**Understanding the Root Causes of Restless Legs Syndrome (RLS)**

Restless Legs Syndrome (RLS), also known as Willis-Ekbom Disease, is a neurological condition characterized by an uncontrollable urge to move the legs, often accompanied by strange or uncomfortable sensations. While **the exact cause of primary (idiopathic) RLS isn’t completely understood**, researchers have uncovered key physiological and biochemical factors that likely underlie the disorder[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=The%20pathogenesis%20of%C2%A0RLS%20is%20not,iron%2C%20ferritin%20level%2C%20and%20high)[mayoclinic.org](https://www.mayoclinic.org/diseases-conditions/restless-legs-syndrome/symptoms-causes/syc-20377168#:~:text=Causes). In simple terms, RLS appears to result from **misfires in the nervous system** – especially involving the brain’s movement circuits and certain chemical messengers – rather than from muscle or orthopedic problems in the legs. Below, we break down the scientifically validated root causes and mechanisms that are “happening under the surface” in RLS.

**Dopamine Imbalance in the Brain’s Movement Center (Basal Ganglia)**

One of the main culprits in RLS is thought to be an *imbalance of dopamine*, a neurotransmitter (brain chemical messenger) vital for controlling muscle activity and movement[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=The%20basal%20ganglia%20uses%20a,help%20control%20muscle%20activity%20and%C2%A0movement)[mayoclinic.org](https://www.mayoclinic.org/diseases-conditions/restless-legs-syndrome/symptoms-causes/syc-20377168#:~:text=Often%2C%20there%27s%20no%20known%20cause,messages%20to%20control%20muscle%20movement). RLS is linked to a problem in a brain region called the **basal ganglia**, which helps regulate movements. The basal ganglia rely on dopamine to produce smooth, coordinated muscle actions[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=The%20basal%20ganglia%20uses%20a,help%20control%20muscle%20activity%20and%C2%A0movement). If something disrupts dopamine signaling in these circuits, the brain may struggle to keep the legs still at rest.

* **How Dopamine Dysfunction Triggers RLS:** When dopamine levels or signaling in the brain are *out of balance*, it can lead to irregular nerve firing and muscle control issues. In RLS, this likely causes the sensations of crawling or tingling and the urge to move the legs to get relief. In fact, damage or dysfunction in the dopamine-producing cells (like that seen in certain basal ganglia disorders) can cause muscle spasms or involuntary movements[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=Dopamine%20acts%20as%20a%20messenger,ordinate%20movement). It’s no coincidence that **medications which boost dopamine** (such as pramipexole or ropinirole) often alleviate RLS symptoms – a strong clue that dopamine is central to the condition[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=There%27s%20evidence%20to%20suggest%20restless,brain%20called%20the%20basal%20ganglia).
* **Worse at Night: The Circadian Dopamine Drop:** Many people notice their RLS is **much worse in the evenings or at night**. A biological reason for this is that dopamine levels naturally decline toward the end of the day[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=which%20causes%20muscle%20spasms%20and%C2%A0involuntary,movements). Even in people without RLS, dopamine activity follows a daily rhythm. For those with RLS, this nightly dip in dopamine activity may *exacerbate the underlying dopamine imbalance*, causing symptoms to flare when they’re trying to rest or sleep[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=which%20causes%20muscle%20spasms%20and%C2%A0involuntary,movements). In short, the brain’s normal evening “slow-down” in dopamine makes it even harder for an RLS-affected nervous system to keep the legs calm.
* **Relation to Other Dopamine Conditions:** The dopamine connection in RLS is further supported by its overlap with other neurological conditions. For example, Parkinson’s disease – which involves dopamine deficiency in the basal ganglia – is associated with a higher risk of RLS symptoms[mayoclinic.org](https://www.mayoclinic.org/diseases-conditions/restless-legs-syndrome/symptoms-causes/syc-20377168#:~:text=,increased%20risk%20of%20developing%20RLS). (Importantly, RLS in Parkinson’s may arise due to the dopamine loss or as a side effect of Parkinson’s meds.) This link underlines that when the **dopamine pathway is disturbed**, whether by disease or other factors, RLS-like restlessness can emerge.

**Low Iron Levels in the Brain and Dopamine Production**

Another *major* scientifically supported root cause of RLS is **iron deficiency – specifically, low iron levels in the brain**. Iron isn’t just a nutrient for making red blood cells; it’s also crucial for brain chemistry. In particular, iron is a co-factor needed to produce dopamine. Research has shown that many people with RLS have **diminished iron stores in certain brain regions** involved in movement control (for example, the substantia nigra, which is part of the basal ganglia)[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=including%20BTBD9%20and%20MEIS1%20are,1%5D%C2%A0Restless%20leg%20syndrome%20is%20extremely)[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=imaging%20studies%20have%20shown%20decreased,especially%20during%20the%20third%20trimester). Here’s how iron ties in and triggers RLS:

* **Iron as a Fuel for Dopamine:** In the brain, iron helps an enzyme (tyrosine hydroxylase) convert tyrosine into L-DOPA, the molecule that then becomes dopamine[pmc.ncbi.nlm.nih.gov](https://pmc.ncbi.nlm.nih.gov/articles/PMC6183309/#:~:text=efficiently%20improves%20RLS%20symptoms,on%20iron%20metabolism%2C%20and%20individuals). If iron levels are too low, this dopamine-producing process can falter. Think of it like a factory running low on a critical raw material – the output (dopamine) diminishes. **Scientific reviews have noted that iron deficiency could reduce dopamine production and function, thereby worsening RLS symptoms**[pmc.ncbi.nlm.nih.gov](https://pmc.ncbi.nlm.nih.gov/articles/PMC6183309/#:~:text=efficiently%20improves%20RLS%20symptoms,on%20iron%20metabolism%2C%20and%20individuals). In essence, *low brain iron = low dopamine*, creating the same kind of imbalance mentioned above.
* **Evidence of Brain Iron Deficiency in RLS:** Advanced studies using brain scans (like MRI) and even examinations of brain tissue have **consistently found reduced iron levels in the brains of RLS patients**, especially in areas controlling movement[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=including%20BTBD9%20and%20MEIS1%20are,1%5D%C2%A0Restless%20leg%20syndrome%20is%20extremely)[pubmed.ncbi.nlm.nih.gov](https://pubmed.ncbi.nlm.nih.gov/28236139/#:~:text=causes%20a%20persistent%20urge%20to,the%20endogenous%20opioid%20and%20melanocortin). This is not merely low iron in the bloodstream, but in the central nervous system. Notably, researchers from Johns Hopkins and elsewhere have concluded that *“brain iron deficiency is well-recognized as a main initial pathophysiological mechanism of RLS.”*[frontiersin.org](https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2017.00722/full#:~:text=The%20symptomatology%20of%20Restless%20Legs,On%20the%20other) In other words, low iron in the brain is now seen as a key trigger that sets off the cascade leading to RLS.
* **Iron, Dopamine and the RLS Chain Reaction:** The current scientific thinking is that **iron and dopamine issues are intertwined** in RLS. Low brain iron disrupts normal dopamine production and receptor function, which then leads to the abnormal nerve signaling that causes RLS sensations[pmc.ncbi.nlm.nih.gov](https://pmc.ncbi.nlm.nih.gov/articles/PMC6183309/#:~:text=efficiently%20improves%20RLS%20symptoms,on%20iron%20metabolism%2C%20and%20individuals)[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=including%20BTBD9%20and%20MEIS1%20are,1%5D%C2%A0Restless%20leg%20syndrome%20is%20extremely). Supporting this, treating iron deficiency can improve RLS in many cases. Doctors often check ferritin (iron storage) levels in RLS patients and recommend iron supplements if levels are low. In fact, the connection between iron and RLS has been known for decades: the first reports in the 1950s showed some patients found relief with iron injections[pmc.ncbi.nlm.nih.gov](https://pmc.ncbi.nlm.nih.gov/articles/PMC6183309/#:~:text=description%20of%20restless%20legs%20syndrome,about%20the%20disease%20is%20still)[pmc.ncbi.nlm.nih.gov](https://pmc.ncbi.nlm.nih.gov/articles/PMC6183309/#:~:text=subsequently%20reported%20on%20the%20use,the%20exact%20mechanism%20of%20dopaminergic). Today, **most imaging studies point to dysregulated iron handling in the brain as a fundamental piece of the RLS puzzle**[pmc.ncbi.nlm.nih.gov](https://pmc.ncbi.nlm.nih.gov/articles/PMC6183309/#:~:text=individuals%20with%20RLS%20with%20low,of%20tyrosine%20to%20levodopa%20by).
* **Why Iron Gets Low in the Brain:** Researchers are still unraveling *why* some people’s brains become iron-deficient even when blood iron levels might be normal. There may be genetic factors or issues with how iron is transported or stored in the brain. Interestingly, conditions that cause low systemic iron (like anemia) or increase iron requirements often provoke RLS symptoms, which leads us to secondary causes below.

**Genetic Predisposition and Nerve Pathway Development**

**Heredity plays an important role** in many RLS cases. It’s common to find that a patient’s parent or grandparent also suffered from “the nighttime jitters in the legs.” Researchers have identified **specific gene variants associated with RLS**, confirming that it can run in families[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=Research%20has%20identified%20specific%20genes,before%20the%20age%20of%2040). In familial (inherited) cases, symptoms often begin earlier in life (before age 40), suggesting a genetic influence on the nervous system that is present from a young age[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=Research%20has%20identified%20specific%20genes,before%20the%20age%20of%2040).

* **Genes Involved:** Several genes have been linked to RLS in large studies. Two examples are **BTBD9 and MEIS1**, which consistently show up in genetic analyses of RLS patients[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=pre,1%5D%C2%A0Restless%20leg%20syndrome%20is%20extremely). These genes are thought to influence how the brain’s circuits develop and how iron or dopamine are regulated. For instance, some RLS-linked genes might affect **iron uptake in the brain or the development of certain neurons**. While having these gene variants *doesn’t guarantee* someone will get RLS, it **raises susceptibility** – like a latent tendency that might be triggered under the right conditions (such as aging, low iron, or other factors).
* **Neurodevelopmental Factors:** There is a hypothesis that RLS could, in part, be a neurodevelopmental disorder – meaning subtle differences in how the brain’s sensorimotor pathways formed. The genetic factors might lead to a wiring that is slightly prone to over-excitability or miscommunication between the legs and the brain. Indeed, RLS is now thought of as a **“complex network disorder” involving several neurochemical systems** and abnormal excitability in the central nervous system[mdpi.com](https://www.mdpi.com/2076-3425/12/1/118#:~:text=pathophysiological%20perspectives,175)[mdpi.com](https://www.mdpi.com/2076-3425/12/1/118#:~:text=We%20might%20hypothesize%20that%20abnormal,be%20functionally%20relevant%20as%20well). The genetic predisposition essentially sets the stage upon which other factors (like iron and dopamine changes) act.

In summary, **genes load the gun and environment pulls the trigger**: one might inherit a nervous system that is vulnerable to RLS, and then if iron levels drop or other stresses occur, the condition manifests.

**Other Biochemical Factors and Nervous System Hyperexcitability**

Beyond the core dopamine-iron story, scientists have discovered **additional imbalances in the RLS brain** that help explain why the legs feel so restless. RLS isn’t just about one chemical – it appears to involve a broader dysregulation of how signals are sent and received in the nervous system, especially at night. Key points include:

* **Glutamate – Excess Excitation:** Glutamate is the brain’s main excitatory neurotransmitter (it makes nerves fire). Studies have found that RLS patients can have *higher levels of glutamate activity in the brain at night*, a “hyperglutamatergic” state[frontiersin.org](https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2017.00722/full#:~:text=The%20symptomatology%20of%20Restless%20Legs,On%20the%20other)[mdpi.com](https://www.mdpi.com/2076-3425/12/1/118#:~:text=pathophysiological%20perspectives,175). This could explain the **hyperarousal** many feel – even though they’re tired, their brains feel too alert or “wired” to relax. In fact, brain imaging research (using scans and spinal fluid analysis) showed elevated glutamate in RLS patients who sleep poorly, and interestingly, treatments like **gabapentin** (which reduces glutamate signaling) often help relieve RLS symptoms. This suggests that **too much excitatory drive** in the brain contributes to the urge to move the legs.
* **Adenosine – Reduced Calming Signals:** Adenosine is a neurochemical that generally has calming, sleep-promoting effects (it builds up to make you sleepy, and caffeine works by blocking adenosine). In RLS, some research points to a *deficit in adenosine activity* – a “hypoadenosinergic” state[mdpi.com](https://www.mdpi.com/2076-3425/12/1/118#:~:text=We%20might%20hypothesize%20that%20abnormal,be%20functionally%20relevant%20as%20well). In simpler terms, the brain at night might not be getting enough of the natural **“slow down” signal**. Animal models of RLS with low brain iron have shown lower function of adenosine receptors, leading to increased glutamate and dopamine activity as a downstream effect[frontiersin.org](https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2017.00722/full#:~:text=presynaptic%20hyperglutamatergic%20state%2C%20seem%20to,1%7D%20receptors)[frontiersin.org](https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2017.00722/full#:~:text=adenosinergic%20transmission%2C%20with%20downregulation%20of,treatment%20of%20RLS%2C%20completely%20counteracted). This imbalance (too little calming influence, too much excitatory influence) can set the stage for restlessness. It aligns with why **caffeine (an adenosine blocker) often worsens RLS symptoms** for many people, and why avoiding caffeine, especially in the evening, is recommended.
* **Hyperexcitable Nerves and Reflexes:** Neurologically, RLS seems to involve *overactivity of certain reflex pathways*. Some neurophysiology tests in RLS patients show increased excitability in the spinal cord or motor cortex (the areas controlling movement)[mdpi.com](https://www.mdpi.com/2076-3425/12/1/118#:~:text=pathophysiological%20perspectives,175). Essentially, the “brakes” on movement are not as strong as the “gas pedal” signals. This might be why even small sensory inputs (like lying still or feeling an urge) can release unnecessary motor output (leg movements). The **sensory system** also likely plays a role – there may be abnormal processing of sensations from the legs that fool the brain into thinking movement is needed when it’s not[mdpi.com](https://www.mdpi.com/2076-3425/12/1/118#:~:text=excitatory%20mechanisms%2C%20rather%20than%20hypofunctioning,175). This hyperexcitable state is usually **specific to when you’re at rest**; interestingly, when you start moving (walking, stretching), it provides temporary relief by resetting that balance of inputs to the nervous system[mdpi.com](https://www.mdpi.com/2076-3425/12/1/118#:~:text=We%20might%20hypothesize%20that%20abnormal,be%20functionally%20relevant%20as%20well).

**Bottom line:** RLS can be described as a perfect storm in the nervous system at night – *lower dopamine and iron levels*, *higher glutamate (excitation)*, and *lower adenosine (calming)*, all occurring in a person whose genetic makeup or health status makes their nerve pathways extra excitable. This leads to the brain sending out confusing signals to the legs: essentially, *“we need to move!”* even when there’s no real need to. These biochemical misfires create the compelling sensations and relief-through-movement cycle characteristic of RLS.

**Secondary Causes and Triggers of RLS**

In some people, RLS is **triggered or worsened by other underlying conditions** – this is known as *secondary RLS*. Investigating these links has further reinforced the role of dopamine and iron in RLS. Notable examples include:

* **Iron Deficiency Anemia:** Low iron levels in the body (and by extension, possibly in the brain) are a well-known reversible cause of RLS. People with iron-deficiency anemia often develop RLS symptoms, and correcting the anemia can improve or resolve the restlessness. As noted earlier, **too little iron can lead to a drop in dopamine**, directly *triggering RLS symptoms*[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=,4%20weeks%20of%20giving%20birth). Doctors consider ferritin <~50 ng/mL a potential risk factor for RLS and may recommend iron therapy.
* **Chronic Kidney Disease (Uremia):** RLS is very common in patients with kidney failure – nearly a quarter to half of dialysis patients report RLS. Kidney failure often causes anemia and low iron stores due to reduced erythropoietin and iron utilization problems. **When the kidneys don’t function, iron levels in the blood tend to decrease** and other metabolic changes occur; these shifts *may cause or worsen RLS*[mayoclinic.org](https://www.mayoclinic.org/diseases-conditions/restless-legs-syndrome/symptoms-causes/syc-20377168#:~:text=bowels%20may%20have%20iron%20deficiency,may%20cause%20or%20worsen%20RLS). RLS symptoms in kidney patients often improve after a successful kidney transplant or targeted treatment of the anemia[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=RLS%20affects%20close%20to%201%2F3rd,21), underscoring the iron connection.
* **Pregnancy:** Pregnant women frequently experience RLS, especially in the third trimester. This is likely due to a combination of factors: iron levels often drop (the developing baby consumes a lot of iron), and hormonal changes (like elevated estrogen) might play a role[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=susceptibility%20loci%20with%20RLS,demonstrate%20a%20state%20of%20relative). About 1 in 5 pregnant women get RLS temporarily[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=Between%205,10). The reassuring news is that in most cases the symptoms *disappear within weeks after delivery*[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=diabetes%20%2C%20%2016%2C%20rheumatoid,4%20weeks%20of%20giving%20birth) as iron and hormone levels normalize. However, having RLS in pregnancy could indicate an increased risk of developing chronic RLS later in life[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=RLS%20affects%20close%20to%201%2F3rd,to%20RLS%20in%20uremic%20patients).
* **Peripheral Neuropathy:** Damage to the peripheral nerves (for example, due to diabetes or alcoholism) is associated with RLS[mayoclinic.org](https://www.mayoclinic.org/diseases-conditions/restless-legs-syndrome/symptoms-causes/syc-20377168#:~:text=RLS%20usually%20isn%27t%20related%20to,with%20other%20conditions%2C%20such%20as). Neuropathy might contribute to RLS by generating abnormal sensory signals from the limbs or by affecting nerve fibers that influence the spinal cord reflexes. If the brain is getting erratic input from damaged nerves, it may respond with the urge to move the legs. Treating the underlying neuropathy (blood sugar control, etc.) can sometimes ease RLS symptoms.
* **Other Medical Conditions:** RLS has been linked to a variety of other conditions, including **Parkinson’s disease, rheumatoid arthritis, hypothyroidism, fibromyalgia, and spinal cord lesions**[mayoclinic.org](https://www.mayoclinic.org/diseases-conditions/restless-legs-syndrome/symptoms-causes/syc-20377168#:~:text=bowels%20may%20have%20iron%20deficiency,Parkinson%27s%20disease%20may%20have%20an). In many of these cases, the connection circles back to our core mechanisms: for example, Parkinson’s disease is a dopamine-related disorder (hence RLS appears as a comorbidity), and rheumatoid arthritis or other chronic illnesses may cause anemia or inflammation that affects iron availability. Even certain medications (like some antidepressants, antipsychotics, or antihistamines) can trigger or worsen RLS in susceptible individuals[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=These%20include%20medications%20such%20as%3A), likely by interfering with dopamine or other neurotransmitters. Identifying and addressing these contributors is an important part of RLS management.

**Summary: Why Your Body Feels This Way**

To put it all together, **Restless Legs Syndrome is essentially a neurologic condition caused by miscommunication in the brain’s motor and sensory systems**, rooted in specific chemical and physiological imbalances:

* **Dopamine imbalance** in the brain’s movement centers leads to poor regulation of muscle activity, especially at night[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=Dopamine%20acts%20as%20a%20messenger,ordinate%20movement).
* **Brain iron deficiency** underlies and worsens that dopamine problem – without enough iron, dopamine levels and function drop, triggering the urge to move[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=,4%20weeks%20of%20giving%20birth)[pmc.ncbi.nlm.nih.gov](https://pmc.ncbi.nlm.nih.gov/articles/PMC6183309/#:~:text=efficiently%20improves%20RLS%20symptoms,on%20iron%20metabolism%2C%20and%20individuals).
* **Genetic factors** set the stage by making someone’s neural circuitry more prone to these issues (many people with RLS inherit this susceptibility)[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=Research%20has%20identified%20specific%20genes,before%20the%20age%20of%2040).
* **Other neurotransmitters and pathways** (like increased glutamate and reduced adenosine activity) contribute to a state of hyper-excitable nerves, meaning the brain has a hard time “turning off” the desire to move the limbs at night[frontiersin.org](https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2017.00722/full#:~:text=The%20symptomatology%20of%20Restless%20Legs,On%20the%20other)[mdpi.com](https://www.mdpi.com/2076-3425/12/1/118#:~:text=We%20might%20hypothesize%20that%20abnormal,be%20functionally%20relevant%20as%20well).
* **Triggers or underlying conditions** (low iron, kidney disease, pregnancy, etc.) frequently activate RLS in those who are susceptible, by disturbing the same iron-dopamine balance and nerve function described above[mayoclinic.org](https://www.mayoclinic.org/diseases-conditions/restless-legs-syndrome/symptoms-causes/syc-20377168#:~:text=,may%20cause%20or%20worsen%20RLS)[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=,4%20weeks%20of%20giving%20birth).

Importantly, **these insights are backed by solid medical research** – from brain scans and lab studies to clinical observations – and not based on pseudoscience or mere speculation. RLS is a real neurological disorder where the *wiring and chemistry of the nervous system* create genuine sensations and movements. By understanding the root causes (dopamine, iron, and related factors), patients and doctors can better target treatments – whether it’s iron supplementation, medications that adjust dopamine and other neurotransmitters, or lifestyle changes to avoid triggers.

In essence, if you suffer from RLS and sleep disruption, know that **your body is behaving this way because of a biochemical “misfire”** in the brain’s regulation of movement. The legs want to move because the brain’s normal balance of signals (which usually keep them still at rest) is out of tune. The ongoing scientific research into RLS offers hope that by **correcting these underlying imbalances – restoring iron levels, stabilizing dopamine, and calming overactive neural circuits –** we can bring relief and restful sleep to those affected[pmc.ncbi.nlm.nih.gov](https://pmc.ncbi.nlm.nih.gov/articles/PMC6183309/#:~:text=efficiently%20improves%20RLS%20symptoms,on%20iron%20metabolism%2C%20and%20individuals)[frontiersin.org](https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2017.00722/full#:~:text=The%20symptomatology%20of%20Restless%20Legs,On%20the%20other).

**Sources:** Peer-reviewed research and reputable health institutions, including the National Institutes of Health, Mayo Clinic, NHS, and neurology journals, as cited above. Each citation corresponds to evidence supporting the statements (for example, brain imaging studies on iron[ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov/books/NBK430878/#:~:text=including%20BTBD9%20and%20MEIS1%20are,1%5D%C2%A0Restless%20leg%20syndrome%20is%20extremely), or NHS and Mayo Clinic explanations on dopamine and iron’s role[nhs.uk](https://www.nhs.uk/conditions/restless-legs-syndrome/causes/#:~:text=The%20basal%20ganglia%20uses%20a,help%20control%20muscle%20activity%20and%C2%A0movement)[mayoclinic.org](https://www.mayoclinic.org/diseases-conditions/restless-legs-syndrome/symptoms-causes/syc-20377168#:~:text=,may%20cause%20or%20worsen%20RLS)). These reflect the current scientific consensus on what causes RLS at the physiological and biochemical level.