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The Maternal Brain: Neuroscience of Matrescence

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Introduction

Understanding maternal wellbeing today requires a progressive, integrated approach that draws on insights from multiple fields of modern science. Fundamental to this exploration are the concepts of matrescence, the profound journey a woman undertakes as she becomes a mother, and the mother–baby dyad, which highlights how mother and infant are deeply linked–biologically, emotionally, and developmentally. Recent research on psilocybin, a compound known for its impact on neuroplasticity and psychological processing, suggests that it may offer therapeutic potential (benefits?) for addressing the unique mental health challenges new mothers experience. To integrate these emerging insights, this thesis introduces the novel MINDS framework, Matrescent Integration via Neuroplasticity, Dyads, and Psilocybin. The MINDS framework proposes that interventions that target neuroplasticity and prioritize the mother-baby dyad may improve women's psychological adaptation to motherhood and thereby strengthen dyadic co-regulation and the quality of the mother-baby dyad. By uniting the pillars of matrescent integration, postpartum neurobiology, and the mother–infant relationship, MINDS envisions a new paradigm for maternal health care that simultaneously supports mothers' matrescent adaptation and their infants' early developmental wellbeing.

The transition into motherhood is not merely a biological event, but a psycho-spiritual initiation—a developmental passage marked by profound vulnerability, physiological adaptability, and individual transformation. This period, termed matrescence, is characterized by dramatic neurological, hormonal, and identity recalibration (Athan, 2024; Raphael, 1975). Since the concept of matrescence emerged it has been recognized across both anthropology and developmental psychology as a universal phenomenon; it transcends biological changes to encompass deep relational, emotional, social, and even cultural transformation (Athan, 2024; O'Reilly, 2010; Stern & Bruschweiler-Stern, 1998).

One of the most significant aspects of the postpartum period is that it establishes the foundation of the mother-baby dyad—a biologically interdependent and co-regulating relational system (MacMillan et al., 2020). During this time the mother's voice, gaze, scent, and emotional presence scaffold the infant's neurodevelopment, sense of safety, and capacity for emotional regulation (Jessen, 2020; MacLean, P. C. 2014; Endevelt-Shapira & Feldman, 2023). Simultaneously, the infant's behavior and cues modulate the mother's endocrine system, neural activity, and emotional state (Swain et al., 2007).

Successful matrescence is central to the well-being of the mother-baby dyad. Disruptions to this delicate system, due to birth trauma, hormonal or endocrine dysregulation, lack of support, or systemic neglect, can have enduring impacts on both mother and child (Erickson et al., 2019). Despite the critical importance of the mother-baby dyad—and its far-reaching implications for healthy individuals, resilient families, and a flourishing society—this relationship is often undervalued or completely ignored in the prevailing western medical and cultural models. The current biomedical model, developed from pathology-focused, rather than salutogenic, care, prioritizes isolated symptom identification and pharmacologic interventions over holistic or relational health strategies (Wade & Halligan, 2017). This paradigm persists despite the success of dyadic interventions (Clark et al., 2008; Forman et al., 2007; McAdow 2025; Paris et al., 2011). Epidemiological studies indicate that care systems which fail to center the mother-baby dyad—whether through early separation, lack of support for bonding, or neglecting interdependent relationship— result in poor mother and infant outcomes; consequences include higher rates of postpartum depression, diminished early attachment, and the risk of long term behavioral issues (Rusanen, E., et al. 2022; Kasamatsu 2019; Śliwerski 2020). The separation of mothers and infants across the health system and services operates to the detriment of the mother-baby dyad. This fragmented approach overlooks promising health strategies and perpetuates disparities for marginalized and socioeconomically deprived mother-infant pairs (Crear-Perry et al., 2021; McAdow 2025).

The emphasis on diagnosing and treating conditions in isolation obscures the relational and developmental context in which maternal and infant health unfold. Far too often, these models ignore the fact that wellbeing within the mother-baby dyad is inherently shared, reciprocal, and sustained though ongoing co-regulating processes. By treating mothers and babies as separate units with isolated symptoms, clinicians and health systems approach treatment plans with an incomplete picture of postpartum health and its underlying relational dynamics (MacMillan et al., 2020; Erickson et al., 2019). For instance, standard clinical guidelines have relied on individual symptom management in mothers and explicitly overlooked the influence of infant cues and relational context. The American College of Obstetricians and Gynecologists' most recent Clinical Practice Guideline still does not address the importance of dyadic screening in the risk assessment for conditions like postpartum depression, anxiety, psychosis or suicidality, nor does it recommend integrated support for both mother and infant (ACOG, 2023). Studies have shown that interventions focused solely on postpartum symptom reduction and management, rather than relational synchrony and bonding, are insufficient for protecting infant neurodevelopment or preventing impaired maternal-infant attachment (Forman 2007; Murray 2003; Clark et al., 2021).

Neglecting the connection between mother and child holds consequences that extend across a variety of interdependent domains: it impacts attachment security, cognitive and emotional resilience, family dynamics, societal structures, healthcare systems, and the broader community landscape. For mothers, it elevates risk for postpartum anxiety, depression, impaired bonding, and diminished self-efficacy in the maternal role (Slomian et al., 2019; Qi, W 2025). The prevalence of postpartum depression ranges from 10–20% globally, with rates up to 1 in 7 women in high-income countries and as high as 1 in 5 in some populations (Carlson, 2025; Hahn-Holbrook 2018; WHO, 2026; Van Niel & Payne, 2020). The most recent studies on postpartum anxiety estimate it affects 12-15% of childbearing women globally, while location specific studies have found incident rates up to 40% (Díaz Ogallar et al., 2025; Feldman et al., 2025; Umuziga et al., 2020). Both conditions are associated with comorbid impaired bonding which compounds the lifelong risks for both mother and child (O'Dea et al., 2023; Rogers et al., 2020).

For infants, the quality of the maternal-infant relationship shapes neurodevelopment, stress regulation, and the architecture of the developing brain (Barba-Müller et al., 2018; Endevelt-Shapira & Feldman, 2023). It sets the foundation for learning, mental health, and capacity for resilience across the lifespan. In recent studies, impaired mother-infant bonding was detected at rates between 3–11% in community samples and as high as 57.1% among mothers with a psychiatric diagnosis or postpartum mood disorder (Junge-Hoffmeister 2022; Şenyaşar Meterelliyoz et al., 2025). Insufficient bonding at 10 months is linked to an increase of asocial behaviors in children by age five, particularly among boys (Kawasaki et al., 2025). Poor maternal mental health is associated with impaired child nutrition, growth, and developmental outcomes (Rahman et al., 2004).

Fortunately, emerging interventions increasingly recognize the importance of protected time and space for maternal adjustment. Studies that track maternal mental health and parenting across generations indicate that supportive mothering in one generation reduces risk for developmental, emotional, and behavioral problems in the next generation (Coe et al., 2020). Likewise, interventions that explicitly support the mother–infant bond—from inpatient mother–baby units to traditional postpartum practices such as "doing-the-month" and Kangaroo Care—are associated with improved mother baby bonding and psychological benefits (Dennis et al., 2007; Gillham & Wittkowski, 2015; Pathak et al., 2023). These findings suggest that interventions are most effective when they prioritize protected space and time where the mother can reorganize her identity and expand her capacity for attuned caregiving; domains that psilocybin appears to modulate through its effects on neuroplasticity.

Psilocybin, the psychoactive compound found in certain mushrooms, has been steadily gaining attention for its capacity to influence the brain's ability to reorganize and form new neural connections (Vargas et al., 2023). Within neuroscience and psychiatry, it has become a candidate treatment for mood and stress-related disorders (Carhart-Harris et al., 2016; Vollenweider & Kometer, 2010). Acting primarily as a serotonin 2A receptor agonist, psilocybin enhances synaptic flexibility and connectivity across brain networks implicated in emotional regulation, self-referential processing, and cognitive control (Carhart-Harris et al., 2017; Vollenweider & Kometer, 2010).

Psilocybin has been shown to promote rapid and robust increases in neuroplasticity (Ly et al., 2018), facilitate adaptive emotional processing (Carhart-Harris et al., 2016), and support meaningful shifts in identity (Carhart-Harris & Goodwin, 2017; Lyons & Carhart-Harris, 2018). In clinical trials that enrolled adults with depression and anxiety, psilocybin led to sustained reductions in depressive and anxious symptoms (Griffiths et al., 2016), along with gains in psychological flexibility, perceived social connectedness, and adaptive changes in personality and outlook—qualities that are highly relevant for parenting and nurturing (Carhart-Harris & Goodwin, 2017; Lyons & Carhart-Harris, 2018). Preliminary research suggests that psilocybin may enhance prosocial emotionality and interpersonal bonding (Bhatt & Weissman, 2024; Mason et al., 2019; Pokorny et al., 2017), processes that overlap conceptually with oxytocin-mediated systems described in attachment research (Feldman, 2017).

These affiliative mechanisms parallel the processes that synchronize interactions between mothers and their infants, including dyadic synchrony and co-regulation (Endevelt-Shapira & Feldman, 2023; Feldman, 2017). It also reliably disrupts the default mode network (DMN), a large-scale brain network involved in self-referential thinking and habitual narratives about the self (Siegel et al., 2024). This can loosen rigid patterns of internal mentation that often underlie depressive and anxious states (Carhart-Harris et al. 2016; Carhart-Harris & Goodwin, 2017; Vollenweider & Kometer, 2010).

The combined effects of psilocybin, increased neuroplasticity, DMN suppression, increased psychological flexibility (Carhart-Harris et al., 2016; Carhart-Harris & Goodwin, 2017; Ly et al., 2018; Vargas et al., 2023), and prosocial emotionality (Bhatt & Weissman, 2024; Mason et al., 2019; Pokorny et al., 2017), align closely with the neurobiological and psychological basis of the matrescent transition and with the foundational requirements for a healthy mother-baby dyad. Importantly for postpartum adaptation, psilocybin stimulates molecular and cellular pathways involved in synaptic remodeling, dendritic growth, and plasticity in the mPFC and hippocampus—regions already undergoing rapid change during matrescence (Catlow et al., 2013; Ly et al., 2018; Vargas et al., 2023; Barba-Müller et al., 2018). These pharmacologically-induced surges in neuroplasticity may support the necessary changes for flexible emotional adaptation, maternal identity integration, and reprioritizing the infant relationship, all of which help to facilitate a healthy transition into motherhood.

The current renaissance of psychedelic research has primarily focused on conditions like treatment-resistant depression, anxiety disorders, post-traumatic stress disorder (PTSD), and substance use disorders (Carhart-Harris et al., 2017). Although the scope of use-case scenarios continues to broaden, maternal mental health and the postpartum period, particularly the nuanced implications for the mother-infant dyad, remain largely unexamined (Jairaj & Rucker, 2022). Despite a growing body of research demonstrating the safety of psychedelics, particularly psilocybin, postpartum women remain under the classification of “vulnerable population” by human subjects protections, and are, therefore, systematically excluded from these studies (Dinis-Oliveira, 2017; Freitas et al., 2024; Marchi et al., 2024).

Specifically, mother-infant bonding, maternal competence, and postnatal identity transformation are rarely measured outcomes in psychedelic research. These regulatory limitations result in a lack of data to address safety, efficacy, and the unique therapeutic needs of mothers during the post-reproductive period, as well as a persistent gap between the fields of maternal-infant health research and psychedelic research. This on-going exclusion serves to maintain a critical gap in knowledge—despite sustained advocacy for more equitable research and growing awareness of unmet needs in maternal mental health (Fitzgerald et al., 2024; Jairaj & Rucker, 2022; McNab et al., 2022; Nutt et al., 2023). As a result, a population that may uniquely benefit from psychedelic care remains largely invisible to the research infrastructure and decision-makers responsible for advancing maternal healthcare.

This theoretic synthesis posits that psilocybin, when used postpartum, may contribute to matrescent integration and the development of a secure, bonded mother-baby dyad. Matrescent Integration via Neuroplasticity, Dyads, and Psilocybin, MINDS, focuses on the mechanisms by which psilocybin modulates key neurobiological and psychological mechanisms that increase neuroplasticity, suppress maladaptive self-referential processing in the DMN, and engage oxytocin-mediated systems supporting caregiving and attachment. These mechanisms collectively support postpartum identity integration, maternal intuition, strengthen the quality of the mother-infant relationship, and reduce postpartum anxiety and depression, indicating that psilocybin may play a positive role in supporting the psychological and neurobiological processes that underlie healthy postpartum adaptation. This theory exists at the intersection of multiple disciplines, including neuroscience, developmental psychology, and women's health. The interdisciplinary MINDS framework—which integrates neurobiological mechanisms, psychological theories of identity transformation, and anthropological insights into matrescence—provides a robust and necessary foundation for future investigation and clinical innovation.

Matrescence: The Developmental Window

During the postpartum period—a liminal phase often defined narrowly in medical literature, as 4-6 weeks post-delivery—mothers undergo a transformation that is foundational to the health and wellbeing of themselves and their infants. This profound shift, known as matrescence, was first coined by anthropologist Dana Raphael in 1973 (Raphael, 1973). Influenced by her work on cross-cultural patterns of motherhood and infant feeding, Raphael described motherhood as a significant social, cultural, biological, and political rite of passage, arguing that "the critical transition period which has been missed is matrescence, the time of mother-becoming" (Raphael, 1973). She articulated that simply giving birth does not take a woman from maiden to mother; there are additional, essential components to this transformation. Far more than biological reproduction, it encompasses neurological and hormonal recalibration, disintegration and reassembly of identity, and emotional and spiritual reorientation (Athan, 2024; Orchard et al., 2023; Raphael, 1973).

Matresence entails a constellation of experiential and identity-level facets, like altered perception and emotionality, shifts in intuition, and reconfigurations of self and world, that together allow her to integrate a new identity and form a secure bond with her infant (Athan, 2024; Stern, 1995). Comparable to adolescence in its complexity and scope, this developmental stage is initiated by the hormonal changes that occur during pregnancy and childbirth (Athan, 2024; Carmona et al., 2019; Orchard et al., 2023). However, biology alone does not determine the trajectory of matrescence: environmental and psychosocial inputs shape the journey at every stage (Athan, 2024; Bronfenbrenner, 1996; Mercer, 1985).

The concept of matrescence as a complex developmental phase is supported by a range of psychological and social theories on maternal role and identity. Notably, Ramona Mercer's Maternal Role Attainment Theory describes a process model by which women acquire competence and confidence in mothering through four dynamic stages: anticipatory (preparation during pregnancy), formal (adopting prescribed social roles immediately after birth), informal (developing a unique maternal style), and personal (internalizing and integrating the maternal identity as one's own) (Mercer, 1985). Mercer's theory emphasizes three central factors for successful maternal role attainment: adaptation, identity, and support. She also notes that while some women experience rapid and harmonious adjustment, others may struggle with prolonged, disrupted, or stalled transitions, particularly in the face of perinatal adversity. Additionally, many women revisit matrescent milestones and challenges with each subsequent child, which underscores the individualized and dynamic nature of matrescence and highlights that the process of matrescent development is rarely linear (Mercer, 1985).

Erik Erikson's theory of psychosocial development offers a framework for further understanding matrescence as a developmental stage in adulthood. According to Erikson, the seventh stage—generativity versus stagnation—typically encompasses the period of middle adulthood, when individuals are most concerned with "establishing and guiding the next generation" (Erikson, 1950). Parenthood, especially the experience of motherhood, constitutes a primary context for the resolution of this developmental crisis, with successful adaptation resulting in the virtue of "care." Erikson, too, conceptualizes that the psychosocial stages are not strictly age-bound, but can be revisited or reactivated in response to critical life events, environmental or psychosocial, that demand identity renegotiation.

Urie Bronfenbrenner's Ecological Systems Theory, meanwhile, situates the mother's adaptation within a nested web of family, cultural, policy, and societal influences to demonstrate how outer contexts shape inner transformation. This theory provides a model by which to understand matrescence as an interconnected, context-dependent developmental process. According to Bronfenbrenner, human development unfolds within layered environmental systems that range from the immediate microsystem of the mother-baby dyad to broader influences such as family, community, culture, and policy (Bronfenbrenner, 1979). This model highlights how a mother's growth and adaptation are shaped not only by their individual traits or immediate relationships, but also by the networks of support, cultural expectations, and resources available, or absent, in their environments. Integrating the Ecological Systems Theory with our understanding of matrescence thus reinforces the view that matrescence is not solely an internal or individual transformation, but a biosocial, context-sensitive transition. It demonstrates that mothers' challenges and growth must be understood, and interventions designed, at multiple interconnected levels, acknowledging the dynamic interplay between biology, individual agency, close relationships, community, and culture.

The multi-layered process of matrescence is marked by changes in physiology, psychology, identity, social roles, and spiritual sense of self, alongside hormonal and neuro-structural changes (Athan, 2024; Carmona et al., 2019; Orchard et al., 2023). Recognizing matrescence as a developmental stage shifts the conversation from whether maternal changes occur to what is at stake when they are ignored. When matrescence is treated on par with adolescence, challenging maternal experiences can be reframed as features of a normative, hormonally primed, neuroplastic transition that requires guidance and support, rather than interpreting the challenges as evidence that an individual woman has failed to cope. From this standpoint, forgetfulness, mood changes, and identity confusion are not trivial complaints or isolated symptoms, but expressions of a structured transformation with identifiable tasks and adaptive gains. This interpretation of, and appreciation for, matrescence holds promise for improving quality of life for women and babies. Lifespan and cognitive research underscore the depth of these stakes, finding that the maternal transition affects neural and cognitive adaptations that can reverberate across decades (Carmona et al. 2019; Martínez-García et al. 2021; Orchard et al. 2023).

In this view, matrescence is not a brief postpartum state, but a developmental inflection point through which maternal experiences scaffold enduring cognitive and socioemotional benefits—or, in contexts of chronic stress and neglect, entrench vulnerability.

Building on psychological development theories, contemporary neuroscience research further conceptualizes matrescence as a distinct developmental period (Athan 2024; Carmona et al. 2019; Orchard et al., 2023). Advances in neuroimaging have revealed that the maternal brain undergoes changes strikingly similar to those seen during adolescence (Carmona et al., 2019; Orchard et al., 2023; Pawluski et al., 2022). Both matrescence and adolescence are hormonally primed transitions marked by profound neuroplastic adaptation, whereby the brain is reshaped to meet the demands of new social roles and environments (Carmona et al., 2019; Orchard et al., 2023; Pawluski et al., 2022).

A landmark comparative neuroimaging study by Carmona and colleagues demonstrated that first-time mothers experience rates of volumetric reductions in grey matter which mirror the pace of neural remodeling observed in adolescent girls (Carmona et al., 2019). Notably, decreased measures of cortical thickness, surface area, gyrification, and sulcal depth, as well as increased sulcal width, changes thought to reflect an adaptive “fine-tuning” process, occur in both groups over compressed periods of development. The authors found that these neuroanatomical changes are functionally analogous: both pregnancy and adolescence trigger a cascade of biological adaptations that reorganize the brain for emerging social and cognitive demands (Carmona et al., 2019).

This direct neurobiological parallel supports the idea that matrescence, like adolescence, constitutes a developmental stage in its own right. Both periods involve the pruning and sculpting of neural circuits, as well as increases in myelination and reorganization of regions implicated in socioaffective and higher-order cognition (Carmona et al., 2019; Martínez-García et al., 2021). For mothers, these changes have the potential to increase capacity for intuitive caregiving, relational adaptation, and identity formation. In both cases, experience-dependent plasticity heightens sensitivity to environmental inputs and affirms that outcomes depend on the quality of social support, cultural context, and stress exposures during the developmental window (Carmona et al., 2019; Orchard et al., 2023; Pawluski et al., 2022; Stern, 1995).

Clinical psychologist Aurélie Athan also argues that matrescence is best understood as a normative, critical stage of adult development—distinct from, but as significant as, adolescence or menopause (Athan, 2024). Her comprehensive “bio-psycho-social-and-beyond” perspective demonstrates why this pivotal developmental window requires a significant reframing. When women struggle with the rapid and lasting changes in brain function and structure, hormonal patterns, identity, and relational capacity, the symptoms are often viewed as a clinical problem or mental pathology in need of prescription. The phrase "baby brain” (or “mom brain”) has long been used to describe alleged cognitive deficits, scatterbrained moments, and forgetfulness experienced by women during pregnancy and the postpartum period (Pownall, 2019). The clinical view of the evolving maternal mind as “baby brain” is reductionist and diminishing to one of the most profound changes a human being can experience.

This stereotype—pervasive both in casual conversation and clinical encounters—frames maternal neurocognitive changes as inherently negative and pathologizes and infantilizes the postpartum mind as diminished or impaired. In fact, the opposite is true: it is a time of enhancement and expansion; an embodiment of possibility. As the maternal brain undergoes the dynamic pattern of neuroplastic remodeling, it facilitates, rather than impedes, adaptation to life as a mother (Logan et al., 2014). Most new mothers report some subjective memory loss or lapses in attention, a phenomenon often interpreted as evidence of "baby brain" (Orchard et al., 2021; Pownall, 2019). However, rigorous objective studies, including both neuropsychological assessments and neuroimaging, have repeatedly failed to find reliable deficits in core cognitive domains among postpartum women compared to non-mother controls, especially beyond the early postpartum weeks (Logan et al., 2014; Orchard et al., 2021).

The "baby brain" stereotype is not only unfounded but also stigmatizing and may contribute to the trivialization of maternal concerns in both healthcare and broader culture. Animal and human studies suggest that maternal brain plasticity supports eventual improvements in social learning, memory, emotional intelligence, and stress resilience (Orchard et al., 2023; Pawluski et al., 2022). In other words, while motherhood may impose new cognitive challenges, it ultimately facilitates adaptive gains essential for matrescent development and infant wellbeing (Orchard et al., 2023). It may even contribute to life-long cognitive improvements. Thus, biomedical paradigms that focus solely on detecting and pathologizing cognitive "deficits" miss the adaptive sophistication of matrescent transformation.

Despite the clarity and prescience of their insights, contributions from Rafael to Athan to Orchard have been set aside in favor of more "quantifiable" endpoints, such as rates of postpartum depression or infant outcomes. In a medical model that prioritizes symptom scales, prevalence rates, and screening adherence metrics- frameworks that focus on identity, meaning, relationality, and lifespan development are harder to operationalize, and therefore less fundable and less publishable. The societal and institutional penchant for medicalizing birth and the postpartum experience sabotages maternal identity integration, leaves women to suffer in isolation, and fails the mother-baby dyad. If only women experienced adolescence, would it still be universally recognized as an "awkward" phase of adjustment or would it, too, be pathologized?

From successful matrescent integration emerges a confident maternal identity, a sense of trust in her intuition, and deep bonding within the mother-baby dyad (Mercer, 1985; Stern, 1995; Bonacquisti et al., 2024; Trinko et al., 2025). Drawing on clinical work, psychiatrist Daniel Stern conceptualized matrescence as a period of identity reorganization, during which women develop a new maternal identity that coexists with, yet transforms, their pre-maternal sense of self (Stern, 1995). Mothers who achieve this integration display flexible problem-solving, low anxiety and depressive symptoms, and greater emotional wellbeing as indicators of successful maternal identity and positive adaptation (Bonacquisti et al., 2024; Trinko et al., 2025). Current research provides substance to earlier intuitive theories that matrescence is a process that unfolds over time. As Raphael observed, “the amount of time it takes to become a mother needs study.” It is possible that with empirical and theoretical attention, matrescence may come to be understood as a cornerstone for collective flourishing.

Biological Foundations of Matrescence

Pregnancy and the postpartum period are marked by significant neuroendocrine changes that result in structural and connectivity adaptations. Understanding this biological reconfiguration is essential because it directly shapes the felt experience of motherhood, vulnerability to mental disruptions, and health of the mother baby dyad. From hormonal messengers that recalibrate emotional circuits, to large-scale brain networks that reorganize attention and identity, this chapter traces the specific adaptations that underlie matrescence—and maps their implications for maternal mental health and the mother-baby dyad.

The biological roadmap begins with the neurochemical landscape—tracking how five key hormones (estrogen, progesterone, oxytocin, cortisol, and serotonin) fluctuate and recalibrate to prime the maternal brain. From there, it examines structural remodeling: gray matter changes that refine emotional processing, white matter shifts that enhance connectivity, and experience-dependent plasticity that sculpts circuits in response to infant interaction. Finally, it explores how these changes integrate across four major brain networks—the default mode network (identity formation), salience network (infant-focused attention), executive control network (caregiving planning), and reward network (motivation for bonding)—to collectively support the psychosocial transition of matrescence. Each biological shift plays a distinct yet interrelated role, and where adaptation falters, vulnerability to mental health disruption emerges.

Neurochemical Landscape: Hormonal Cascade

From the moment of conception, the levels and interactions of internal chemical messengers begin to shift. Hormones are purposefully and progressively recalibrated to sustain implantation, remodel maternal physiology to support a developing fetus, and prepare the body for parturition (Dukic et al., 2024; Russell et al., 2001). Beyond their reproductive functions, these hormonal sequences also reorganize to psychologically prime a woman's brain for the role of mother and lay the biological groundwork for the experiential features of matrescence:

heightened empathy, intensified response to infant cues, softened boundaries, and an inclination to reorganize self and relationships around the mother–infant dyad (Barba-Müller et al., 2018; Dukic et al., 2024; Russell et al., 2001). Each hormone plays a distinct yet interrelated role to facilitate maternal adaptation.

Estrogen and Progesterone: Initiating Maternal Adaptation

Steroid hormones estrogen and progesterone, with receptors expressed densely throughout limbic and hypothalamic circuits, rise during pregnancy and then drop precipitously following childbirth (Dukic et al., 2024; Kruijver et al., 2002; Russell et al., 2001). Estradiol, the most biologically active estrogen, facilitates core reproductive functions such as uterine growth and placental development, initiates widespread synaptic remodeling, promotes neurogenesis, and drives structural changes within regions associated with social cognition and emotional regulation; including the medial prefrontal cortex (mPFC), hippocampus, and amygdala (Brinton, 2009; Dukic et al., 2024). These neural adaptations are linked to heightened emotional sensitivity, improved social cognition, and greater stress resilience in the transition to motherhood (Barba-Müller et al., 2018; Hoekzema et al., 2020).

Progesterone complements estrogen-mediated changes (Gilfarb & Leuner, 2022). Through its neuroactive metabolites, this steroid hormone enhances GABAergic signaling throughout limbic and hypothalamic circuits to increase inhibitory tone and reduce neuronal excitability (Gilfarb & Leuner, 2022; Kapur & Joshi, 2021). The shift towards inhibition can have anxiolytic effects which help to regulate affect and buffer the maternal brain from stress, an adaptation that supports emotional stability during the demands of early caregiving (Gilfarb & Leuner, 2022; Kapur & Joshi, 2021; Meltzer-Brody & Kanes, 2020).

The abrupt decline in estrogen and progesterone at birth marks a transition from a relatively neuroprotected state to one of neuroplastic fragility—a critical period of heightened neuroplasticity alongside potential vulnerability (Brinton, 2009; Dukic et al., 2024; Schiller et al., 2014). Neural circuits that have been reshaped for caregiving become highly sensitive to environmental input and the maternal brain is susceptible to both adaptive restructuring and stress-related dysregulation (Barba-Müller et al., 2018; Khayat et al., 2025; McEwen et al., 2015). This plasticity-limbo is a core biological feature of matrescence. Within this window, estrogen and progesterone dependent reorganization determines whether a woman psychologically reorients in a way that facilitates healthy caregiving and identity integration or toward patterns associated with mood disturbance and difficulty in the new maternal role (Barba-Müller et al., 2018; Brinton, 2009; Schiller et al., 2014).

Oxytocin: The Dyadic Architect

In response to the decline in estrogen and progesterone, oxytocin, a neuropeptide, emerges as a pivotal hormonal mediator of physical, emotional, and behavioral adaptation (Russell et al., 2001; Walter et al., 2021). Oxytocin coordinates physiological functions such as uterine contraction and milk ejection, as well as psychological functions that shape the mental landscape of early mothering (Russell et al., 2001). Oxytocinergic signaling promotes behaviors that create a secure mother-baby dyad (Nagasawa et al., 2012; Scatliffe et al., 2019; Strathearn et al., 2009). Through these actions, oxytocin anchors matrescence in a dyadic mode of functioning: the mother's thoughts, feelings, and priorities reorganize around the relationship with her baby (Kim & Strathearn, 2016; Nagasawa et al., 2012; Scatliffe et al., 2019).

Oxytocin further contributes to dyadic synchronization by intertwining cues and behaviors to create a positive feedback loop (Feldman, 2012). Peripherally, when the infant latches, it triggers mechanoreceptors in the nipple that send sensory signals to the hypothalamus where the posterior pituitary releases oxytocin into the bloodstream; oxytocin then binds to receptors on myoepithelial cells that surround the mammary alveoli which causes them to contract and expel milk (Pillay, 2023; Valtcheva & Froemke, 2018). Centrally, oxytocin is released within brain circuits that modulate maternal motivation and caregiving behaviors (Strathearn, 2011); this baby-initiated contact augments maternal oxytocin and reciprocally increases her responsiveness (Feldman, 2007).

In the maternal brain, oxytocinergic projections in the reward circuits stimulate dopamine release which amplifies the perceived value of infant cues so that the baby's sounds, scent, and presence become inherently rewarding (Numan & Young, 2016; Rincón-Cortés & Grace, 2020; Strathearn et al., 2009). At the same time, oxytocin dampens amygdala reactivity which reduces hypervigilance and supports calm, pleasant, present interactions (Radke et al., 2017; Rincón-Cortés & Grace, 2020). For the infant, breastfeeding and skin-to-skin contact increases oxytocin which helps to regulate stress physiology and cultivates a sense of safety in relation to the mother (Ionio et al., 2021; Moberg & Prime, 2013). During these interactions, a mother's regulated emotional state down-shifts the infant's arousal to a state of contentment, the peaceful baby reinforces the mother's oxytocin-driven reward circuit (Feldman, 2007; Ionio et al., 2021; Strathearn et al., 2009). This reciprocal loop is a necessary adaptation for a secure mother–baby dyad (Aureli et al., 2022; Feldman, 2012; Ionio et al., 2021; Moberg & Prime, 2013) .

When oxytocin signaling is disrupted, the same mechanisms that ordinarily scaffold a secure, synchronized dyad may instead undermine the emerging relationship (Scatliffe et al., 2019). Experimental models that block oxytocin signaling, or interfere with postnatal neural plasticity, reliably impair maternal motivation and caregiving behaviors, which underscores oxytocin's mechanistic role in bonding (Barba-Müller et al., 2018; Sanson & Bosch, 2022). Mothers with dysregulated oxytocin may not experience the intrinsic motivation to initiate or sustain caregiving behaviors (Sanson & Bosch, 2022; Scatliffe et al., 2019). The withdrawal from key nurturing activities further suppresses endogenous oxytocin which may impair milk production and eliminate one of the most powerful bonding experiences for the mother-baby dyad (Modak et al., 2023; Moberg & Prime, 2013; Nagel et al., 2022).

Over time, the absence of oxytocin-mediated connections weakens both relational bonding and physiological adaptation (Moberg & Prime, 2013; Sanson & Bosch, 2022; Scatliffe et al., 2019). Because babies rely on maternal warmth and physical presence to regulate their own stress and develop emotional security, sustained deficits can affect their brain development, emotional resilience, and long-term social capabilities (Dégeilh et al., 2018; Rifkin-Graboi et al., 2015; Ulmer-Yaniv et al., 2023). This establishes a maladaptive feedback loop where diminished contact and impaired mothering may contribute to feelings of detachment and increase vulnerability to postpartum mental health and challenges integrating a new identity (Modak et al., 2023; Nagel et al., 2022; Sanson & Bosch, 2022).

Oxytocin is implicated in the longer-term structural and functional remodeling of the maternal brain (Kim & Strathearn, 2016). Elevated oxytocin is a key modulator of associated with changes in gray matter volume, adaptive synaptic pruning, as well as increased connectivity within the hypothalamus, mPFC, amygdala, and reward pathways: changes that refine neural networks for social recognition, motivation, and maternal bonding (Kim & Strathearn, 2016). Higher oxytocin levels correlate with increased activation in social-emotional reward networks; which are integral to motivation, affect regulation, social recognition, and reward processing (Rincón-Cortés & Grace, 2020; Strathearn, L., 2009). Collectively, these processes position oxytocin as a key architect of the structural and functional reorganization of the maternal brain that underlies core matrescent features such as heightened empathy, improved perception, intensified emotional responses, all critical predictors of matrescent and dyadic health (Kim & Strathearn, 2016; Rincón-Cortés & Grace, 2020; Matsunaga et al., 2020; Scatliffe et al., 2019).

Cortisol and the HPA Axis: Adaptive and Maladaptive Stress Responses

Immediately after birth, cortisol levels—which increase during pregnancy— decline as placental hormone production ceases (Russell et al., 2001). With adequate rest, emotional support, and practical help, key reproductive hormones recalibrate from a gestational endocrine profile to a stable postpartum baseline (Chauhan & Tadi, 2022). For new mothers, moderately elevated, well-regulated cortisol supports both physiological adaptations and psychological resilience (Beijers et al., 2022; Carroll et al., 2017). Postpartum steroid hormones are associated with selective reductions in GMV and increased synaptic efficiency—neurostructural changes that appear to streamline the neural circuits involved in the intense multitasking and emotional attunement in early caregiving (Pritschet et al., 2024). In this context, cortisol helps fuel the mental energy, vigilance, and intuitive, flexible responsiveness required to meet the ever-changing needs of their baby (Fleming, Steiner, & Corter, 1997).

Postnatal cortisol patterns are complicated by the convergence of overlapping stressors: sleep fragmentation, relentless caregiving tasks, complex relationships, and novel psychological demands are all serve as potent activators of cortisol production (Herman et al., 2016; Laurent et al., 2011). The hypothalamic-pituitary-adrenal (HPA) axis—responsible for coordinating the stress response—continuously reacts to unpredictable infant cues by releasing cortisol into the bloodstream (Laurent et al., 2011). If these reliable HPA triggers are buffered by social connection, tangible support, and opportunities for rest, the stress response can remain within an adaptive range. When paired with social isolation, financial strain, relationship conflict, trauma, or insufficient support, the stress system can become dysregulated and begin to interfere with the very neural plasticity matrescence depends on (Khayat et al., 2025; McEwen et al., 2015).

When cortisol is out of balance, adaptive postpartum neural remodeling may be disrupted. At persistently high levels, hypercortisolemia, cortisol becomes a neurotoxin (Lupien et al., 2018). Chronic overexposure is linked to suppressed neurogenesis, impaired synaptogenesis, and atypical dendritic branching (Lupien et al., 2018). Altered or impaired connectivity in the hippocampus, prefrontal cortex, and limbic structures can delay postpartum recovery, compromise structural adaptations, and lead to impaired flexibility, planning, and emotion regulation (McEwen et al., 2015; Nehls et al., 2024). Similarly, excessive cortisol withdrawal, hypocortisolemia, is associated with overall reductions in GMV and impaired neuroplasticity that may lead to diminished structural recovery after birth (Lupien et al., 2018; McEwen et al., 2015). Brain regions most affected include the hippocampus, amygdala, and prefrontal cortex, which play a major role in memory processing, emotional regulation, and stress regulation (Lupien et al., 2018). This has been associated with an increased risk of mood and cognitive disturbances, which may affect maternal behavior and, ultimately, the quality of mother–infant attachment (Laurent et al., 2011). This suggests that cortisol is a determining factor in how matrescent brain plasticity consolidates. It can support a stable, caregiving-oriented mode that supports maternal psychological flexibility, new ways of thinking and acting, and a sense of meaning and purpose in the mothering role, or instead shift toward destabilization, anxiety, depression, and difficulty integrating a new maternal identity (Beijers et al., 2022; Laurent et al., 2011; McEwen et al., 2015; Moses-Kolko et al., 2014).

Serotonin: Recalibration and Vulnerability

As a hormone-like signal and central neurotransmitter, serotonin holds particular importance for the reorganization of maternal neural circuits and plasticity. During late pregnancy and postpartum the serotonergic system undergoes significant recalibration (Rybaczyk et al., 2005; Pawluski & Li, 2019). Throughout pregnancy, elevated estrogen strengthens serotonergic tone—increased activity of key enzymes that drive serotonin production, upregulated serotonin receptor expression, and promotes serotonin release in the brain—to support mood regulation, stress resilience, and maternal adaptation (Hudon Thibeault et al., 2019; Rybaczyk et al., 2005). After childbirth, the abrupt withdrawal of estrogen and progesterone removes key trophic drivers on the serotonin system. Without the stabilizing effects of estrogen, the brain loses a natural buffer: enzymes, transporters, and receptors that support serotonergic signaling are downregulated and overall serotonin activity is reduced (Hudon Thibeault et al., 2019; Rybaczyk et al., 2005). These shifts increase vulnerability to mood swings, irritability, and postpartum depression (Meltzer-Brody & Kanes, 2020). More broadly, the serotonergic system represents one mechanistic pathway by which the neurochemical cascade shapes matrescent adaptation and the emerging mother–baby dyad (Hudon Thibeault et al., 2019; Lonstein, 2018; Pawluski & Li, 2019).

Serotonin helps drive the neural remodeling that supports the transition to motherhood (Pawluski & Li, 2019). It does so in part through signaling at the 5-HT2A receptors that are densely expressed in higher-order association cortex and limbic–prefrontal circuits (Celada et al., 2013; Teissier et al., 2017). Through these pathways, serotonergic signaling promotes the birth and survival of new neurons, especially in the hippocampus and cortex, and supports synaptogenesis, dendritic remodeling, and axonal growth within neural circuits associated with memory, stress regulation, emotion, and psychological flexibility (Teissier et al., 2017; Kraus et al., 2017; Pawluski & Li, 2019). Serotonin-dependent plasticity in these circuits helps mothers meet the cognitive and emotional demands of caring for a newborn by maintaining adaptability in prefrontal and limbic networks that underlie maternal motivation and responsiveness (Lonstein, 2018; Pawluski & Li, 2019). In turn, this flexibility supports resilience and adaptation to postpartum stressors that arise from the demands of early motherhood.

Beyond its direct effects on neuronal signaling, serotonin contributes to maternal brain plasticity in part by engaging growth-promoting cascades that upregulate brain-derived neurotrophic factor (BDNF) (Kraus et al., 2017). BDNF supports synaptic plasticity, neuronal survival, and structural remodeling in regions that undergo pregnancy-related GMV changes, including cortical midline, associated with self-referential processing within the default mode network, autobiographical memory, future thinking, etc. as well as temporo-parietal areas, implicated in mentalizing, perspective taking, self-other distinction, etc. (Azarias et al., 2025; Hoekzema et al., 2017; Kraus et al., 2017). Through these BDNF-dependent mechanisms, serotonergic signaling can promote dendritic remodeling, synaptogenesis, and refinement of large-scale association networks, thereby providing a cellular and circuit substrate for updating self-representations and socioemotional schemas during the transition to motherhood (Azarias et al., 2025; Kraus et al, 2017; Lonstein, 2018) As a result, women can recalibrate self-concept and socioemotional processing in ways that support the consolidation of a maternal identity as they transition into their new role.

Dense serotonergic innervation of limbic and prefrontal circuitry, including hubs of the DMN, situates serotonin–BDNF signaling at a key intersection where reproductive hormones, experience-dependent plasticity, and large-scale network reconfiguration converge across pregnancy and postpartum (Hoekzema et al., 2017; Lonstein, 2018; Pawluski & Li, 2019). By enhancing the capacity of these circuits to reorganize in response to caregiving experiences, serotonin–BDNF coupling links cellular-level plasticity to psychological outcomes, and increases the extent to which interactions with the infant can reshape neural systems (Kraus et al., 2017; Lonstein, 2018; Pawluski & Li, 2019). Experience dependent changes in networks that support self-referential thought, emotion regulation, and social reward function to strengthen a securely attached mother–infant relationships (Dégeilh et al., 2018; Feldman, 2015; Pawluski & Li, 2019).

Integrated Neurochemical Landscape

Taken together, these hormonal sequences create a dynamic biochemical environment that sculpts the physical structure of the maternal brain, alters neural connectivity, and calibrates functional responsiveness-driven shifts in estrogen and progesterone establish overall neuroplastic tone. The balance between bonding-promoting (oxytocin) and stress-activated (cortisol) systems shape whether the reconfigured circuits support sensitive caregiving or tilt toward dysregulation and vulnerability to mood disturbance. Serotonergic modulation further links these endocrine changes to BDNF-dependent remodeling to provide a mechanistic bridge between hormonal transitions, matrescent brain reorganization, and 5-HT2A-mediated plasticity processes (Popova et al., 2017; Pawluski et al., 2019). Each hormonal system has unique, interdependent, effects that contribute to the extensive remodeling of neural circuits which underpin the features of matrescence and the formation of the mother-baby dyad.

Structural and Functional Neural Remodeling

Neuroanatomical remodeling in matrescence refers to the coordinated reshaping of brain anatomy that occurs across pregnancy and postpartum to facilitate caregiving and support the mother–baby dyad (Martínez-García et al., 2021). Grey matter remodeling involves targeted changes and refinements in the social-cognitive and emotion-regulation regions (Hoekzema et al., 2016). White matter and neuro-connectivity reorganization recalibrate large-scale networks toward specialized processing (Pritschet et al., 2024). Experience-dependent plasticity, driven by the infant and early caregiving interactions, further sculpt maternal circuits (Feldman, 2015; Pritschet et al., 2024). Together, these processes reorganize the maternal brain from an individually oriented system into one that is selectively tuned for the dyad (Barba-Müller et al., 2018; Martínez-García et al., 2021; Hoekzema et al., 2016). It provides the neural substrate for matrescent integration, new ways of thinking and acting, and the formation of a secure, co-regulated mother–baby dyad (Bjertrup et al., 2019; Feldman, 2015; Musser et al., 2012).

Grey Matter: Morphological Plasticity

Grey matter changes that remodel the brain for the transition into matrescence are primarily concentrated in areas that support social cognition, emotion regulation, and memory (Martínez-García et al., 2021). These include the medial prefrontal cortex, posterior cingulate cortex and other DMN hubs, along with temporal association areas and hippocampal structures (Martínez-García et al., 2021). Pronounced reduction in GMV during pregnancy persists for at least one year postpartum with the strongest effects in midline DMN regions and the lateral temporal cortex (Hoekzema et al., 2016; Servin-Barthet et al., 2025; Pritschet et al., 2024). Multivariate patterns of GMV reductions in social-cognitive regions classified, with 100% accuracy, which women had been pregnant versus controls who had not (Hoekzema et al., 2016). These patterns predicted postpartum maternal attachment scores and remained detectable at least two years later (Hoekzema et al., 2016).

One study that combined EEG, transcranial doppler, and brain MRI reported cortical volume reductions of approximately 6.8% and 13.2% in postpartum women (Luo et al., 2020). Other studies have detected GMV decreases on the order of about 5% globally (Pritschet et al., 2024; Servin-Barthet et al 2025). Across these datasets, pattern level signatures of brain change can reliably distinguish previously pregnant women from never-pregnant women, with some multivariate models classifying pregnancy history with near-perfect accuracy (Hoekzema et al., 2016).

These findings suggest that GMV reductions and refinements are targeted, enduring adaptations rather than nonspecific loss. The concentrated thinning of social-cognitive and default-mode regions likely reflects synaptic pruning and microstructural refinement. These adaptations streamline the circuits that support mentalization, emotion regulation, and autobiographical self-processing in relation to the baby. In functional terms, this remodeling may help the maternal brain prioritize infant-related information, reduce competition from self-focused concerns, and support faster, more efficient responses to the infant’s cues.

White Matter: Connectivity Plasticity

White matter architecture and connectivity also reorganize across pregnancy and the postpartum period to refine how neural systems communicate in the service of caregiving and the mother–baby relationship (Dufford et al., 2019; Martínez-García et al., 2021). Precision longitudinal imaging that followed a single participant from preconception through two years postpartum found that pregnancy is accompanied by week-by-week increases in global white matter microstructural integrity (Pritschet et al., 2024). In parallel with widespread GMV reductions and cortical thinning, white matter changes peak in late gestation and partially normalize after birth, which suggests a transient window of heightened structural efficiency (Pritschet et al., 2024).

These increases are especially evident in major association tracts, including segments of the corpus callosum, cingulum bundle, and inferior fronto-occipital and longitudinal fasciculi, which provide long-range communication among nodes of the DMN, salience, and executive-control networks; regions involved in emotion, salience, and higher-order cognition (Pritschet et al., 2024). Later postpartum months are associated with higher resting-state connectivity between the amygdala and several other neural networks; stronger amygdala–nucleus accumbens connectivity has been associated with more positive, well-organized behavior in mother-baby interaction (Dufford et al., 2019).

These findings indicate that pregnancy and the postpartum period are characterized by increased myelination and axonally mediated, network-level refinements that strengthen communication between regions involved in self-referential processing, emotion regulation, vigilance, and social cognition. The reconfiguration of white matter helps mothers to more rapidly detect and understand infant cues, align internal states with external demands, and sustain flexible, responsive engagement with their babies. These adaptations provide a structural backbone for the mother–baby-centered mind that emerges during matrescence. Experience-Dependent Plasticity

Experience-Dependent Plasticity

An additional, and often overlooked, dimension of these structural changes is experience-dependent plasticity. Evidence from neuroimaging studies suggests that caregiving experience is reflected in brain structure and function: sensitivity, hostility, and synchrony map onto variation in corticolimbic structure and resting-state connectivity within the DMN, salience, and frontolimbic networks (Dufford et al., 2019; Feldman & Atzil et al., 2011; Feldman, 2015). Intervention studies have demonstrated that when caregiving behavior shifts, maternal brain function shifts as well (Giuliani et al., 2019; Swain et al., 2017) . This highlights that experience is a contributing factor of which adaptations are strengthened and which are derailed.

Higher maternal sensitivity in early interactions is a predictor of larger infant hippocampal volume and stronger hippocampal connectivity with ventromedial and dorsolateral prefrontal, temporal, and fusiform regions involved in emotion regulation and social communication—patterns that support better stress regulation, memory, and socioemotional functioning over time (Rifkin-Graboi et al., 2015). In contrast, studies have linked low maternal sensitivity and high maternal stress to atypical infant hippocampal growth and functional connectivity, with downstream associations to greater difficulties in memory and emotion regulation and increased depressive or anxiety symptoms in later childhood or adolescence ((Lee et al., 2019; Khoury et al., 2023; Rifkin-Graboi et al., 2013). These findings point to a bidirectional, experience-dependent loop in which the mother's brain and the infant's developing limbic–prefrontal systems that co-shape one another, to scaffold the child's neurodevelopment and influence the mother's ability to integrate a maternal identity.

Integrated Anatomical Adaptations

Both grey and white matter changes, along with experience-dependent plasticity, converge on cortical and subcortical structures central to maternal adaptation. In particular, the regions within the broader caregiving circuit are changed to prioritize infant needs, recalibrate emotional and stress responses, and increase the motivational pull of caregiving. These anatomical adaptations form the infrastructure through which matrescent identity, relational modes of mind, and a co-regulated mother–baby dyad are built and maintained.

Neural Circuitry

Neural circuit remodeling in matrescence is the process by which large-scale brain networks are reconfigured to support caregiving, matrescent identity, and the mother–baby dyad. Core networks—including the default mode, executive control, salience, and reward networks—amend their patterns of communication in ways that reorganize self-focus, heighten sensitivity to infant cues, and bind caregiving more tightly to motivation and reward. Ultimately, these adaptations aim to redirect the maternal brain toward a dyad-centered, flexible mode that integrates a new matrescent identity and supports a secure mother–baby dyad.

Default Mode Network: Matrescent Identity—Creation, Narration, and Integration

The DMN is a set of interconnected regions—medial prefrontal cortex, posterior cingulate/precuneus, and inferior parietal cortex—that shows greater activity at rest and during mind wandering, daydreaming, and remembering than during many externally focused tasks

(Menon, 2023). Evidence shows DMN activity supports autobiographical memory and self-referential thought, which makes it a likely neural substrate for the sense of self (Fuentes-Claramonte et al., 2019). This network also facilitates mental time-travel, foresight, and flexible thinking—abilities that are critical for risk assessment, decision-making, and future planning (Roberts et al., 2017; Schacter et al., 2007; Schacter et al., 2008; Østby et al., 2012). The ability to draw on past experiences and stitch them into a cohesive narrative is especially important for matrescent identity integration, as mothers work to weave their pre-motherhood selves into their present role.

Across the postpartum period studies report that intrinsic DMN coherence—the way its regions communicate with one another—and the coupling of its hubs with limbic structures like the amygdala and hippocampus undergo notable changes (Dufford et al., 2019; Hoekzema et al., 2022). Extensive reshaping of the DMN during pregnancy, including reliable GMV reductions and cortical thinning in midline and lateral parietal regions, appears to track how strongly a mother bonds with her baby rather than reflecting global cognitive decline (Hoekzema et al., 2016). This remodeling lays the neural groundwork for a kind of ego-softening, in which rigid boundaries between self and other become more permeable, and positions the DMN as a hub where intrinsic information—prior beliefs, long-term memories, and emotional dispositions—is continually updated in light of the baby's presence.

In this process, DMN connectivity changes in ways that quiet some of the self-focused looping and make more room for an updated autobiographical memory in which the baby becomes a central point of reference. When this remodeling process goes well, a mother can hold both her pre-maternal and maternal selves together within a dyadic frame. Mothers increasingly think and feel in terms of "we" and "the baby," not because the "I" disappears, but because the internal narrative of the self now routinely includes the infant and the mother–infant dyad. A well-adapted DMN can support rapid, context-sensitive shifts—for instance, moving from soothing a crying infant to checking in on the mother's own emotional state and needs, and then back again (Menon, 2023; Orchard et al., 2023).

When this communication is compromised, it may be harder for internally generated thoughts to be guided and shaped in a way that supports sensitive caregiving (Chen et al., 2024). DMN dysregulation is likely to show up as rumination, negative self-focus, intrusive thoughts, and depressive symptoms that fragment the sense of self and interfere with emotionally present interactions (Chen et al., 2024; Chou et al., 2023; Sobral et al., 2025). A negatively biased or self-focused DMN may produce an internal stream of thought like, "I am a terrible mother; this baby would be better off without me." In contrast, a dyad-focused internal narrative might be, "This is really hard right now, and I feel overwhelmed. My baby is tiny and needs my help, maybe if I hold them and sing we will both calm down."

These structural and functional reconfigurations move the maternal brain from an individually oriented mode into one that is more baby-focused, flexible, and responsive to the relational demands of the dyad (Hoekzema et al., 2016). Overall, a well-adapted postpartum DMN appears less locked into its pre-pregnancy patterns and communication with other networks is more flexible and integrated (Hoekzema et al., 2022; Orchard et al., 2023). In this sense, the DMN offers both a lens on matrescent mental health risk and a promising target for interventions that aim to restore flexible, relationship-centered identity processes capable of scaffolding maternal wellbeing and support the infant's socioemotional development.

Salience Network: Prioritizing Attention Toward the Infant

The salience network is a large-scale paralimbic–limbic system anchored in the anterior insula and dorsal anterior cingulate cortex, with additional nodes in regions such as the amygdala and hippocampus (Menon & Uddin, 2010). It detects and prioritizes emotionally and physiologically relevant stimuli and helps switch other networks into "high-alert" modes when needed (Menon & Uddin, 2010). In the maternal brain, core nodes including the amygdala, insula, dorsal anterior cingulate cortex, and hippocampus are reshaped to more efficiently flag emotional salience, blend interoceptive and affective signals, and organize behavioral responses to a distressed infant (Kim et al., 2020; Menon & Uddin, 2010). When this circuitry recalibrates adaptively, mothers become more attuned to infant cues without being overwhelmed by them. The amygdala and insula help amplify the mother's ability to detect the baby's cues, while prefrontal and hippocampal systems contextualize what is happening and help modulate the maternal stress response (Herman et al., 2016; van Rooij et al., 2021).

When salience circuitry is shaped by chronic stress, limited social support, or hormonal disturbances, mothers often exhibit heightened threat reactivity, difficulty down-regulating anxiety, or blunted emotional responses—patterns that can undermine caregiving quality and increase risk for postpartum depression and anxiety (McEwen et al., 2015; Moses-Kolko et al., 2014). In this context, the salience network functions as a key mechanism that can either scaffold or strain the mother–infant relationship, based on how effectively it integrates infant-related signals with the mother's own regulatory resources (Dégeilh et al., 2018; Moses-Kolko et al., 2014).

Executive Control Network: Planning for the Dyad

The frontoparietal system—often referred to as the executive control network—includes the dorsolateral prefrontal cortex, dorsal anterior cingulate, and lateral parietal cortex (Menon, 2023). It is responsible for core executive functions: working memory, cognitive flexibility, and inhibitory control, all of which are essential for managing the "mental load" of caregiving and coordinating day-to-day life with an infant (Diamond, 2013; Nordenswan et al., 2021). In the context of matrescence, this network helps mothers hold multiple demands in mind at once, shift between competing tasks, and inhibit impulses that might clash with quality caregiving; over time, the ability to do this reliably can strengthen the sense of competence and confidence in the maternal role (Bridgett et al., 2017; Diamond, 2013).

As the maternal brain reorganizes, executive control circuits become increasingly involved in planning for the dyad rather than for the individual alone (Hoekzema et al., 2016; Martínez-García et al., 2021; Nordenswan et al., 2021). Prefrontal and parietal regions support the ability to anticipate an infant's needs, schedule and sequence daily routines, and integrate practical considerations—sleep, feeding, work, finances—with the mother's own wellbeing (Hoekzema et al., 2016; Nordenswan et al., 2021). Emerging evidence suggests that motherhood is associated with more efficient coordination between cognitive control regions and emotion-related circuits to support a more flexible and responsive regulation system in mothers compared with non-mothers (Orchard et al., 2023). The executive control network helps translate information flagged by the salience network into concrete, organized action in service of the mother-baby dyad (Menon, 2023).

When executive function is compromised—by sleep deprivation, chronic stress, mood symptoms, or structural disadvantage—mothers may struggle with planning, follow-through, and emotional regulation, even when caregiving intentions are strong (Diamond, 2013; Nordenswan et al., 2021). Difficulties in working memory or cognitive flexibility can make it challenging to stay responsive to infant cues while also managing household tasks, paid work, or other children, which may increase feelings of overwhelm or self-doubt (Diamond, 2013; Deater-Deckard et al., 2012). Studies link lower maternal executive function to harsher or more inconsistent parenting, while higher executive function is associated with greater sensitivity, emotional availability, and more organized interactions with the child (Deater-Deckard et al., 2012; Nordenswan et al., 2021). From this perspective, the executive control network plays a central role in planning for the dyad and supporting the everyday decisions, trade-offs, and adjustments that allow both mother and infant to thrive.

Reward Network: Motivation for Dyad Engagement

Another important shift in matrescence occurs in the brain's reward and motivation systems, which reorganize to make baby-related cues highly motivating and to sustain the effortful work of caregiving (Hoekzema et al., 2020; Rincón-Cortés & Grace, 2020). Core hubs of the mesolimbic dopamine pathway—the ventral tegmental area, nucleus accumbens, and ventral striatum—show structural and functional adaptations across pregnancy and postpartum that amplify responses to infant faces, cries, and other cues (Hoekzema et al., 2020; Rincón-Cortés &

Grace, 2020). Functional imaging studies indicate that infant stimuli engage these reward regions more strongly in mothers than in non-mothers, and that stronger activation tends to correlate with greater maternal sensitivity, more positive caregiving, and stronger feelings of attachment (Atzil et al., 2011; Rigo et al., 2018; Strathearn et al., 2009). Oxytocin modulates this system by boosting dopaminergic signaling in mesolimbic circuits, effectively linking social bonding to reward to create a loop in which caregiving feels intrinsically motivating rather than an externally imposed obligation (Numan & Young, 2016; Rincón-Cortés & Grace, 2020; Valtcheva & Froemke, 2019).

When this circuitry is working well, nourishing and nurturing behaviors are experienced as emotionally rewarding, even energizing, to help mothers stay engaged despite sleep loss and stress. When this reward system is dysregulated and reward processing is blunted, the pull of infant cues is weak, and mothers may withdraw their attention, invest less effort in caregiving, or struggle to build a healthy bond with their baby (Moses-Kolko et al., 201; Rincón-Cortés & Grace, 2020). Thus, the reward system is a key pathway by which matrescent integration can falter, with consequences for both maternal mental health and the developing dyad. Attending to this circuitry is an important mechanistic detail, as well as, a clinical and ethical imperative: how the reward system adapts—or fails to adapt— contributes largely to whether motherhood is experienced as enlivening and connected or as a grueling and unsustainable obligation.

Integrated Neural Circuitry

The coordinated reorganization of these large-scale brain systems allows each of them to update their patterns of communication around a new goal: supporting the mother-baby unit. Salience circuits flag infant signals as urgent, executive systems organize and implement the responses, reward circuits reinforce caregiving as meaningful, and the DMN integrates these experiences into an evolving maternal identity. Maternal wellbeing depends on integrated neural architecture, not just the absence of symptoms, in order to thrive.