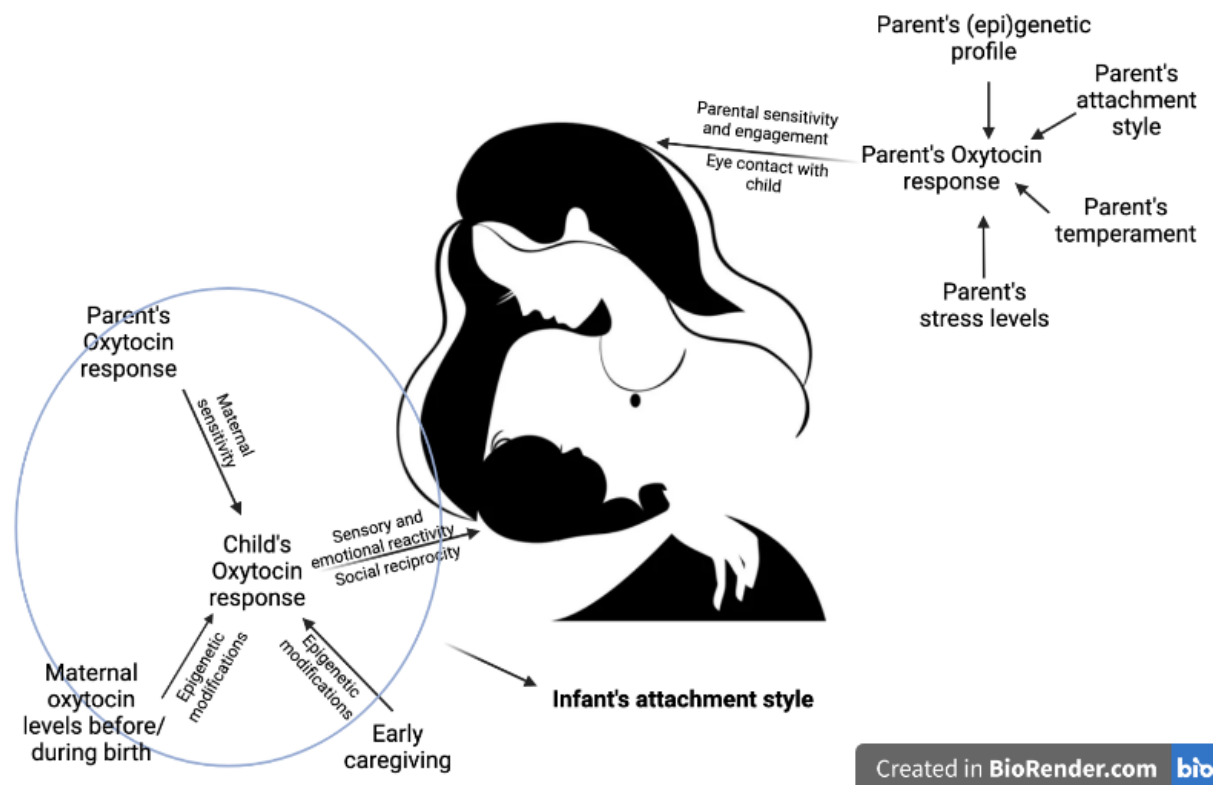


Figure 2: The figure summarizes the different factors that influence the attachment formation between a mother and child.

Top right corner: a parent's genetic profile, their own attachment style, their temperament, and stress levels all influence how they interact with their infant. Researchers have found that these factors modify the mother's sensitivity and engagement with their child as well as their likelihood of maintaining eye contact with a distressed infant.

Bottom left corner: the mother's oxytocin levels before and during birth as well as the mother's oxytocin response to their infant during interactions can modify the infant's own oxytocin levels and response. Likewise, the early caregiving experiences of a child can lead to epigenetic changes that alter their oxytocin profile. Ultimately, these factors influence the infant's social reciprocity and



friendships later in life, as well their emotional and sensory reactivity. All these factors also shape the attachment style that the infant will develop.

Let's get to the second part of Figure 2.

What determines the child's oxytocin response and thus attachment formation?

1. I am certain you have heard it before: experiences in early life can shape your brain, body and, ultimately, who you become. One of the ways this 'molding' happens is in infancy where the **quality of maternal caregiving can lead to epigenetic changes in the oxytocin receptor gene** (Krol et al., 2019a). If an infant receives low quality care it will lead to a type of epigenetic modification called methylation, which shuts down the gene's activity. In other words, if an infant receives low levels of care, it leads to reduced oxytocin activity in the infant.

Importantly, studies have found that this effect is unidirectional: while a mother's caregiving can change the infant's oxytocin gene methylation status, the infant's behavior does not change the mother's oxytocin activity. This means that while the mother's behavior can have significant implications for the infant's development, the reverse is not true (Krol et al., 2019a).

How does that affect the infant? In many ways! One of the ways is that infants with greater methylation (and thus reduced oxytocin activity) display more brain reactivity, in a part of the brain called right inferior frontal cortex, in response to angry and fearful faces, and reduced brain activity (compared to infants with less methylation) when seeing happy faces (Krol et al., 2019b).

Another way in which an infant's behavior is affected by their methylation state is on their sensory responses to what happens in their environment (isn't that just fascinating?!) (Krol et al., 2019a). Infants with higher methylation displayed more negative facial (and presumably vocal) reactions to scratchy sounds, tight-fitting clothes, bright lights, and pungent odors. This result is important because enhanced negative reactions to these types of sensory experiences are associated with autism and ADHD (Salley et al., 2013). Does that mean that low quality caregiving during infancy could lead to autism or ADHD later in life? Potentially. But it also means that creating interventions to change a parent's engagement with and behavior towards



their infant can reduce reactivity to the environment (take a look at [this newsletter](#) on how therapists are doing just that).

2. Oxytocin receptor levels increase in women during pregnancy, which likely contributes to increased oxytocin activity during this period as a part of or priming towards bonding with their unborn infant (Kenkel et al., 2019). In contrast to the adult brain, the brain of a fetus has a permeable blood-brain barrier. This means that whatever is circulating in the blood of the pregnant woman, can enter the fetal brain and cause significant changes to its function and, obviously, development. In studies with rodents, injections of oxytocin during pregnancy led pups to display enhanced caregiving and become more sociable as adults. These behavioral effects were mediated by epigenetic changes in the pups' oxytocin receptor gene (just like early caregiving could change this gene!). Overall, this research implies that a **woman's oxytocin levels during pregnancy can have direct influences on the child's brain development and social interactions**. Indeed, a woman's oxytocin levels during pregnancy, particularly during the first trimester, correlate with the quality of the mother-child attachment bond after birth (Feldman et al., 2007; Levine et al., 2007), which we would expect also to increase the child's social skills later in life (see the next point for more on this). Clearly, this research begs the question of whether oxytocin administration to pregnant women at risk (for example mothers known to have insecure attachment styles and/or low oxytocin levels) could enhance their unborn child's life quality.

3. At this point, you are probably not surprised to hear that a **parent's oxytocin response influences the infant's oxytocin activity**. Many studies have identified a meaningful association between the oxytocin levels of the mother (but not the father) and the child at various stages of development (Kroll et al., 2019a,b; Feldman et al., 2013). What are the behavioral consequences of this correlation? As we discussed above, a mother's oxytocin levels modify how much she interacts with her infant physically (i.e. touch/caressing), cognitively (i.e. shared attention) and emotionally (i.e. keeping eye contact while the infant is in distress). Together with the quality of early care, a mother's oxytocin response predicts the oxytocin levels of their child as well as the child's social behavior and quality of friendships later in life (Feldman et al., 2013). In other words, a mother's oxytocin profile and caregiving predict which attachment style her child will form (Kohlhoff et al., 2021), and therefore also gives us insights into the mental health struggles the child may encounter later in life (read about those in the recent [Neuroscience Newsletter on attachment](#)).



As you can tell from the above discussion, oxytocin plays a critical role in attachment formation between caregiver and child.

I find it fascinating, and slightly disturbing, that the early life experiences of a parent can so directly influence their levels of engagement and sensitivity towards their child, to an extent that is powerful enough for researchers to predict what attachment style and oxytocin levels their child will develop. It's a powerful example of intergenerational transmission of caregiving, similar to what we talked about in the recent [Neuroscience Newsletter on intergenerational trauma](#). How is this transmission of caregiving possible? Oxytocin receptors are expressed in different brain regions, and the more receptors you have, the more oxytocin hormones can activate these. If you have either lower amounts of receptor expression or reduced levels of circulating oxytocin, it will ultimately lead to reduced activity of these brain regions.

If you grow up with reduced oxytocin receptor levels, perhaps due to enhanced epigenetic methylation, it will fundamentally change the way your brain is activated and therefore molded over the course of childhood. Perhaps in a way that changes how you later form relationships.

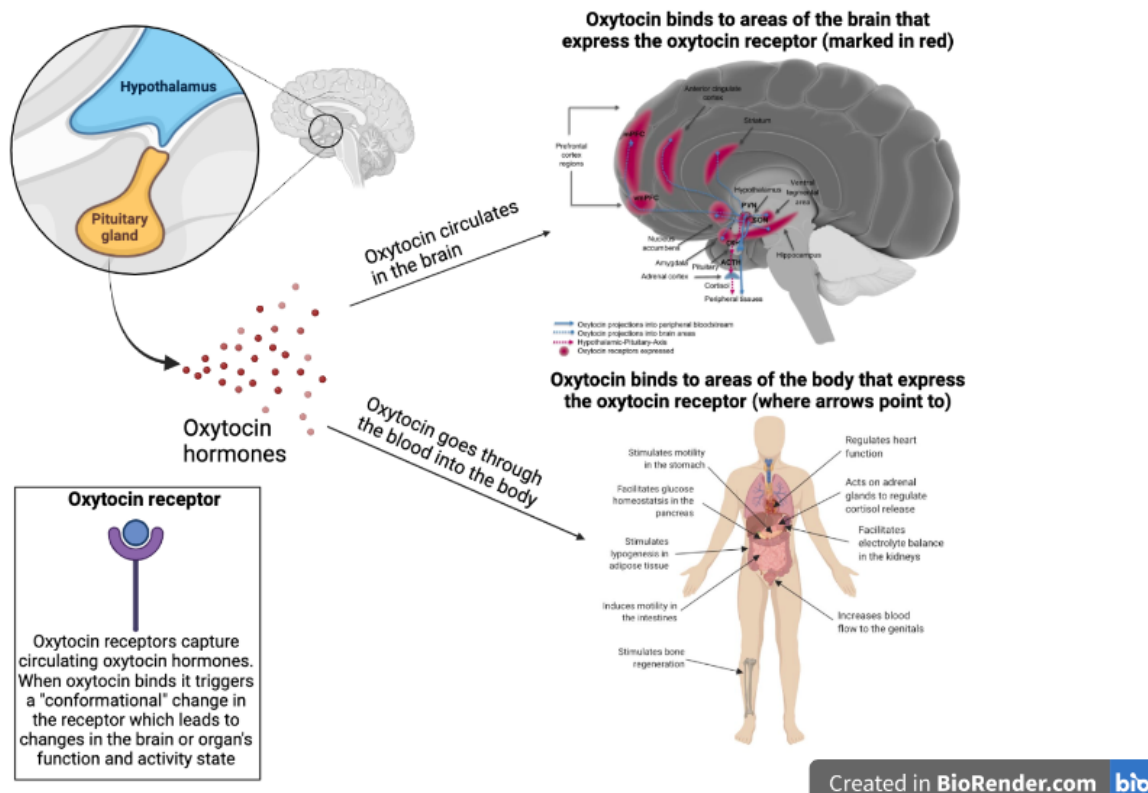


Figure 3: A simplified overview of how oxytocin is released from a region in the brain called the Pituitary gland, which leads to oxytocin circulation both in the “periphery” (meaning the body) and the “central nervous system” (meaning the brain and spinal cord). Oxytocin binds to the oxytocin receptor, which we know can be modified by epigenetic mechanisms, and leads to changes in the activity and functional state of the brain region or organ in which it is expressed.

Click [here](#) to access the source of the picture with the brain and its oxytocin receptor expression.

We will all be okay

So here we are. You had a bad upbringing, and you suspect your parents’ oxytocin levels were on the low side. Are you a lost cause? Is your current or future child a lost cause? No! Researchers have not only revealed how early caregiving and parental oxytocin can affect a child, for better or worse, they have also demonstrated the **fantastic ability of infants to change**. We have previously talked about this in the context of brain plasticity, and this extends also to hormones such as oxytocin. Compared to mothers, **infant oxytocin levels and responses (to maternal stimuli) are much more dynamic, meaning that they display more variability over time** (Krol et al., 2019a). This result signifies that infants may be



more sensitive to single events leading to fast changes in oxytocin levels, while a parent is less affected by experiences and express their “normal” oxytocin response regardless. This result is very reminiscent of what other scientists have referred to as **“critical periods”**: when the brain (and body) are more flexible and fluid in their responses. These periods occur during early development and in [adolescent](#) and form the foundation for the less flexible (yet still changeable) adult brain.

The main take away here is that infants and children are more capable of changing their oxytocin levels.

So, for example, if you did not receive good care in the early years of childhood but did later, **your oxytocin system likely reflects the “good years” more so than the bad ones.** I also write about this in [this newsletter](#) on how multiple factors can influence your attachment style as a child and an adult. This is of course no comfort if you grew up in a sub-par environment your entire childhood with no access to peer or school support. However...

... You should also keep in mind that oxytocin **is just one of the systems that are important for parental behavior and child development.** We already discussed the role of stress hormones in parent behavior with higher stress levels leading to reduced parent-child interactions (Walter et al., 2021). Groundbreaking research by a group at McGill University in the 90’s, reported how variations in caregiving by rat mothers (yes, not all rat mothers take care of their pups in equally good ways), led to epigenetic changes in the pups’ stress response system, which ultimately served as a “transmission” for bad (or good) parenting when they had their own pups (just like we saw with oxytocin!) (Szyf et al., 2005; Francis et al., 1999).

Remarkably, this research was later replicated in humans by monitoring the frequency of breast feeding as a proxy for maternal caregiving (Lester et al., 2018). Why breastfeeding and not play-time, eye-contact, facial mimicry? Most likely because breastfeeding is a much more objective metric, that is less likely to be influenced by researcher’s interpretation (for example, what constitutes play time?). Despite the obvious limitations of relying on breast feeding as a proxy for maternal caregiving, the researchers did find some very interesting results: the infants that received more breast feeding had lower levels of methylation of a specific gene associated with stress responses as well as reduced behavioral reactivity to a stressful situation (Lester et al., 2018). **Basically, the infants of mothers that**



breastfed a lot were less likely to be in a state of stress physiologically and behaviorally. Ultimately, when both infant and mother are less stressed, it will influence the quality of their attachment. In other words, like the groundbreaking rodent studies, human attachments are not just influenced by oxytocin but also other hormones and epigenetic changes.

Interestingly, **studies have found that oxytocin and cortisol levels are inversely related**, and that stressful experiences can be “buffered” by higher oxytocin levels (McQuaid et al., 2016; Corbett et al., 2016). Along those lines, oxytocin may play a role in a person’s resilience to stressful situations (Takayanagi and Onaka, 2021).

If you want some ideas on tangible ways to improve your ability to form attachments, check out [this newsletter](#) which touches on evidence-based approaches on this topic.

What’s next?

In this newsletter I honed in on the biological process of forming an attachment between caregiver and child. As you have probably noticed, I almost exclusively refer to cis-gendered mothers. Unfortunately, that is a legacy of the current research which we have yet to overcome. Some work has studied attachment formation in cis-gendered men, but typically this work is done in heterosexual couples or widows thus precluding any conclusions about attachment formation between caregiver and child in cis-gendered homosexual couples. And what about people that are not cis-gendered or do not identify with any of the categories created for sexual or gender orientation? We know very little, and certainly not enough to draw any scientifically valid conclusions. However, the activity of the “attached” brain is awfully alike the brain that is “in love”. We will be talking a lot more about that in this month’s Mental Health Newsletter on the neuroscience of romantic relationships (if you are interested in learning more about this but you are still on the Lone Wolf Plan, I’d encourage you to sign up for the Continued Education Plan instead).

However, the point I want to make is this:

if you can be in love – which is ubiquitous to all people regardless of gender or sexual orientation (or ethnicity



for that matter) – then you can form attachments with children too.

Right now, we only have research demonstrating this link between the attached and in love brain in cis-gendered mothers, but my prediction is that we will see similar results in other gender and sexual groups when researchers get their act together and start studying all of the human beings present in this world.

I am also excited to announce the release of a new Newsletter: The Cheater (yes, I like giving my plans elusive yet entertaining names).

This newsletter will be a *monthly book review*, supplemented with *additional points and research*, on the intersection of mental health, neuroscience, and psychology. One of the books that are soon to be reviewed is [“The Mother Brain” by Chelsea Conaby](#). In this book, she interrogates the past and present science on the brain of mothers, and addresses the historical, political, and cultural expectations and understanding of being a mother. I am absolutely thrilled to be releasing this newsletter option, and I hope you will join me in the process of diving into all these books!



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