

What are the relationships among the Endocrine System, Neurodevelopmental and Psychiatric Disorders and Cancer?

Endocrine System, Brain Disorders, and Cancer: How They Interact

The endocrine system regulates hormones that shape brain development, mood, metabolism, immunity, and cell growth. Across these papers, disturbances of this system and exposure to endocrine-disrupting chemicals (EDCs) link neurodevelopmental and psychiatric disorders with increased cancer risk and altered tumor behavior.

Endocrine–Brain Links: Neurodevelopmental and Psychiatric Disorders

- Human brain development is partly governed by hormones (thyroid, sex steroids, others); disrupting these signals can impair cognition and behavior (Özel & Rüegg, 2023).
- Prenatal or perinatal exposure to EDCs is consistently associated with **autism spectrum disorder, ADHD, global developmental delay, intellectual disability, and communication disorders** in human studies (Rivollier et al., 2019; Schug et al., 2015; Özel & Rüegg, 2023; Damiano et al., 2025).
- In utero exposure to synthetic estrogens/progestins has been associated with schizophrenia, bipolar disorder, severe depression, anxiety, eating disorders, and ASD, with **multi- and transgenerational** neurodevelopmental effects likely mediated by epigenetic changes (Sultan et al., 2025; Soyer-Gobillard et al., 2025).
- Endocrine diseases themselves (Cushing’s, thyroid dysfunction, PCOS, acromegaly, diabetes, obesity) often present with depression, anxiety, eating disorders, and cognitive impairment, sometimes persisting after hormonal correction (Salvador et al., 2020; Tamagno & Epelbaum, 2015; Barbu et al., 2020).
- Dysfunction of the hypothalamic–pituitary axes and broader neuroendocrine imbalance is increasingly framed as central to psychiatric pathology and a therapeutic target (Gaspary et al., 2025; Ehsanifar et al., 2025).

Types of Endocrine Influences on Neurodevelopment

Influence type	Example outcomes	Citations
Thyroid/sex hormone disruption (EDCs)	Lower IQ, ADHD, ASD	(Rivollier et al., 2019; Schug et al., 2015; Özel & Rüegg, 2023)
Synthetic sex hormones in utero	Psychosis, mood disorders, ASD across generations	(Sultan et al., 2025; Soyer-Gobillard et al., 2025)
Hypothalamic/endocrine genetic syndromes	Obesity, behavioral problems (e.g., Prader–Willi)	(Tauber & Høybye, 2021)

FIGURE 1 Hormonal and chemical influences on brain development

Endocrine Dysregulation and Cancer

- EDCs can alter hormone balance, stimulate tumor growth, and increase risk of endocrine-related cancers (breast, prostate, thyroid, uterus, testis, ovary) (Ahn & Jeung, 2023; Macedo et al., 2022). Thyroid cancer shows particularly high risk after EDC exposure (Macedo et al., 2022).
- Endocrine and metabolic disorders (obesity, diabetes, Cushing's, other hormonal abnormalities) reprogram systemic metabolism and are causally linked to higher incidence and worse outcomes in several cancers, including breast and others (Lakhani et al., 2023; Jiang et al., 2020; Macedo et al., 2022; Hawazie & Druce, 2025).
- Cancer itself behaves as a **neuroendocrine organ**, producing hormones and neurotransmitters that reset central neuroendocrine control, favoring tumor expansion (Slominski et al., 2023; Jiang et al., 2020).

Integrated Neuro-Endocrine-Immune Network: Shared Pathways

- A multidirectional **neuro–endocrine–immune network** underlies many non-communicable diseases, including cancer, allergy, autoimmunity, obesity, and neurodevelopmental/psychiatric disorders (Jiang et al., 2020; Galbiati et al., 2021).
- Chronic stress and depression activate the HPA axis and sympathetic nervous system, altering cortisol and catecholamines; these hormones modulate immune surveillance and can promote tumor growth and angiogenesis (Jiang et al., 2020; Dong et al., 2025).
- EDCs target this same network, acting on immune cells, microglia, and neurons, and increasing susceptibility to cancer, neurodegenerative and psychiatric conditions (Ahn & Jeung, 2023; Galbiati et al., 2021; Damiano et al., 2025; Ehsanifar et al., 2025).

Summary

Across these studies, the endocrine system forms a central hub linking brain development, mental health, metabolism, immunity, and cancer. Hormonal imbalances and environmental endocrine disruptors can increase risk of neurodevelopmental and psychiatric disorders and multiple cancers, often via shared neuro-endocrine-immune and metabolic pathways. Cancer, in turn, can hijack neuroendocrine control and is influenced by psychiatric states such as depression, reinforcing a bidirectional, systems-level relationship among endocrine function, brain disorders, and malignancy.

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