



The Mind-Body Connection in OCD: A Holistic Six-Domain Approach

A practical guide to exploring the often-overlooked physiological factors that may influence your OCD experience

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Version 1, June 2025



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How to Use This Guide This comprehensive guide is designed for different readers at various stages of their OCD journey:

- **Newly diagnosed:** Focus on understanding the six domains and building awareness of patterns
- **Currently in treatment:** Explore which domains might complement your existing care
- **Experiencing a plateau:** Consider a more comprehensive exploration of physiological factors
- **Healthcare professionals:** Use as a framework for understanding integrative approaches

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1. Introduction

Have you ever noticed that your OCD symptoms seem to fluctuate, even when you're consistently following your therapy plan? Or perhaps you've made great progress with conventional treatment but still experience symptom fluctuations during certain times or situations. You're not alone. While traditional approaches to OCD—such as Exposure and Response Prevention (ERP) therapy and medications (if appropriate)—create essential foundations for wellness [1, 2, 3], emerging research suggests that OCD isn't just about what's happening in your mind—it's a complex experience potentially influenced by many interconnected systems throughout your body [4, 5].

For over 20 years, I lived with undiagnosed OCD, spending hours each day trapped in cycles of intrusive thoughts and mental rituals that were invisible to everyone around me. The turning point in my life came when I finally received an accurate diagnosis and began conventional treatment. Psychotherapy with an OCD Specialist and medication provided essential relief that truly changed everything for me.

Yet through my wellness journey, I discovered something profound: exploring and supporting the physiological factors influencing my OCD created even more significant improvements in my overall wellbeing. When I began investigating the connections between my gut health, inflammation levels, hormonal cycles, and nervous system patterns, I

found keys to understanding why my symptoms would intensify during certain periods despite consistent therapy.

This guide introduces a holistic approach that I use in my practice, exploring six interconnected physiological domains that may influence overall wellbeing in people with OCD [11, 15, 21, 27, 31, 36]. By exploring the intimate relationships between brain function, inflammation, gut health, hormones, nervous system regulation, and environmental factors [4, 11, 15, 21, 27, 31], we can develop a more comprehensive understanding of OCD that honours its complexity.

This complementary perspective may help you better understand and support your overall wellbeing alongside your conventional OCD treatment [6], providing additional pathways for wellness that work in harmony with evidence-based approaches.

In this guide, you'll discover:

- How six interconnected physiological systems may influence OCD development, symptoms and recovery
- The research pattern model that explains how multiple factors can converge to contribute to symptom intensity
- How addressing these contributing factors may enhance overall wellbeing alongside conventional treatment
- Ways to improve your overall wellness that extend beyond OCD-specific benefits
- A self-assessment tool to identify which domains might be most relevant to your experience
- Practical approaches for supporting each domain alongside conventional treatment
- Insights from both current research and personal experience

Why a Complementary Approach May Be Valuable

The goal of this complementary approach isn't to replace conventional treatment—it's to improve overall wellbeing and thereby potentially support the effectiveness of conventional treatment by addressing the whole person. This integrated perspective recognises that mental and physical health are deeply interconnected, especially with complex conditions like OCD. By identifying and optimising potential contributing physiological factors that may be influencing symptom development, intensity, and progression, we can potentially create more comprehensive support that addresses both psychological and biological aspects of wellbeing.

ERP therapy requires us to face our worst fears without performing the compulsions we have previously relied on sometimes for decades. For me, this meant driving without checking my mirrors repeatedly or mentally reviewing my route, despite the overwhelming fear that I might have hit

someone without realising it. It meant doing a quick check of only those appliances I'd used that morning before leaving the house on my way out without re-checking and/or taking photos, leaving the house and not looking back, even when my mind screamed that I was endangering my loved ones.

This evidence-based therapy was extremely challenging, especially initially. I remember those early months taking two steps forward, three steps back - my OCD was fighting back. Combining conventional treatments with complementary naturopathic approaches created a synergistic effect that significantly improved my overall wellbeing outcomes. I found that supporting physiological factors such as autonomic regulation, inflammation, and gut health alongside my medication helped me face the intensity required for ERP therapy. Together, this holistic combination helped reduce both the intensity and frequency of symptom fluctuations over time.

2. The Six Domains Explained



Domain One: Neurological Patterns

Understanding Brain Chemistry & Neural Circuits in OCD



What's Happening: Your brain uses chemical messengers (neurotransmitters like serotonin, dopamine, glutamate and gamma-aminobutyric acid {GABA}) to communicate between nerve cells. Research suggests these messaging systems may function differently in people experiencing OCD, with potential alterations in neurotransmitter balance and neural circuitry (the brain pathways that control thoughts and behaviours) [4, 5].

Research Evidence: Research shows OCD often involves excessive glutamate (an excitatory brain chemical that creates mental "revving") and reduced GABA (a calming brain chemical that helps you feel settled). One study found participants with OCD had elevated cortical glutamate and reduced GABA [4]. The NMDA receptor (a specific type of brain cell connection point) often shows dysfunction in OCD. Magnesium acts as a "natural NMDA receptor antagonist, blocking excessive excitation" (helping to calm overactive brain circuits) [7].

OCD involves hyperactivity in specific brain pathways called cortico-striatal-thalamic-cortical (CSTC) loops (think of these as the brain's "quality control circuits"). These circuits normally "filter sensory information and help select appropriate behavioural responses" but in OCD show "excessive activity in the direct pathway (excitatory) relative to the indirect pathway (inhibitory)" (meaning the "go" signals are too strong compared to the "stop" signals) [5].

Recent cognitive neuroscience research has expanded our understanding of these neural patterns, showing that OCD involves both structural and functional brain differences that affect how information is processed, and decisions are made [8].

Personal Experience: In my own experience, when I discovered how nutrients like magnesium affect GABA and NMDA receptors (specialised brain cell connection points that regulate excitation and calming), it completely transformed my understanding of why I felt constantly "wired" despite exhaustion. I'd been supplementing with magnesium for muscle cramps, but once I learned about its role in nervous system function and switched to a more bioavailable form (one that's better absorbed and used by the body) along with a more appropriate dosage for my needs, I noticed my baseline anxiety decreased significantly [7]. This discovery was like finding a missing puzzle piece in my wellness journey—helping me understand why some days my intrusive thoughts felt more intense than others, even when external stressors remained the same.

Key Takeaways: Neurological Patterns

OCD involves imbalances in multiple neurotransmitter systems, with recent research highlighting:

- **Glutamate-GABA dysfunction:** Excessive glutamate (excitatory) and reduced GABA (calming), creating an excitatory-inhibitory imbalance that influences compulsive behaviours [4]
- **Serotonin dysregulation:** The primary target of SSRI medications, affecting mood regulation and neural circuit communication [1, 2, 9]
- **Dopamine involvement:** Affecting motivation, reward processing, and the reinforcement of compulsive behaviours [4]

- **Neural circuit patterns:** The cortico-striatal-thalamic-cortical (CSTC) loops show hyperactivity, creating patterns where thoughts and behaviours become repetitive and difficult to interrupt [5]
- **Nutritional cofactors (helper molecules) matter:** Key nutrients like magnesium (which helps balance NMDA receptors), B vitamins (essential for creating neurotransmitters), and amino acids (the building blocks found in protein-rich foods that your body uses to create neurotransmitters) provide the foundation for balanced brain chemistry [10]
- **Individual patterns vary:** While these mechanisms are consistent across OCD patients, the specific imbalances and most effective support strategies differ between individuals, highlighting the importance of personalised approaches

While these neurological patterns form the foundation of OCD symptoms, they don't exist in isolation. The body's inflammatory responses directly influence brain function, creating another crucial domain in our understanding of OCD.

Domain Two: Inflammation Processes

Understanding Inflammation and Brain Function



What's Happening: Your immune system's inflammatory responses may affect your brain function and could play a role in OCD for some individuals. Research suggests inflammation may influence neurotransmitter function and neural communication, potentially contributing to certain mental health patterns [11, 12].

Research Evidence: A systematic review of proinflammatory cytokines (inflammatory messenger molecules) in OCD found significant reductions in IL-1 β (interleukin-1 beta) levels in OCD patients, with complex patterns for other inflammatory markers and moderating effects of age, medication, and comorbid depression [12]. While IL-1 β is an inflammatory molecule, it also plays important roles in normal brain communication [39], so abnormally low levels found in OCD patients may represent dysregulation rather than improvement. Direct measurement studies have demonstrated increases in TNF- α (tumour necrosis factor-alpha) and IL-6 (interleukin-6) levels in OCD patients compared to healthy controls, providing evidence for immune system involvement in OCD pathophysiology (the underlying biological processes of the condition) [13]. Elevated TNF- α and IL-6 are particularly concerning because these inflammatory molecules can cross into the brain [40, 41] and directly interfere with serotonin function by increasing serotonin transporter activity [42, 43], increase glutamate activity [44], and disrupt the blood-brain barrier [45, 46] - all of which can worsen anxiety and compulsive behaviours.

Beyond these direct cytokine effects, inflammation can also trigger broader changes in brain function. Brain immune cells called microglia (the brain's cleanup crew) can become overactive in OCD, creating neuroinflammation (inflammation within the brain) that affects neural circuit function relevant to the disorder [11]. Additionally, inflammatory processes can oxidize tetrahydrobiopterin, a crucial cofactor (helper molecule) needed for neurotransmitter synthesis (production), further disrupting brain chemistry [47]. Paediatric research has also identified specific inflammatory patterns that may contribute to symptom development and intensity [14].

Personal Experience: I'll never forget coming down with COVID-19 six weeks after giving birth to my daughter and suddenly experiencing a dramatic spike in my OCD symptoms that seemed completely disproportionate to the physical illness. My obsessions became more frequent, intrusions more distressing, and compulsions harder to resist. This was mere months before receiving my OCD diagnosis and starting treatment.

My curiosity about this connection led me to research the links between inflammation and brain function. What I discovered explained so much about my experience — inflammatory messengers can directly alter neurotransmitter function and disrupt normal brain communication, affecting how our brain operates [11]. When I began incorporating anti-inflammatory foods and specific nutrients that support the body's natural anti-inflammatory pathways in addition to incorporating activities known to reduce inflammation, I noticed more stability in my mental state even during physical illness. These simple changes created a level of resilience I hadn't experienced before showing me that what I'd accepted as "normal" wasn't necessarily optimal. *Please note: Individual experiences vary significantly, and this reflects my personal journey, not a typical outcome.*

Key Takeaways: Inflammation Processes

- Systematic research demonstrates complex cytokine patterns in OCD patients
- Inflammation directly alters neurotransmitter function and availability
- Infection, illness, and certain foods can trigger inflammatory responses
- Anti-inflammatory approaches may help support overall wellbeing
- Identifying and avoiding your personal inflammatory triggers may help to reduce unexpected symptom flares—common triggers include processed foods, sugar, food sensitivities, chronic stress, poor sleep, and seasonal allergens

This inflammatory process extends beyond direct brain effects—it creates a bidirectional relationship with another critical system: our digestive tract, which serves as both a source and target of inflammatory processes.

Domain Three: Digestive Function

The Gut-Brain Connection in OCD



What's Happening: The microbes in your gut may influence your brain through several pathways, including neurotransmitter production and inflammation regulation.

Growing research suggests this gut-brain axis creates a two-way communication system that may play a role in mental health conditions, including OCD [15, 16].

Research Evidence: A groundbreaking 2025 review confirmed "approximately 90% of the body's serotonin is produced in the gut by enterochromaffin cells (specialised cells in your intestinal lining) [15]. People with OCD often have "reduced gut microbiome diversity and fewer butyrate-producing bacteria" (meaning less variety of beneficial gut bacteria and fewer bacteria that produce compounds that support brain health) [17], affecting how the gut and brain communicate. Specific bacterial species (*Bacteroides* and *Lactobacillus*) produce GABA, a key inhibitory (calming) neurotransmitter often dysregulated in OCD (meaning certain gut bacteria actually manufacture your brain's primary calming chemical) [15, 16]. Another 2025 study found "SCFA levels (short-chain fatty acids - beneficial compounds produced by beneficial gut bacteria) strongly correlate with symptom severity in neurodevelopmental conditions" [18].

Recent comprehensive research on the gut-brain-microbiome axis has identified multiple bidirectional pathways of communication (meaning your gut talks to your brain AND your brain talks back to your gut), with dietary patterns profoundly shaping gut microbiota composition and functionality [19]. This research demonstrates that dysbiosis (an imbalance in gut bacteria where harmful bacteria outnumber beneficial ones) disrupts the balance between pro-inflammatory and anti-inflammatory responses, directly affecting mental health outcomes.

Personal Experience: One of the most profound discoveries in my wellness journey came when I identified several food sensitivities that were influencing my overall anxiety levels which ultimately affected how I would respond to intrusive thoughts. I was always one to ignore this link early on because I didn't think I experienced digestive discomfort after certain meals or connect that link to the intensification of intrusive thoughts that would follow hours later.

When I removed certain foods from my diet over periods of time, I began to notice clear connections—particularly with gluten, sugar and certain food chemicals. The first week after removing these triggers, I felt subtle improvements. By the third week, both my digestive symptoms and the intensity of my intrusive thoughts had decreased noticeably. But perhaps most profound was experiencing an overall quieting of my mind—a sense of mental calm and clarity that I had never really experienced before. This connection was so clear that I could predict symptom fluctuations based on accidental exposures—a pattern I would have never recognised without systematic tracking. Again, I realised that what I'd accepted as "normal" wasn't necessarily optimal. *Please note: Individual experiences vary significantly, and this reflects my personal journey, not a typical outcome.*

Learning that gut bacteria actually produce neurotransmitters was revolutionary in my understanding of why digestive symptoms often paralleled my mental state confirming what research now shows: gut health truly influences mental health [15, 16, 20].

Key Takeaways: Digestive Function

- The gut microbiome directly influences neurotransmitter production and availability
- Approximately 90% of serotonin is produced in the gut
- Specific bacterial species produce GABA, a key inhibitory (calming) neurotransmitter
- Food sensitivities can trigger inflammation affecting brain function
- Systematic tracking can help identify personal gut-brain connections

Just as our digestive system influences our brain function, our hormonal systems create another layer of mind-body interaction that can significantly affect OCD symptoms throughout various life cycles.

Domain Four: Hormonal Balance

Chemical Messengers Affecting Symptom Intensity



What's Happening: Hormones are chemical messengers that may affect brain function, mood, and anxiety levels. Research suggests that fluctuations in sex hormones, stress hormones, and thyroid hormones may influence OCD symptom intensity in some individuals [21, 22, 23].

Research Evidence: Research shows "OCD symptoms worsen in 20-65% of female patients during the luteal phase (the two weeks before menstruation), with symptom exacerbation often beginning at ovulation and increasing until menstruation" [21]. Oestrogen affects multiple neurotransmitters - it "increases serotonin synthesis (production), decreases breakdown, and enhances receptor sensitivity" (meaning your mood-regulating serotonin works more effectively) and "enhances GABA-

ergic transmission" (helping your brain's natural calming system function better) [22]. Progesterone metabolites (breakdown products, particularly allopregnanolone) enhance GABA receptor function (helping your brain's natural calming system work better) [23]. When these drop rapidly in the late luteal phase, there is "reduced GABA-ergic inhibition" (meaning your brain's calming system becomes less effective, potentially increasing anxiety and obsessive thoughts) [23].

People with OCD often show abnormal cortisol rhythms (irregular patterns of your main stress hormone throughout the day) and "hyperreactive cortisol response to specific OCD triggers" (meaning stress hormone levels spike dramatically when confronted with OCD-related situations) [24]. Recent research has identified cross-condition hormonal effects that influence multiple aspects of mental health, demonstrating the widespread impact of hormonal fluctuations [25]. Additionally, thyroid dysfunction (when your thyroid gland produces too much or too little thyroid hormone) has been identified as a significant factor in OCD symptom patterns [26].

Personal Experience: Charting my OCD symptoms alongside my menstrual cycle revealed undeniable patterns that transformed how I approached my wellness journey. I noticed my intrusive thoughts would intensify dramatically during the luteal phase, progressively getting worse from the day after ovulation until my period arrived.

Those few days before my period I felt like a completely different person with no rational sense whatsoever—everything was catastrophised and joy felt unattainable. Once I recognised this pattern, I could prepare for these more challenging days with additional support strategies. I adjusted my self-care routines during these times, incorporated specific nutrients that support hormonal balance, and communicated with my therapist about these fluctuations.

Understanding that these intensifications were largely physiological rather than psychological helped me approach them with less self-judgment and more practical support. This knowledge gave me back a sense of control I hadn't felt in years.

Key Takeaways: Hormonal Balance

- Many women notice OCD symptoms fluctuating with menstrual cycles
- Oestrogen enhances serotonin function while progesterone affects GABA
- Stress hormones like cortisol can maintain high anxiety states
- Tracking hormonal patterns helps prepare for more challenging periods

- Targeted nutritional support may help balance hormonal fluctuations

These hormonal fluctuations work in concert with our autonomic nervous system, creating patterns of activation and regulation that directly influence how we experience and respond to OCD symptoms.

Domain Five: Autonomic Regulation

Nervous System Balance & OCD Management



What's Happening: Your autonomic nervous system regulates your stress response and has two main branches—the sympathetic ("alert") and parasympathetic ("calm") systems. Research suggests that some people with OCD may experience patterns of nervous system regulation that include more frequent or persistent activation of the alert system [24, 27].

Research Evidence: Studies report "higher resting heart rate and reduced heart-rate variability in OCD, indicating sympathetic overactivation and reduced parasympathetic tone" (meaning people with OCD tend to have faster heartbeats and less flexible nervous systems, staying more "revved up" than relaxed) [24]. OCD involves problems with the vagus nerve (a major nerve that connects your brain to your digestive system and helps activate your body's relaxation response), which normally helps calm the body. "A well-functioning vagal brake enables social engagement under stress" but "OCD may involve dysfunction in the vagal brake mechanism" (meaning the natural "brakes" that should calm you down during stress may not work as effectively) [27].

People with OCD often have a "hypersensitive threat detection system (overactive amygdala)" (meaning the brain's alarm system goes off too easily and too intensely) and "difficulty distinguishing between real and perceived threats" (struggling to tell the difference between actual danger and imagined danger) [28]. OCD symptoms intensify during sympathetic ("fight/flight") states, which create "narrowed attention focus (often on threat)," "decreased prefrontal cortex activity," (reduced function in the brain's reasoning centre) and "reduced cognitive flexibility" (difficulty switching between different thoughts or adapting thinking patterns) [29]. Polyvagal theory research has further expanded our understanding of these nervous system patterns, showing how different states of autonomic activation affect our capacity for social engagement and emotional regulation (how well we can connect with others and manage our emotions depending on whether we're in "safe," "alert," or "shutdown" nervous system states) [30].

Personal Experience: Learning specific techniques to shift from sympathetic dominance (fight/flight) to ventral vagal state (safe/social)

gave me practical tools for interrupting the physiological anxiety that influenced my obsessions. One technique I personally began using almost from the beginning of my ERP therapy journey and that I often recommend to clients is what I call the 'Pause and Three Deep Breaths' technique. This simple, easy-to-remember technique involves stopping before any compulsive action, taking three deliberate deep breaths, and then consciously choosing your next step rather than reacting automatically. It creates a powerful pattern interrupt that engages the prefrontal cortex (your brain's executive decision-making centre) while activating the parasympathetic nervous system (your body's relaxation response).

Before understanding nervous system regulation, I'd try to "think" my way out of anxiety, which never worked. My breakthrough came when I realised, I needed to address the physical sensations first. Once I learned to recognise my nervous system states and had tools to shift them, I could create a calmer physiological foundation from which to apply my ERP therapy skills. This approach was like discovering a new dimension in my wellness journey—one that worked with my body rather than just my thoughts. *Please note: Individual experiences vary significantly, and this reflects my personal journey, not a typical outcome.*

Key Takeaways: Autonomic Regulation

- OCD often involves sympathetic nervous system dominance (fight/flight state)
- This physical state creates feelings of urgency that drive compulsions
- Specific breathing techniques can help shift into parasympathetic (calm) state
- The 'Pause and Three Deep Breaths' technique combines multiple regulation approaches
- Regular practice creates better baseline regulation over time

While these internal physiological domains create the foundation of our mind-body connection, our external environment provides the context in which these systems operate, offering another important domain for understanding and supporting OCD.

Domain Six: Environmental Influences

How Surroundings & Lifestyle Affect Symptoms



What's Happening: Your physical environment, sleep quality, exposures to environmental substances, and daily rhythms may influence your brain function and could potentially affect OCD symptoms. Research suggests these environmental factors may play a role in symptom fluctuations for some individuals [31, 32].

Research Evidence: "Poor sleep dramatically worsens OCD symptoms by impairing prefrontal cortex function" (disrupting your brain's ability to think clearly and make rational decisions) [31]. Sleep disruption also increases "amygdala reactivity," (making your brain's alarm system more sensitive) and disrupts the "glymphatic system" (your brain's nighttime cleaning system) that clears toxins from the brain [31]. Many people "report symptom intensification in fall/winter" or "spring exacerbation with increased allergens" [32]. This may relate to "inflammatory changes with seasonal allergen exposure" and "vitamin D deficiency affecting immune regulation" (low vitamin D levels disrupting how your immune system functions) [32].

A 2025 study found chemical exposures significantly affect brain function, showing "phthalate exposure showed significant correlation with commission error T-scores in visual attention tests" (meaning exposure to common plastic chemicals was linked to attention problems) [33]. "Water-damaged buildings often harbour toxic mould species" that produce mycotoxins (poisonous compounds produced by certain moulds) which "cross blood-brain barrier affecting neural function" and "create chronic inflammatory response in susceptible individuals" (causing ongoing inflammation that can affect brain function in sensitive people) [34]. Research on dietary patterns has also demonstrated significant environmental influences on mental health, with adherence to anti-inflammatory dietary patterns showing protective effects against mood symptoms [35].

Personal Experience: Creating a sleep sanctuary and establishing digital boundaries significantly reduced my baseline anxiety and compulsive checking. I used to keep my phone by my bed and would frequently check emails or social media first thing in the morning and right before sleep. What I didn't realise was how this constant connection was keeping my nervous system in a state of hypervigilance.

When I established a "phone quarantine" (keeping my phone on do not disturb from a certain time in the evening) and created a consistent sleep routine, I noticed a remarkable difference in my morning anxiety levels. This simple change reduced my need to perform morning checking rituals and helped me start the day with more presence and less urgency around my intrusive thoughts.

Similarly, I discovered that certain environments—particularly cluttered spaces with too many visual stimuli—would increase my sense of internal disorder and trigger more frequent intrusive thoughts. Creating more minimalist spaces with reduced sensory input became another tool in managing my symptoms.

Key Takeaways: Environmental Influences

- Poor sleep can dramatically worsen OCD symptoms and wellbeing
- Seasonal changes can affect symptom intensity through multiple mechanisms
- Environmental toxins like mould may trigger neuroinflammation
- Creating supportive physical spaces can reduce baseline stress
- Digital habits significantly influence nervous system regulation

3. The Research Pattern Model of OCD Development

Now that we understand these interconnected domains that influence mental health, let's explore how they converge to create what research suggests is a pattern that can lead to the development and progression of OCD.

Through my personal experience with OCD, extensive research, and clinical work, I've come to understand something crucial: conditions like OCD rarely emerge from a single cause. Instead, they tend to develop when multiple contributing factors across these domains eventually exceed the body's adaptive capacity.

To illustrate how these domains interact in real life, let me share a research pattern example based on patterns observed repeatedly in clinical practice and research literature. This example demonstrates how multiple factors across all six domains can converge to exceed a person's adaptive capacity, creating conditions that contribute to OCD symptom development and intensity.

Research Pattern Example

Starting with the **Neurological Patterns** domain, research shows genetic predisposition patterns, including variations in genes affecting methylation pathways and neurotransmitter function [36]. MTHFR gene variations, for example, affect methylation pathways crucial for neurotransmitter synthesis (production), which may help explain why certain nutritional interventions create significant differences for some individuals [36, 10].

Moving from Neurological Patterns to **Autonomic Regulation**, research identifies heightened sensitivity and attunement to details as characteristics common in many people with OCD [24, 27]. This nervous system sensitivity creates a heightened stress response that can perpetuate OCD patterns. Early life experiences can shape specific fear pathways in the brain and create patterns of hypervigilance—what research understands as early trauma embedding in both neural circuits and the autonomic nervous system [37, 38].

Moving to the **Digestive Function** domain, research shows that antibiotic use can disrupt gut microbiome composition and trigger inflammation, directly affecting brain chemistry [15, 16]. Studies clearly demonstrate connections between infections and OCD onset through multiple inflammatory pathways [12, 13].

This leads us to the **Inflammation Processes** domain. Research demonstrates how antibiotic disruption of gut flora creates intestinal inflammation and increased blood-brain barrier permeability. What begins in the digestive system can spread to systemic inflammation, which then affects neurological function [12, 17]. Food sensitivities can create chronic inflammation that directly influences OCD symptoms—something research continues to explore through systematic investigation protocols [11, 12].

Research shows that people with anxiety and OCD often remain in a persistent fight-or-flight state, depleting crucial nutrients like B vitamins, magnesium, and zinc at a faster rate than those without these conditions [10]. When combined with gut inflammation causing malabsorption (reduced ability to absorb nutrients from food), this creates a challenging cycle where the body needs more nutrients precisely when absorption is compromised. These nutrients are essential for proper neurotransmitter function and stress resilience, potentially perpetuating the very symptoms that created the deficiency in the first place.

Transitioning to the **Environmental Influences** domain, research on mould exposure demonstrates significant intensification of OCD symptoms through neuroinflammatory effects [34]. Environmental factors represent a significant but often overlooked contributor to symptom patterns.

Finally, exploring the **Hormonal Balance** domain, research shows that pregnancy hormonal fluctuations can trigger major symptom changes [21, 22]. The dramatic shifts in oestrogen and progesterone alter neurotransmitter function and enhance inflammatory responses, creating conditions that may intensify OCD patterns.

What makes this research pattern particularly instructive is how it demonstrates that no single factor typically causes OCD. Rather, it's often the accumulation and interaction of multiple contributing factors that eventually exceed adaptive capacity. This pattern may help explain why addressing multiple domains simultaneously appears to support more comprehensive wellbeing than focusing on any single factor in isolation, as suggested by the research presented throughout this guide [6].

4. Six-Domain Self-Assessment Tool

I created this self-assessment tool after years of tracking patterns in both clinical research and personal experience. What started as personal curiosity became a systematic approach that revealed connections between various physiological factors and symptom patterns—links between digestive symptoms and intrusive thought intensity, hormonal fluctuations and OCD themes, and environmental factors and baseline anxiety levels.

This tool isn't diagnostic, but rather a starting point for identifying which physiological domains might be most relevant to your unique OCD experience. It can help guide conversations with your healthcare providers about potential complementary approaches to support your conventional treatment.

Instructions: For each domain below, check any statements that resonate with your experience. There are no right or wrong answers—just your personal patterns.

Domain 1: Neurological Patterns

Check any that apply to your experience:



- I experience brain fog alongside OCD symptoms
- My thoughts feel "stuck" in repetitive patterns
- I have energy crashes that seem to worsen my mental symptoms
- My symptoms are worse at certain times of day (morning, afternoon, evening)
- I'm sensitive to caffeine and notice it affects my anxiety or obsessive thoughts
- I feel mentally "wired" but physically exhausted
- I've noticed B vitamins or magnesium seem to help my mood or anxiety
- I feel like my brain is "revving" and I can't slow down my thoughts

Domain 2: Inflammation Processes

Check any that apply to your experience:



- My OCD symptoms intensify when I'm fighting an illness
- Physical pain or inflammatory conditions seem to affect my OCD symptoms

- My skin, eyes, or sinuses feel more sensitive when my OCD symptoms flare up
- My anxiety/OCD symptoms worsen when I'm dealing with allergies or hay fever
- I notice my OCD symptoms worsen during times of physical stress
- I feel more obsessive or anxious after eating inflammatory foods like fried, sugary or highly processed meals
- I experience joint pain, headaches, or other inflammatory symptoms alongside mental symptoms
- Anti-inflammatory foods (like omega-3s) seem to help my overall wellbeing

Domain 3: Digestive Function

Check any that apply to your experience:



- I notice significant differences in my OCD symptoms based on my diet
- I experience digestive discomfort or issues alongside OCD symptoms
- My OCD symptoms sometimes worsen after eating certain foods
- I've noticed connections between gut health and mental clarity
- I feel more anxious or obsessive 2-4 hours after eating gluten-containing foods
- I experience bloating, gas, or other digestive issues regularly
- I've noticed probiotics seem to help my mood
- I have felt ongoing digestive discomfort following a course of antibiotics

Domain 4: Hormonal Balance

Check any that apply to your experience:



- I notice OCD symptom changes related to hormonal cycles
- Stress seems to significantly impact my OCD intensity
- My energy levels fluctuate alongside OCD symptoms
- I feel more obsessive or anxious in the days before my period

- Hormonal changes (pregnancy, menopause, puberty) have affected my OCD
- My symptoms worsen during times of high stress or major life changes
- I have difficulty winding down at the end of the day
- I feel like my stress hormones are constantly "revved up"

Domain 5: Autonomic Regulation

Check any that apply to your experience:



- I experience physical anxiety symptoms with OCD (racing heart, shallow breathing)
- I have difficulty "turning off" my stress response
- Certain breathing or relaxation techniques help reduce my symptoms
- I feel physically "keyed up" when experiencing intrusive thoughts
- My heart rate feels elevated even when I'm trying to relax
- I notice my breathing becomes shallow when I'm anxious
- I have trouble feeling calm in my body, even when my mind is relatively quiet
- I feel like I'm constantly in "alert" mode

Domain 6: Environmental Influences

Check any that apply to your experience:



- Sleep quality significantly affects my OCD symptoms
- Seasonal changes impact my OCD intensity
- Sensory inputs (sounds, lights, textures) affect my anxiety levels
- Poor sleep dramatically worsens my OCD the next day
- Cluttered or chaotic environments increase my obsessive thoughts
- I'm sensitive to artificial lights, loud noises, or strong smells
- Digital device use (especially before bed) seems to worsen my symptoms
- Certain environments or settings trigger or intensify my OCD

Interpreting Your Results

What Your Checks Reveal: This assessment helps identify which physiological domains may be most relevant to your OCD experience. The domains with the most checked items may be areas where targeted complementary approaches could be most beneficial.

- **0-2 checks in a domain:** This domain may not be a primary factor influencing your OCD symptoms.
- **3-4 checks in a domain:** This domain may be moderately influencing your symptoms and worth exploring with complementary approaches.
- **5+ checks in a domain:** This domain likely plays a significant role in your OCD experience and may benefit from prioritised attention.

Important Note: Many people find they check multiple items across several domains—this is completely normal and reflects the interconnected nature of these physiological systems. Checking many boxes doesn't indicate that your condition is more severe; rather, it demonstrates how these domains influence each other. Often, addressing one domain (like sleep quality) can positively impact others (like hormonal balance and inflammation levels), creating beneficial ripple effects throughout your wellbeing.

Remember: This assessment is a starting point for personal exploration and conversations with healthcare providers—not a diagnostic tool.

Next Steps Based on Your Results

For each domain where you checked multiple items, consider these initial exploration steps:

Neurological Patterns:



- Track your mental clarity alongside food intake for 1-2 weeks
- Notice how sleep quality affects your symptom intensity
- Discuss nutrient testing options with qualified practitioners

Inflammation Processes:



- Observe how illness or allergies affect your OCD symptoms
- Consider an anti-inflammatory diet trial for 2-3 weeks if appropriate for you
- Track your symptom intensity alongside inflammatory foods (fried, sugary or highly processed meals)

Digestive Function:



- Monitor digestive comfort alongside OCD symptom intensity
- Consider introducing probiotics or digestive support with qualified practitioners if appropriate
- Explore potential food sensitivities with qualified guidance

Hormonal Balance:



- Track your symptoms alongside your menstrual cycle (if applicable)
- Monitor stress levels and their impact on symptom intensity
- Consider discussing hormone testing with qualified practitioners

Autonomic Regulation:



- Practice the 'Pause and Three Deep Breaths' technique daily
- Notice your breathing patterns during high-symptom periods
- Explore regular gentle movement if appropriate for you for nervous system support

Environmental Influences:



- Optimise your sleep environment and track results
- Assess your digital habits and their impact on symptoms
- Consider environmental factors like seasonal changes or mould exposure

Important: Always discuss complementary approaches with your healthcare team, especially if you're currently undergoing conventional treatment.

5. Creating Your Personalised Wellbeing Plan

A comprehensive approach might include:

1. **Strong Foundation:** Continuing with evidence-based therapy (Exposure and Response Prevention - ERP) and medication (if prescribed by your doctor)
2. **Personal Exploration:** Identifying which physiological areas seem most relevant to your experience
3. **Gentle Integration:** Gradually incorporating supportive practices **after discussing them with your team of qualified health professionals** that address your unique needs
4. **Mindful Observation:** Noticing how different factors affect your wellbeing and adjusting accordingly

5. **Professional Collaboration:** Working with healthcare providers who understand both conventional and complementary approaches

When implementing this comprehensive approach, it's important to understand that physiological changes often follow a different timeline than psychological interventions. While some practices like nervous system regulation techniques can produce noticeable shifts within days, deeper changes in inflammatory patterns, microbiome composition, and hormonal regulation may take weeks or months to fully manifest. This process resembles cultivating a garden rather than flipping a switch—each small, consistent action contributes to creating the conditions where wellness becomes possible.

Signs That Exploring These Domains Might Help

Consider exploring these complementary pathways if you:

- Notice your symptoms seem worse during certain times or situations
- Experience significant fluctuations despite consistent therapy
- Have made progress but reached a plateau in symptom improvement
- Feel there might be "missing pieces" in your current approach

6. Practical Next Steps

This holistic six-domain approach doesn't replace conventional OCD care—it's designed to potentially enhance it through thoughtful integration. Here are some starting points based on where you are in your journey:

If You're Just Beginning:

- Focus first on evidence-based conventional care (ERP therapy, medication if recommended by your doctor)
- Start gentle self-care practices for overall wellbeing
- Begin noticing patterns in how various factors might affect your symptoms

If You're Already in Treatment:

- Continue your current treatment approach with your healthcare providers
- Consider which domains might be most relevant to your experience
- Discuss any complementary approaches with **all** your healthcare providers before implementation

If You've Reached a Plateau:

- Maintain your therapeutic foundation with your current healthcare providers
- Consider whether a more comprehensive exploration of physiological factors might be helpful

- Work with practitioners who understand both conventional and complementary approaches and who collaborate with your existing healthcare team

Honouring Your Unique Journey

Your experience with OCD is unique, and the most effective approach honours your individual needs, values, and circumstances. There is no one-size-fits-all solution, but rather a thoughtful exploration of what works best for you.

From my own journey with OCD, I've learned that wellness is rarely linear. There have been setbacks and challenges along the way, but each small step forward compounds over time. The combination of conventional treatments with complementary approaches actively addressing these six domains has created a level of wellness and symptom management I never thought possible during my darkest days with OCD.

By expanding our understanding to include both psychological and physiological aspects, we create space for comprehensive support that addresses the full complexity of OCD. I hope this holistic approach provides helpful insights for your wellness journey. Remember that small steps consistently taken can lead to meaningful improvements over time.

I invite you to approach this holistic perspective with both openness and discernment. Consider which domain seems most relevant to your experience right now and explore one simple practice from that area as a starting point.

Remember that integrating complementary approaches with your conventional treatment isn't about replacing what works—it's about enhancing your overall support system by addressing the beautiful complexity of mind-body connections.

7. About Janaya Karloci

Supporting OCD Wellbeing Through Complementary Approaches



As someone who lived with undiagnosed OCD for over 20 years before finding balance through integrated approaches, I bring a unique perspective that many practitioners cannot offer—authentic understanding forged through personal experience, combined with evidence-informed clinical expertise.

My journey inspired me to develop this holistic six-domain approach specifically for OCD after discovering how naturopathic approaches could complement my conventional

treatment in ways that transformed my wellness journey. This experience led me to focus on supporting OCD and related conditions in my practice.

My unique position—standing in both the worlds of naturopathic practice and lived OCD experience—allows me to bridge these perspectives in ways that honour the importance of conventional treatment while recognising opportunities for complementary support. This integrated approach guides all aspects of my clinical work, research, and educational efforts.

As a degree-qualified naturopath (with distinction), I'm passionate about bridging the gap between conventional OCD treatment and evidence-informed naturopathic care. I work collaboratively with psychologists, psychiatrists, and other healthcare providers to ensure truly integrated care that addresses both psychological and physiological aspects of OCD. My approach always honours the foundation of conventional treatment while exploring complementary strategies that may help address the often-overlooked physiological factors that can influence OCD experiences.

Join My OCD Wellness Community

If you found this approach helpful and would like ongoing support for your OCD wellness journey, I invite you to join my community:

If you haven't already, [**Subscribe to My Newsletter**](#) to receive regular evidence-informed insights, practical strategies, and exclusive resources specifically for OCD management that you won't find anywhere else. My subscribers get priority access to:

- Early notification of workshops and programs
- Exclusive content on implementing holistic approaches to OCD
- Practical tools for each domain
- The latest research on integrative approaches to OCD

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Join my Facebook Group "[**OCD & The Mind-Body Connection: Complementary Support Community**](#)"

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8. References

[1] American Psychiatric Association, Koran, L. M., Hanna, G. L., Hollander, E., Nestadt, G., & Simpson, H. B. (2007). Practice guideline for the treatment of patients with obsessive-compulsive disorder. Arlington, VA: American Psychiatric Association. <https://www.researchgate.net/publication/5990301>

[2] National Collaborating Centre for Mental Health (UK). (2006). Obsessive-compulsive disorder: Core interventions in the treatment of obsessive-compulsive disorder and body dysmorphic disorder (NICE Clinical Guidelines, No. 31). British Psychological Society. <https://pubmed.ncbi.nlm.nih.gov/21834191/>

[3] Stein, D. J., Costa, D. L. C., Lochner, C., Miguel, E. C., Reddy, Y. C. J., Shavitt, R. G., van den Heuvel, O. A., & Simpson, H. B. (2019). Obsessive-compulsive disorder. *Nature Reviews Disease Primers*, 5, Article 52. <https://doi.org/10.1038/s41572-019-0102-3>

[4] Biria, M., et al. (2023). Cortical glutamate and GABA are related to compulsive behaviour in individuals with obsessive compulsive disorder and healthy controls. *Nature Communications*, 14(1), 3324. <https://doi.org/10.1038/s41467-023-38695-z>

[5] van den Heuvel, O. A., et al. (2016). Brain circuitry of compulsion. *European Neuropsychopharmacology*, 26(5), 810-827. <https://doi.org/10.1016/j.euroneuro.2015.12.005>

[6] Sarris, J., Camfield, D., & Berk, M. (2012). Complementary medicine, self-help, and lifestyle interventions for obsessive-compulsive disorder (OCD) and the OCD spectrum: A systematic review. *Journal of Affective Disorders*, 138(3), 213-221. <https://doi.org/10.1016/j.jad.2011.04.051>

[7] Jewett, B. E., & Thapa, B. (2025). Physiology, NMDA Receptor. In StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK519495/>

[8] Bragdon, L. B., Eng, G. K., Recchia, N., Collins, K. A., & Stern, E. R. (2023). Cognitive neuroscience of obsessive-compulsive disorder. *Psychiatric Clinics of North America*, 46(1), 53-67. <https://doi.org/10.1016/j.psc.2022.11.001>

[9] Seibell, P. J., & Hollander, E. (2014). Management of obsessive-compulsive disorder. *F1000Research*, 11, 82. <https://pmc.ncbi.nlm.nih.gov/articles/PMC4126524/>

[10] Kennedy, D. O. (2016). B vitamins and the brain: Mechanisms, dose and efficacy—A review. *Nutrients*, 8(2), 68. <https://doi.org/10.3390/nu8020068>

[11] Bhatt, S., et al. (2024). Targeting inflammatory signaling in obsessive-compulsive disorder: A promising approach. *Metabolic Brain Disease*, 39(1), 335-346. <https://doi.org/10.1007/s11011-023-01314-3>

[12] Gray, S. M., & Bloch, M. H. (2012). Systematic review of proinflammatory cytokines in obsessive-compulsive disorder. *Current Psychiatry Reports*, 14(3), 220-228. <https://doi.org/10.1007/s11920-012-0272-0>

[13] Konuk, N., et al. (2007). Plasma levels of tumor necrosis factor-alpha and interleukin-6 in obsessive compulsive disorder. *Mediators of Inflammation*, 2007, 65704. <https://doi.org/10.1155/2007/65704>

[14] Westwell-Roper, C., et al. (2022). Severe symptoms predict salivary interleukin-6, interleukin-1 β , and tumor necrosis factor- α levels in children and youth with obsessive-compulsive disorder. *Journal of Psychosomatic Research*, 158, 110743. <https://doi.org/10.1016/j.jpsychores.2022.110743>

[15] Rathore, K., et al. (2025). The bidirectional relationship between the gut microbiome and mental health: A comprehensive review. *Cureus*, 17(3), Article e80810. <https://doi.org/10.7759/cureus.80810>

[16] Petrut, S.-M., et al. (2025). Gut over mind: Exploring the powerful gut-brain axis. *Nutrients*, 17(5), Article 842. <https://doi.org/10.3390/nu17050842>

[17] Turna, J., et al. (2020). The gut microbiome and inflammation in obsessive-compulsive disorder. *Journal of Psychiatric Research*, 123, 150-157. <https://pubmed.ncbi.nlm.nih.gov/32307692/>

[18] Boonchooduang, N., et al. (2025). Impact of psychostimulants on microbiota and short-chain fatty acids alterations in children with attention-deficit/hyperactivity disorder. *Scientific Reports*, 15, Article 3034. <https://doi.org/10.1038/s41598-025-87546-y>

[19] Kumar, A., et al. (2024). The role of gut microbiota in anxiety and depression: A neuropsychobiological perspective. *International Journal of Creative Research Thoughts*, 12(12), c969-c977. <https://ijcrt.org/papers/IJCRT2412319.pdf>

[20] Schnorr, S.L., & Bachner, H.A. (2016). Integrative therapies in anxiety treatment with special emphasis on the gut microbiome. *The Yale Journal of Biology and Medicine*, 89(3), 397-422. <https://pmc.ncbi.nlm.nih.gov/articles/PMC5045149/>

[21] Labad, J., Menchón, J. M., Alonso, P., Segalàs, C., Jiménez, S., & Vallejo, J. (2005). Female reproductive cycle and obsessive-compulsive disorder. *The Journal of Clinical Psychiatry*, 66(4), 428-435. <https://doi.org/10.4088/jcp.v66n0404>

[22] Del Río, J. P., Allende, M. I., Molina, N., Serrano, F. G., Molina, S., & Vigil, P. (2018). Steroid hormones and their action in women's brains: The importance of hormonal balance. *Frontiers in Public Health*, 6, 141. <https://doi.org/10.3389/fpubh.2018.00141>

[23] Hantsoo, L., & Epperson, C. N. (2015). Premenstrual dysphoric disorder: Epidemiology and treatment. *Current Psychiatry Reports*, 17(11), Article 87. <https://doi.org/10.1007/s11920-015-0628-3>

[24] Pittig, A., et al. (2013). Heart rate and heart rate variability in panic, social anxiety, obsessive-compulsive, and generalized anxiety disorders at baseline and in response to relaxation and hyperventilation. *International Journal of Psychophysiology*, 87(1), 19-27.

<https://doi.org/10.1016/j.ijpsycho.2012.10.012>

[25] Roberts, B., Eisenlohr-Moul, T., & Martel, M. M. (2018). Reproductive steroids and ADHD symptoms across the menstrual cycle. *Psychoneuroendocrinology*, 88, 105-114.

<https://doi.org/10.1016/j.psyneuen.2017.11.015>

[26] Caykoylu, A., Sahin, E. K., & Ugurlu, M. (2022). Could the thyroid gland dominate the brain in obsessive-compulsive disorder?

Neuroendocrinology, 112(12), 1143-1154.

<https://pubmed.ncbi.nlm.nih.gov/35443249>

[27] Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, 74(2), 116-143. <https://doi.org/10.1016/j.biopsych.2006.06.009>

[28] Cisler, J. M., & Koster, E. H. W. (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative review. *Clinical Psychology Review*, 30(2), 203-216. <https://doi.org/10.1016/j.cpr.2009.11.003>

[29] Zaccaro, A., et al. (2018). How breath-control can change your life: A systematic review on psycho-physiological correlates of slow breathing. *Frontiers in Human Neuroscience*, 12, Article 353.

<https://doi.org/10.3389/fnhum.2018.00353>

[30] Porges, S. W. (2004). Neuroception: A subconscious system for detecting threats and safety. *Zero to Three*, 24(5), 19-24.

[31] Cox, R. C., et al. (2016). Sleep disturbance and obsessive-compulsive symptoms: Results from the national comorbidity survey replication. *Journal of Psychiatric Research*, 96, 210-215.

<https://pubmed.ncbi.nlm.nih.gov/26802809/>

[32] Yurdagül Altintas, E., Kütük, M., & Tufan, A. E. (2021). Seasonal Variations in Obsessive-Compulsive Disorder: Analysis of Prospective-Clinical Data. *Noro Psikiyatri Arsivi*, 58, 193-199. <https://doi.org/10.29399/npa.27205>

[33] Yeo, K. E., et al. (2025). Association between endocrine-disrupting chemicals exposure and attention-deficit/hyperactivity disorder symptoms in children with attention-deficit/hyperactivity disorder. *Journal of Korean Academy of Child and Adolescent Psychiatry*, 36(1), 18-25. <https://doi.org/10.5765/jkacap.240035>

[34] Hope, J. (2013). A review of the mechanism of injury and treatment approaches for illness resulting from exposure to water-damaged buildings, mold, and mycotoxins. *The Scientific World Journal*, 2013, Article 767482. <https://doi.org/10.1155/2013/767482>

[35] Arshad, H., et al. (2024). Adherence to MIND diet and risk of recurrent depressive symptoms: Prospective Whitehall II cohort study. *Nutrients*, 16(23), 4062. <https://doi.org/10.3390/nu16234062>

[36] Pauls, D. L., et al. (2014). Obsessive-compulsive disorder: An integrative genetic and neurobiological perspective. *Nature Reviews Neuroscience*, 15, 410-424. <https://doi.org/10.1038/nrn3746>

[37] Destrée, L., Brierley, M. E., Albertella, L., Jobson, L., & Fontenelle, L. F. (2021). The effect of childhood trauma on the severity of obsessive-compulsive symptoms: A systematic review. *Journal of Psychiatric Research*, 142, 345-360. <https://doi.org/10.1016/j.jpsychires.2021.08.017>

[38] Boswell, J. F., et al. (2013). Intolerance of uncertainty: A common factor in the treatment of emotional disorders. *Journal of Clinical Psychology*, 69(6), 630-645. <https://doi.org/10.1002/jclp.21965>

[39] Schneider, H., Pitossi, F., Balschun, D., Wagner, A., del Rey, A., & Besedovsky, H. O. (1998). A neuromodulatory role of interleukin-1 β in the hippocampus. *Proceedings of the National Academy of Sciences*, 95(13), 7778-7783. <https://doi.org/10.1073/pnas.95.13.7778>

[40] Pan, W., & Kastin, A. J. (2002). TNF α transport across the blood-brain barrier is abolished in receptor knockout mice. *Neuroscience Letters*, 322(1), 33-36. <https://www.sciencedirect.com/science/article/abs/pii/S0014488602978714>

[41] Banks, W. A., Kastin, A. J., & Broadwell, R. D. (1995). Passage of cytokines across the blood-brain barrier. *Neuroimmunomodulation*, 2(4), 241-248. <https://doi.org/10.1159/000097202>

[42] Kong, E., Sucic, S., Monje, F. J., Reisinger, S. N., Savalli, G., Diao, W., ... & Pollak, D. D. (2015). STAT3 controls IL6-dependent regulation of serotonin transporter function and depression-like behavior. *Scientific Reports*, 5, 9009. <https://doi.org/10.1038/srep09009>

[43] Zhu, C. B., Blakely, R. D., & Hewlett, W. A. (2006). The proinflammatory cytokines interleukin-1beta and tumor necrosis factor-alpha activate serotonin transporters. *Neuropsychopharmacology*, 31(10), 2121-2131. <https://doi.org/10.1038/sj.npp.1301029>

[44] Takeuchi, H., Jin, S., Wang, J., Zhang, G., Kawanokuchi, J., Kuno, R., ... & Suzumura, A. (2006). Tumor necrosis factor- α induces neurotoxicity via glutamate release from hemichannels of activated microglia in an autocrine manner. *Journal of Biological Chemistry*, 281(30), 21362-21368. <https://doi.org/10.1074/jbc.M600504200>

[45] Aslam, M., Ahmad, N., Srivastava, R., & Hemmer, B. (2012). TNF-alpha induced NF κ B signaling and p65 (RelA) overexpression repress Cldn5 promoter in mouse brain endothelial cells. *Cytokine*, 57(2), 269-275. <https://doi.org/10.1016/j.cyto.2011.10.016>

[46] Yang, Y., & Rosenberg, G. A. (2011). Blood-brain barrier breakdown in acute and chronic cerebrovascular disease. *Stroke*, 42(11), 3323-3328. <https://doi.org/10.1161/STROKEAHA.110.608257>

[47] Miller, A. H., Haroon, E., Raison, C. L., & Felger, J. C. (2013). Cytokine targets in the brain: impact on neurotransmitters and neurocircuits. *Depression and Anxiety*, 30(4), 297-306. <https://doi.org/10.1002/da.22084>

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