Why is Neurology's understanding of Neuro-Immune Mechanisms important for the assessment and treatment of people with Neurodevelopmental, Psychiatric and Brain Injury in the Criminal Justice System?

Neuro–Immune Mechanisms and Justice-Involved Populations: Why Neurology Matters

People in the criminal justice system have high rates of neurodevelopmental disorders, psychiatric illness and brain injury. Many of these conditions are now known to involve **immune dysregulation and neuroinflammation**, which has direct implications for how they are assessed and treated.

Why Neuro–Immune Mechanisms Matter for Diagnosis

- Immune processes help maintain **CNS homeostasis, cognition and social behavior**; chronic inflammation, autoimmunity and infection can disrupt higher-order brain networks and mimic or drive psychiatric syndromes such as schizophrenia, autism, bipolar disorder and depression (Pape et al., 2019; Novellino et al., 2020).
- Innate immune cells (microglia, astrocytes) and cytokines shape brain development and synaptic pruning; disturbances are linked to neurodevelopmental disorders including autism and schizophrenia (Novellino et al., 2020; Zengeler & Lukens, 2021; Anderson et al., 2025; Kim et al., 2024).
- Large transcriptomic studies show immune-related genes are altered across major psychiatric and neurological disorders, with neuroimmune networks interacting directly with neuronal systems (Chen et al., 2022; Zhong et al., 2023).
- For justice-involved people, this means some “behavioral” problems may be **immune-driven brain disease**, calling for neurological and immunological work-up (e.g., inflammatory markers, autoantibodies, neuroimaging) rather than purely behavioral or punitive responses (Pape et al., 2019; Novellino et al., 2020; Irani et al., 2021; Cohen et al., 2024).

Examples of Immune–Brain Links Relevant to Forensic Populations

Condition type	Key neuro–immune insights	Citations
Neurodevelopmental disorders	Immune signaling and microglia are critical for brain maturation; immune dysfunction and early-life immune challenges raise NDD risk	(Anderson et al., 2025; Zengeler & Lukens, 2021; Kim et al., 2024)
Psychiatric disorders	Pro-inflammatory cytokines and innate immunity contribute to depression, PTSD, anxiety, schizophrenia; inflammation alters motivation, threat processing and connectivity	(Bower & Kuhlman, 2022; Novellino et al., 2020; Risbrough et al., 2021; Goldsmith et al., 2023; Miller et al., 2016; Lauten et al., 2024)

Condition type	Key neuro–immune insights	Citations
Traumatic brain injury	TBI triggers acute and chronic neuroinflammation; immune responses can be beneficial or harmful and are linked to later neuropsychiatric symptoms	(Hours et al., 2025; Jassam et al., 2017; Feiger et al., 2022; Zheng et al., 2022)

FIGURE 1 Representative neuro–immune mechanisms across brain conditions.

Implications for Treatment and Risk Management

- Reviews emphasize that recognizing **immune-mediated subgroups** within neuropsychiatric diagnoses allows **mechanism-based immune treatments** (e.g., cytokine-targeted therapies, neuromodulation that optimizes immune–brain interactions) (Pape et al., 2019; Guo et al., 2026; Hours et al., 2025; Risbrough et al., 2021; Miller et al., 2016).
- In TBI, timing and phenotype of the inflammatory response are crucial; personalized immunomodulatory strategies may limit secondary injury and reduce later depression, anxiety and PTSD (Hours et al., 2025; Jassam et al., 2017; Feiger et al., 2022; Zheng et al., 2022).
- Inflammation-related changes in brain connectivity underlie transdiagnostic symptoms such as anhedonia and anxiety, suggesting that anti-inflammatory or immune-modulating approaches could improve behavior and functional outcomes (Goldsmith et al., 2023; Miller et al., 2016).
- For neurodevelopmental disorders, understanding prenatal and postnatal immune influences opens possibilities for **early identification and mitigation** of risk, including in children on pathways into justice systems (Zengeler & Lukens, 2021; Anderson et al., 2025; Kim et al., 2024).

Why This Is Specifically Important in Criminal Justice Settings

- Neuroimmune insights challenge rigid divisions between “neurological” and “psychiatric” disorders and support joint **neurology–psychiatry assessment** for complex behavior, aggression, or cognitive/behavioral change (Pape et al., 2019; Novellino et al., 2020; Irani et al., 2021).
- Elevated peripheral innate immune markers predict increased risk of dementia, stroke, depression and anxiety and are associated with structural and connectivity changes in brain regions tied to behavior (Zhong et al., 2023). Such markers could help flag high-risk individuals for further neurological evaluation and targeted treatment rather than purely custodial management.
- PTSD and trauma-related conditions common in justice-involved populations involve persistent dysregulation of innate and adaptive immunity; current symptom-focused therapies may not address this biology, underscoring the need for **integrated neuroimmune-informed care** (Bower & Kuhlman, 2022; Risbrough et al., 2021; Lauten et al., 2024).

Summary

Neurology’s understanding of neuro–immune mechanisms shows that immune dysregulation and neuroinflammation are central to many neurodevelopmental, psychiatric, and post-TBI conditions. In criminal justice contexts, this knowledge is crucial to: (1) recognize when behavior reflects treatable immune-mediated brain dysfunction; (2) use biomarkers and imaging to refine diagnosis and risk assessment; and (3) develop targeted, mechanism-based treatments (including immunotherapies and neuromodulation) that may reduce symptoms, disability and reoffending, rather than relying on purely behavioral or punitive approaches.

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