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Editorial

Special Issue "Translating Molecular Psychiatry: From Biomarkers to Personalized Therapies"

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1. Introduction: Psychiatry at the Molecular Crossroads

Psychiatry stands at a turning point, where molecular insights promise to revolutionize how we diagnose, monitor, and treat neuropsychiatric conditions, including Alzheimer's, Parkinson's, depression, dementia, and schizophrenia (SCZ), among others. For decades, diagnoses have relied on descriptive syndromes, while treatment decisions have been guided by trial and error rather than molecularly grounded evidence [1–6]. Despite the remarkable growth of neuroscience, few insights have crossed the bridge into clinical psychiatry [1,2,5,7,8]. Treatments for depression, bipolar disorder (BD), SCZ, and dementia remain only partially effective, and diagnostic overlap between major psychiatric conditions continues to hinder precision care [9–14].

Against this backdrop, the concept of molecular psychiatry has emerged [8,15–17]. Its central promise is straightforward yet ambitious: to translate biological signatures into clinical tools for diagnosis, prognosis, and therapy selection [2,15,18–21]. However, the road from bench to bedside is far from linear [2,16,17,22–24]. Many biomarker findings remain inconsistent, mechanistic insights often lack replication, and new therapeutic candidates are slow to reach clinical trials [2,16,25–27].

This Special Issue, Translating Molecular Psychiatry: From Biomarkers to Personalized Therapies (https://www.mdpi.com/journal/ijms/special_issues/H435J0IJA5 (accessed on 12 October 2025)), directly addresses these challenges. It brings together eight contributions that span the spectrum—from inflammation in mood disorders to blood–brain barrier (BBB) dysfunction in SCZ, from RNA editing biomarkers and AI-driven diagnostics to novel therapeutic approaches in AD and neurodevelopmental disorders. Collectively, these papers exemplify the current state of the field and offer a window into its future.

2. Mapping the Terrain: Current Insights from the Special Issue

This Special Issue brings together eight papers that highlight the ways molecular psychiatry is steadily moving toward translation, with work ranging from mood disorders and SCZ to biomarker discovery and the development of new therapies. Each contribution takes a different route, yet together they form a coherent map pointing toward a psychiatry that is at once mechanistically rigorous and clinically meaningful. Organized into four overarching themes, these studies reveal how seemingly distinct lines of research can converge on a single aim: advancing personalized care (Table 1).

2.1. Immune-Related Insights in Mood Disorders

Ríos et al. examined inflammatory biomarkers in 109 euthymic bipolar patients, focusing on interleukin-6 (IL-6) and high-sensitivity C-reactive protein (hs-CRP) [28]. They

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found that IL-6, but not hs-CRP, was linked to cognitive deficits in memory, attention, and visuospatial skills, as well as to increased hospitalization risk. This positions IL-6 as a candidate biomarker for cognitive vulnerability in BD and underscores the clinical significance of immune dysregulation. Bottaccioli et al. offered a conceptual advance, critiquing the reductionist search for a single molecular "switch" in depression [29]. Instead, they argued for a psychoneuroendocrineimmunology (PNEI) model, which views depression as a systemic disorder shaped by psychological, biological, and behavioral interactions. Their call for integrated, personalized interventions reframes depression as a multifaceted condition requiring multidimensional care (Table 1).

Table 1. Advances in molecular psychiatry: Immune, biomarker, and therapeutic frontiers. Summary of key insights from recent studies featured in this issue, spanning immune-related mechanisms in mood disorders, treatment strategies and blood–brain barrier (BBB) dysfunction in schizophrenia (SCZ), precision biomarker discovery through AI integration, and novel therapeutic approaches for Alzheimer's and neurodevelopmental disorders. Together, these findings illustrate how diverse lines of inquiry are converging to refine mechanistic understanding and drive personalized psychiatry.

Category	Key Points (≤3)	Ref.
Immune-Related Insights in Mood Disorders	• IL-6, not hs-CRP, linked to cognitive deficits in BD. • Higher IL-6 predicted worse memory, attention, visuospatial skills. • Elevated IL-6 correlated with greater hospitalization risk.	[28]
	• Critiques reductionist biomarker-based models. • Proposes systemic PNEI framework for depression. • Advocates integrated, personalized interventions.	[29]
SCZ: Treatment Optimization and BBB Dysfunction	• Compared OIS vs. TIS regimens in 152 patients. • Both effective, but TIS avoided toxic serum peaks. • TIS offers safer, more stable pharmacokinetics.	[30]
	• Synthesized evidence of BBB disruption in SCZ. • Implicated endothelial, tight junction, and immune dysfunction. • BBB is both vulnerability and therapeutic target.	[31]
Precision Biomarkers and AI in Psychiatric Diagnosis	• RNA editing biomarkers analyzed with machine learning. • Distinguished BD, SCZ spectrum, and healthy controls. • Demonstrated diagnostic potential of molecular–AI integration.	[32]
	• Reviewed psychiatric syndromes from brain tumors. • Highlighted metabolic, cytokine, and circuit disruptions. • Proposed AI/biomarker-based neuro-oncology–psychiatry paradigm.	[33]
Novel Therapies in Alzheimer's and Developmental Disorders	• Systematic review of six preclinical studies. • AdipoRon reduced neuroinflammation, tau pathology, improved cognition. • Calls for translational studies in humans.	[34]
	• Rat model of GBS-induced chorioamnionitis. • Maternal IL-1Ra prevented autism- and CP-like traits. • Suggests prenatal immunotherapy to prevent neurodevelopmental disorders.	[35]

AI, artificial intelligence; BBB, blood–brain barrier; BD, bipolar disorder; CP, cerebral palsy; GBS, group B streptococcus; hs-CRP, high-sensitivity C-reactive protein; IL-1Ra, interleukin-1 receptor antagonist; IL-6, interleukin-6; OIS, one-injection start; PNEI, psychoneuroendocrineimmunology; RNA, ribonucleic acid; SCZ, schizophrenia; TIS, two-injection start.

2.2. Schizophrenia (SCZ): Treatment Optimization and BBB Dysfunction

Trovini et al. compared two strategies for initiating long-acting injectable (LAI) aripiprazole in 152 patients [30]. Both regimens improved psychopathology, but the two-injection start (TIS) maintained therapeutic serum levels without the high peaks seen in the one-injection start (OIS), suggesting a safer pharmacokinetic profile. This practical study provides immediate guidance for optimizing SCZ treatment. Zhang et al. reviewed evidence that BBB dysfunction plays a central role in SCZ pathophysiology [31]. They inte-

grated findings from postmortem studies, biomarker assays, and advanced imaging to show how endothelial dysfunction, tight junction abnormalities, and neuroinflammation disrupt barrier integrity. Importantly, they discussed the bidirectional effects of antipsychotics on BBB function, highlighting its dual role as a therapeutic target and potential liability.

2.3. Precision Biomarkers and AI in Psychiatric Diagnosis

Checa-Robles et al. presented proof-of-concept evidence that RNA editing biomarkers, when analyzed with machine learning, can distinguish between BD, SCZ spectrum disorders, and healthy controls [32]. This integration of molecular data and computational tools marks a significant step toward objective, biomarker-based diagnosis in psychiatry. Șerban et al. focused on neuropsychiatric syndromes caused by brain tumors [33]. They argued that these syndromes are intrinsic manifestations of tumor biology, driven by metabolic reprogramming, cytokine release, and circuit disruption. By highlighting lesion-network mapping, exosomal biomarkers, and AI predictive modeling, they envisioned new strategies for early detection and precision treatment, reframing neuro-oncology as a frontier of psychiatric translation.

2.4. Novel Therapies in Alzheimer's and Developmental Disorders

Barbalho et al. systematically reviewed studies on AdipoRon, an adiponectin receptor agonist, in AD models [34]. AdipoRon reduced inflammation, improved mitochondrial function, mitigated tau hyperphosphorylation, and enhanced cognition, suggesting a promising multi-target therapeutic. The authors identified key research gaps, emphasizing the need for translational work in humans. Ayash et al. used a rat model of Group B Streptococcus (GBS)-induced chorioamnionitis to test IL-1 receptor antagonist (IL-1Ra) [35]. Male offspring exposed in utero developed autism- and cerebral palsy (CP)-like traits, but maternal IL-1Ra treatment reversed these outcomes. The findings point to immunomodulation during pregnancy as a potential preventive strategy against infection-driven neurodevelopmental disorders.

3. Present Challenges and Gaps

Despite promising advances, molecular psychiatry still faces significant hurdles before translation can become reality. The eight contributions, while diverse in scope, collectively highlight recurring gaps that restrain progress. These include methodological inconsistencies, fragmented frameworks, and limited clinical validation. Such persistent obstacles underscore the pressing need for integrative strategies that bridge discovery and practice [36].

First, biomarker research in molecular psychiatry continues to struggle with problems of reproducibility and limited scale. IL-6 has been identified as a potential marker in BD, and RNA editing holds diagnostic promise [37–42]. Yet, such findings arise from modest cohorts, and without rigorous multisite validation, clinical translation remains premature [2,37,43–45].

Diagnostic overlap remains an enduring challenge that continues to complicate translation [43,45–48]. Biomarker discovery and AI-driven approaches have offered promising tools, yet they fall short when confronted with the blurred boundaries of psychiatric nosology. Disorders such as BD and SCZ share symptoms and molecular signatures [49–53]. Clear differentiation demands methodological refinement alongside conceptual innovation [48,54–57].

Barriers in clinical translation remain evident, as progress from preclinical discovery to human application proves limited [58,59]. Novel therapeutics highlight this gap. AdipoRon, for example, shows neuroprotective effects in animal models, yet its safety and efficacy

in humans remain unknown [60]. Prenatal IL-1 blockade presents intriguing possibilities, but ethical, regulatory, and safety concerns restrict its immediate evaluation in clinical pregnancy trials [61,62].

Finally, psychiatry continues to wrestle with its conceptual framework. The PNEI model for depression highlights the danger of reductionism, yet systemic integration remains more aspirational than operational in current clinical settings. A similar tension exists in neuro-oncology, where psychiatric dysfunction is often treated as secondary rather than intrinsic to tumor biology.

Conceptual gaps persist as psychiatry struggles with its foundational frameworks [29,63,64]. Despite advances, reliance on reductionist models continues to overshadow systemic approaches. The PNEI model underscores the pitfalls of narrow perspectives in depression research [29,65]. In neuro-oncology, a parallel tension emerges, where psychiatric dysfunction is often regarded as secondary instead of being intrinsic to tumor biology [66].

Together, these challenges make clear that progress in molecular psychiatry requires more than incremental advances. What is needed is a deliberate integration of validated biomarkers, mechanistic insight, and carefully designed clinical trials. Only by addressing methodological, diagnostic, translational, and conceptual barriers in concert can the field truly move toward personalized and effective psychiatric care.

4. Building the Bridge: Advances Highlighted in This Special Issue

This collection makes a distinctive contribution by linking mechanistic discoveries with translational relevance across psychiatric and neurological domains. Although significant hurdles remain, the studies presented here demonstrate clear progress. Each contribution advances understanding in a way that pushes the field closer to practical applications, offering tangible steps toward clinical translation.

In the domain of inflammation, two contributions stand out for their translational significance. One identifies IL-6 as a predictor of cognitive impairment in BD, highlighting its role as a potential biomarker [28]. The other demonstrates how interleukin-1 (IL-1) blockade may prevent neurodevelopmental injury [35]. Together, these findings strengthen the connection between immune dysregulation and psychiatric outcomes.

Advances in treatment optimization for SCZ are illustrated by two complementary findings. Clinically, the tailored intermittent strategy for initiating LAIs enhances safety and stability, offering direct guidance for practice [30]. Mechanistically, recognition of BBB dysfunction reframes pathophysiology, opening new avenues for both diagnostic refinement and innovative therapeutic strategies [31].

Advances in biomarker precision reveal how molecular and computational tools can reshape psychiatric diagnosis. RNA editing signatures integrated with artificial intelligence (AI) provide a compelling proof-of-concept for distinguishing complex disorders with greater accuracy [32]. Equally transformative is the recognition that tumor-associated psychiatric syndromes arise intrinsically from cancer biology, forging new connections between oncology and psychiatry [33].

Finally, progress in novel therapeutics illustrates how complex disorders may benefit from multi-target strategies. AdipoRon emerges as a promising candidate, reducing neuroinflammation, mitigating tau pathology, and improving cognition in preclinical models of AD [34]. At the same time, tumor-induced psychiatric dysfunction is reframed as a primary condition, expanding therapeutic horizons.

Collectively, these advances illustrate a decisive shift in psychiatry from reliance on descriptive syndromes toward biologically anchored frameworks. What emerges is a discipline that increasingly integrates mechanistic discovery with translational potential [67–71].

By aligning molecular insights with clinical application, the field is steadily constructing bridges toward precision and personalized care.

5. The Road Ahead

The future of molecular psychiatry lies in a stepwise progression, where short-term goals provide the groundwork for larger transformations over the next decade. This trajectory can be envisioned in two phases: immediate priorities over the next two to four years and broader, paradigm-shifting advances within five to ten years.

5.1. Near-Term (2–4 Years)

In the near term, priorities in mood disorder research will focus on validating IL-6 as a reliable biomarker [38,72–74]. Multisite longitudinal studies are essential to confirm its predictive value for cognitive outcomes and clinical trajectories. Alongside this effort, small-scale clinical trials will begin to test anti-inflammatory strategies in BD, aiming to determine feasibility, safety, and preliminary efficacy [75–77]. Together, these initiatives could establish immune modulation as a tangible therapeutic pathway [78–80].

For SCZ, advances in treatment protocols and mechanistic exploration will take center stage [81–83]. The tailored intermittent strategy for initiating LAIs is poised to enter clinical guidelines, where its potential to enhance safety and stability could shift prescribing practices [84]. At the same time, advanced imaging methods will be deployed to systematically characterize BBB disruption [31,81,83]. Such studies may reveal how endothelial dysfunction and immune interactions contribute to disease progression, creating opportunities for therapeutic targeting [81–83].

Biomarker precision will advance through replication and expansion [85]. RNA editing signatures must be validated in larger, well-characterized cohorts to move from proof-of-concept toward robust application [32,86,87]. Integration with multi-omics platforms, including genomics, proteomics, and metabolomics, will further strengthen diagnostic potential by capturing the multidimensional complexity of psychiatric disorders [88–90]. These combined approaches could eventually yield clinically usable biomarker panels that surpass the limitations of symptom-based diagnosis.

In neurodegeneration and developmental psychiatry, early translational steps will be pursued with caution but also with urgency [90]. Pilot human studies of AdipoRon will test whether its multi-target effects observed in preclinical models can translate into meaningful outcomes in AD [34,91,92]. At the same time, early-phase trials of IL-1 blockade in high-risk pregnancies or neonatal populations will be considered, though only under rigorous ethical and safety oversight [61,93,94]. These initiatives could set the stage for transformative preventive strategies (Table 2).

Table 2. Translational trajectories in molecular psychiatry: From current gaps to future directions. Timeline of advances across four major domains of molecular psychiatry. The table highlights persisting gaps, key contributions from this Special Issue, and projected trajectories over the near term (2–4 years) and long term (5–10 years). Together, these directions illustrate how biomarker validation, mechanistic insight, and integrative frameworks may converge to shape precision psychiatry.

Category	Key Gaps	Advances from this Special Issue	Future Directions (Near-Term 2–4 yrs/Long-Term 5–10 yrs)
Mood Disorders	• Inconsistent biomarker findings. • Lack of systemic treatment frameworks.	• IL-6 predicts cognition in BD. • PNEI paradigm reframes depression.	• Near-term: Validate IL-6; test anti-inflammatory interventions. • Long-term: Integrate PNEI into personalized care.

Table 2. *Cont.*

Category	Key Gaps	Advances from this Special Issue	Future Directions (Near-Term 2–4 yrs/Long-Term 5–10 yrs)
SCZ	• Limited optimization of LAI protocols. • Poor understanding of BBB pathology.	• TIS regimen improves safety. • BBB identified as mechanistic target.	• Near-term: Adopt TIS in practice; imaging BBB dysfunction. • Long-term: BBB-targeted therapies; personalized antipsychotics.
Precision Biomarkers & AI	• Small-scale biomarker studies. • Diagnostic overlap of BD and SCZ.	• RNA editing + AI distinguishes conditions. • Tumor syndromes reframed as intrinsic.	• Near-term: Replicate RNA panels; expand AI models. • Long-term: Clinical AI platforms for biomarker-based diagnosis.
Neurodegeneration & Developmental disorders	• Preclinical–clinical gap. • Ethical challenges in prenatal interventions.	• AdipoRon shows neuroprotection. • IL-1 blockade reverses prenatal injury traits.	• Near-term: Pilot human studies (AdipoRon, IL-1). • Long-term: Embed multi-target AD therapies; preventive immunomodulation in pregnancy.

AD, Alzheimer's disease; AI, artificial intelligence; BBB, blood–brain barrier; BD, bipolar disorder; IL-1, interleukin-1; IL-6, interleukin-6; LAI, long-acting injectable; PNEI, psychoneuroendocrineimmune; SCZ, schizophrenia; TIS, two-injection start.

5.2. Long-Term (5–10 Years)

In the next decade, psychiatry is likely to be transformed by AI–guided biomarker panels that combine molecular signatures, clinical features, and digital phenotyping [95–98]. These platforms will not only improve early diagnosis but also guide personalized therapy selection [8,96,99]. Such tools have the potential to move psychiatry away from trial-and-error prescribing and toward precision interventions matched to each patient's biological and behavioral profile [8,69,96].

Alongside these advances, a systemic paradigm informed by the PNEI model will shape integrated treatment approaches [29,100,101]. Care will no longer be divided into isolated domains but will instead merge biological, psychological, and behavioral dimensions into a unified framework [29,100,102]. This integrative strategy is expected to produce durable outcomes, offering improvements that reductionist models have struggled to achieve [29,103,104].

Neuro-oncology will provide a compelling example of how these principles can be applied in practice [105–107]. Psychiatric dysfunction in patients with brain tumors will increasingly be recognized as an intrinsic manifestation of tumor biology [107–109]. In response, clinical protocols will evolve to combine oncological and psychiatric management from the outset [105,106,108]. Such integration could ensure that cognitive and affective symptoms are addressed as core features of disease, not as secondary complications [110,111].

Preventive psychiatry is also poised to expand its scope [112–114]. Immunomodulation during pregnancy may become a validated protective strategy against infection-driven neurodevelopmental disorders [115–117]. With careful ethical oversight and rigorous testing, such approaches could significantly reduce the burden of conditions like autism spectrum disorders and CP, shifting psychiatry toward a model of early intervention and prevention [116,118,119].

Finally, progress in neurodegeneration will focus on AD, where multi-target agents such as AdipoRon may enter clinical practice [34,91,120]. Coupled with biomarker-based early detection, these therapies could intervene before irreversible cognitive decline occurs [121–123]. Together, these innovations promise a decade in which psychiatry evolves into a discipline defined by prevention, precision, and integration [124].

Viewed as a whole, the near- and long-term trajectories suggest a field on the verge of transformation. Incremental advances will build the scaffolding for breakthroughs, while

paradigm shifts will redefine how psychiatry is practiced. The road ahead is ambitious yet achievable, charting a future of precision, prevention, and integrative care.

6. Conclusions: From Discovery to Translation

The eight contributions of this Special Issue highlight a psychiatry in transition, shifting from descriptive diagnoses and symptom-based treatments toward mechanistically informed, biomarker-driven, and personalized care. Collectively, they demonstrate how translational research can illuminate the path forward. Immune markers such as IL-6 provide insight into cognition in BD, while AI applied to RNA editing offers a proof-of-concept for diagnostic precision. Advances in SCZ research show that optimized initiation strategies for LAIs can enhance safety, while recognition of BBB dysfunction reframes disease mechanisms. In parallel, novel therapeutics such as AdipoRon in Alzheimer's models and prenatal IL-1 blockade in developmental contexts highlight the translational potential of multi-target and preventive approaches. Yet these strides are not achieved in isolation. The field's future depends on sustained collaboration that brings psychiatry into conversation with neurology, immunology, oncology, and computational sciences. By weaving together these disciplines, psychiatry can transform molecular discoveries into clinically actionable strategies. Precision psychiatry is no longer a distant aspiration but an emerging reality that requires collective commitment to become fully realized.

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Abbreviations

The following abbreviations are used in this manuscript:

AD	Alzheimer's disease
AI	artificial intelligence
BBB	blood–brain barrier
BD	bipolar disorder
CP	cerebral palsy
GBS	group B streptococcus
hs-CRP	high-sensitivity C-reactive protein
IL-1	interleukin-1
IL-1Ra	interleukin-1 receptor antagonist
IL-6	interleukin-6
LAI	long-acting injectable
OIS	one-injection start
PNEI	psychoneuroendocrineimmunology
SCZ	schizophrenia
TIS	two-injection start

References

1. Harrison, P.J.; Geddes, J.R.; Tunbridge, E.M. The Emerging Neurobiology of Bipolar Disorder. *Trends Neurosci.* **2018**, *41*, 18–30. [CrossRef]
2. Abi-Dargham, A.; Moeller, S.J.; Ali, F.; DeLorenzo, C.; Domschke, K.; Horga, G.; Jutla, A.; Kotov, R.; Paulus, M.P.; Rubio, J.M.; et al. Candidate biomarkers in psychiatric disorders: State of the field. *World Psychiatry* **2023**, *22*, 236–262. [CrossRef]
3. Vieta, E.; Berk, M.; Schulze, T.G.; Carvalho, A.F.; Suppes, T.; Calabrese, J.R.; Gao, K.; Miskowiak, K.W.; Grande, I. Bipolar disorders. *Nat. Rev. Dis. Primers* **2018**, *4*, 18008. [CrossRef]
4. Waszkiewicz, N. Mentally Sick or Not-(Bio)Markers of Psychiatric Disorders Needed. *J. Clin. Med.* **2020**, *9*, 2375. [CrossRef]

5. Dacquino, C.; De Rossi, P.; Spalletta, G. Schizophrenia and bipolar disorder: The road from similarities and clinical heterogeneity to neurobiological types. *Clin. Chim. Acta* **2015**, *449*, 49–59. [CrossRef] [PubMed]
6. Tanaka, M. Parkinson's Disease: Bridging Gaps, Building Biomarkers, and Reimagining Clinical Translation. *Cells* **2025**, *14*, 1161. [CrossRef]
7. Gruzdev, S.K.; Yakovlev, A.A.; Druzhkova, T.A.; Guekht, A.B.; Gulyaeva, N.V. The Missing Link: How Exosomes and miRNAs can Help in Bridging Psychiatry and Molecular Biology in the Context of Depression, Bipolar Disorder and Schizophrenia. *Cell. Mol. Neurobiol.* **2019**, *39*, 729–750. [CrossRef] [PubMed]
8. Comai, S.; Manchia, M.; Bosia, M.; Miola, A.; Poletti, S.; Benedetti, F.; Nasini, S.; Ferri, R.; Rujescu, D.; Leboyer, M.; et al. Moving toward precision and personalized treatment strategies in psychiatry. *Int. J. Neuropsychopharmacol.* **2025**, *28*, pyaf025. [CrossRef]
9. McIntyre, R.S.; Berk, M.; Brietzke, E.; Goldstein, B.I.; López-Jaramillo, C.; Kessing, L.V.; Malhi, G.S.; Nierenberg, A.A.; Rosenblat, J.D.; Majeed, A.; et al. Bipolar disorders. *Lancet* **2020**, *396*, 1841–1856. [CrossRef] [PubMed]
10. Goes, F.S. Diagnosis and management of bipolar disorders. *BMJ* **2023**, *381*, e073591. [CrossRef]
11. Wolfers, T.; Doan, N.T.; Kaufmann, T.; Alnæs, D.; Moberget, T.; Agartz, I.; Buitelaar, J.K.; Ueland, T.; Melle, I.; Franke, B.; et al. Mapping the Heterogeneous Phenotype of Schizophrenia and Bipolar Disorder Using Normative Models. *JAMA Psychiatry* **2018**, *75*, 1146–1155. [CrossRef] [PubMed]
12. Cheon, E.J.; Bearden, C.E.; Sun, D.; Ching, C.R.K.; Andreassen, O.A.; Schmaal, L.; Veltman, D.J.; Thomopoulos, S.I.; Kochunov, P.; Jahanshad, N.; et al. Cross disorder comparisons of brain structure in schizophrenia, bipolar disorder, major depressive disorder, and 22q11.2 deletion syndrome: A review of ENIGMA findings. *Psychiatry Clin. Neurosci.* **2022**, *76*, 140–161. [CrossRef] [PubMed]
13. Mandal, P.K.; Gaur, S.; Roy, R.G.; Samkaria, A.; Ingole, R.; Goel, A. Schizophrenia, Bipolar and Major Depressive Disorders: Overview of Clinical Features, Neurotransmitter Alterations, Pharmacological Interventions, and Impact of Oxidative Stress in the Disease Process. *ACS Chem. Neurosci.* **2022**, *13*, 2784–2802. [CrossRef]
14. Tanaka, M. Beyond the boundaries: Transitioning from categorical to dimensional paradigms in mental health diagnostics. *Adv. Clin. Exp. Med.* **2024**, *33*, 1295–1301. [CrossRef]
15. Capatina, T.F.; Oatu, A.; Babasan, C.; Trifu, S. Translating Molecular Psychiatry: From Biomarkers to Personalized Therapies—A Narrative Review. *Int. J. Mol. Sci.* **2025**, *26*, 4285. [CrossRef]
16. García-Gutiérrez, M.S.; Navarrete, F.; Sala, F.; Gasparyan, A.; Austrich-Olivares, A.; Manzanares, J. Biomarkers in Psychiatry: Concept, Definition, Types and Relevance to the Clinical Reality. *Front. Psychiatry* **2020**, *11*, 432. [CrossRef]
17. Venkatasubramanian, G.; Keshavan, M.S. Biomarkers in Psychiatry—A Critique. *Ann. Neurosci.* **2016**, *23*, 3–5. [CrossRef]
18. Do, K.Q. Bridging the gaps towards precision psychiatry: Mechanistic biomarkers for early detection and intervention. *Psychiatry Res.* **2023**, *321*, 115064. [CrossRef]
19. Kraguljac, N.V.; McDonald, W.M.; Widge, A.S.; Rodriguez, C.I.; Tohen, M.; Nemeroff, C.B. Neuroimaging Biomarkers in Schizophrenia. *Am. J. Psychiatry* **2021**, *178*, 509–521. [CrossRef]
20. Roy, B.; Yoshino, Y.; Allen, L.; Prall, K.; Schell, G.; Dwivedi, Y. Exploiting Circulating MicroRNAs as Biomarkers in Psychiatric Disorders. *Mol. Diagn. Ther.* **2020**, *24*, 279–298. [CrossRef] [PubMed]
21. Tanaka, M.; Vécsei, L. From Microbial Switches to Metabolic Sensors: Rewiring the Gut-Brain Kynurenine Circuit. *Biomedicines* **2025**, *13*, 2020. [CrossRef]
22. Prompiengchai, S.; Dunlop, K. Breakthroughs and challenges for generating brain network-based biomarkers of treatment response in depression. *Neuropsychopharmacology* **2024**, *50*, 230–245. [CrossRef]
23. Abi-Dargham, A.; Horga, G. The search for imaging biomarkers in psychiatric disorders. *Nat. Med.* **2016**, *22*, 1248–1255. [CrossRef] [PubMed]
24. Szabó, Á.; Galla, Z.; Spekker, E.; Szűcs, M.; Martos, D.; Takeda, K.; Ozaki, K.; Inoue, H.; Yamamoto, S.; Toldi, J.; et al. Oxidative and Excitatory Neurotoxic Stresses in CRISPR/Cas9-Induced Kynurenine Aminotransferase Knockout Mice: A Novel Model for Despair-Based Depression and Post-Traumatic Stress Disorder. *Front. Biosci.* **2025**, *30*, 25706. [CrossRef]
25. Lozupone, M.; Seripa, D.; Stella, E.; La Montagna, M.; Solfrizzi, V.; Quaranta, N.; Veneziani, F.; Cester, A.; Sardone, R.; Bonfiglio, C.; et al. Innovative biomarkers in psychiatric disorders: A major clinical challenge in psychiatry. *Expert. Rev. Proteomics* **2017**, *14*, 809–824. [CrossRef]
26. Kraus, B.; Zinbarg, R.; Braga, R.M.; Nusslock, R.; Mittal, V.A.; Gratton, C. Insights from personalized models of brain and behavior for identifying biomarkers in psychiatry. *Neurosci. Biobehav. Rev.* **2023**, *152*, 105259. [CrossRef]
27. Berdeville, C.; Silva-Amaral, D.; Dalgalarrondo, P.; Banzato, C.E.M.; Martins-de-Souza, D. A scoping review of protein biomarkers for schizophrenia: State of progress, underlying biology, and methodological considerations. *Neurosci. Biobehav. Rev.* **2025**, *168*, 105949. [CrossRef] [PubMed]
28. Ríos, U.; Pérez, S.; Martínez, C.; Moya, P.R.; Arancibia, M. Inflammation and Cognition in Bipolar Disorder: Diverging Paths of Interleukin-6 and Outcomes. *Int. J. Mol. Sci.* **2025**, *26*, 6372. [CrossRef] [PubMed]

29. Bottaccioli, A.G.; Bologna, M.; Bottaccioli, F. Rethinking Depression-Beyond Neurotransmitters: An Integrated Psychoneuroendocrineimmunology Framework for Depression's Pathophysiology and Tailored Treatment. *Int. J. Mol. Sci.* **2025**, *26*, 2759. [CrossRef]
30. Trovini, G.; Lombardozzi, G.; Kotzalidis, G.D.; Lionetto, L.; Russo, F.; Sabatino, A.; Serra, E.; Castorina, S.; Civita, G.; Frezza, S.; et al. Optimising Aripiprazole Long-Acting Injectable: A Comparative Study of One- and Two-Injection Start Regimens in Schizophrenia with and Without Substance Use Disorders and Relationship to Early Serum Levels. *Int. J. Mol. Sci.* **2025**, *26*, 1394. [CrossRef]
31. Zhang, F.; Zhang, J.; Wang, X.; Han, M.; Fei, Y.; Wang, J. Blood-Brain Barrier Disruption in Schizophrenia: Insights, Mechanisms, and Future Directions. *Int. J. Mol. Sci.* **2025**, *26*, 873. [CrossRef]
32. Checa-Robles, F.J.; Salvetat, N.; Cayzac, C.; Menhem, M.; Favier, M.; Vetter, D.; Ouna, I.; Nani, J.V.; Hayashi, M.A.F.; Brietzke, E.; et al. RNA Editing Signatures Powered by Artificial Intelligence: A New Frontier in Differentiating Schizophrenia, Bipolar, and Schizoaffective Disorders. *Int. J. Mol. Sci.* **2024**, *25*, 12981. [CrossRef]
33. Șerban, M.; Toader, C.; Covache-Busuioc, R.A. Brain Tumors, AI and Psychiatry: Predicting Tumor-Associated Psychiatric Syndromes with Machine Learning and Biomarkers. *Int. J. Mol. Sci.* **2025**, *26*, 8114. [CrossRef]
34. Barbalho, S.M.; Laurindo, L.F.; de Oliveira Zanuso, B.; da Silva, R.M.S.; Gallerani Caglioni, L.; Nunes Junqueira de Moraes, V.B.F.; Fornari Laurindo, L.; Dogani Rodrigues, V.; da Silva Camarinha Oliveira, J.; Beluce, M.E.; et al. AdipoRon's Impact on Alzheimer's Disease-A Systematic Review and Meta-Analysis. *Int. J. Mol. Sci.* **2025**, *26*, 484. [CrossRef]
35. Ayash, T.A.; Allard, M.J.; Chevin, M.; Sébire, G. IL-1 Blockade Mitigates Autism and Cerebral Palsy Traits in Offspring In-Utero Exposed to Group B Streptococcus Chorioamnionitis. *Int. J. Mol. Sci.* **2024**, *25*, 11393. [CrossRef] [PubMed]
36. Tanaka, M.; Battaglia, S.; Liloia, D. Navigating Neurodegeneration: Integrating Biomarkers, Neuroinflammation, and Imaging in Parkinson's, Alzheimer's, and Motor Neuron Disorders. *Biomedicines* **2025**, *13*, 1045. [CrossRef] [PubMed]
37. Carvalho, A.F.; Solmi, M.; Sanches, M.; Machado, M.O.; Stubbs, B.; Ajnakina, O.; Sherman, C.; Sun, Y.R.; Liu, C.S.; Brunoni, A.R.; et al. Evidence-based umbrella review of 162 peripheral biomarkers for major mental disorders. *Transl. Psychiatry* **2020**, *10*, 152. [CrossRef]
38. Rowland, T.; Perry, B.I.; Upthegrove, R.; Barnes, N.; Chatterjee, J.; Gallacher, D.; Marwaha, S. Neurotrophins, cytokines, oxidative stress mediators and mood state in bipolar disorder: Systematic review and meta-analyses. *Br. J. Psychiatry* **2018**, *213*, 514–525. [CrossRef] [PubMed]
39. Hartwig, F.P.; Borges, M.C.; Horta, B.L.; Bowden, J.; Davey Smith, G. Inflammatory Biomarkers and Risk of Schizophrenia: A 2-Sample Mendelian Randomization Study. *JAMA Psychiatry* **2017**, *74*, 1226–1233. [CrossRef]
40. Kageyama, Y.; Kasahara, T.; Kato, M.; Sakai, S.; Deguchi, Y.; Tani, M.; Kuroda, K.; Hattori, K.; Yoshida, S.; Goto, Y.; et al. The relationship between circulating mitochondrial DNA and inflammatory cytokines in patients with major depression. *J. Affect. Disord.* **2018**, *233*, 15–20. [CrossRef]
41. Salvetat, N.; Checa-Robles, F.J.; Delacrétaz, A.; Cayzac, C.; Dubuc, B.; Vetter, D.; Dainat, J.; Lang, J.P.; Gamma, F.; Weissmann, D. AI algorithm combined with RNA editing-based blood biomarkers to discriminate bipolar from major depressive disorders in an external validation multicentric cohort. *J. Affect. Disord.* **2024**, *356*, 385–393. [CrossRef] [PubMed]
42. Hayashi, M.A.F.; Salvetat, N.; Cayzac, C.; Checa-Robles, F.J.; Dubuc, B.; Mereuze, S.; Nani, J.V.; Molina, F.; Brietzke, E.; Weissmann, D. Euthymic and depressed bipolar patients are characterized by different RNA editing patterns in blood. *Psychiatry Res.* **2023**, *328*, 115422. [CrossRef]
43. Pinto, J.V.; Moulin, T.C.; Amaral, O.B. On the transdiagnostic nature of peripheral biomarkers in major psychiatric disorders: A systematic review. *Neurosci. Biobehav. Rev.* **2017**, *83*, 97–108. [CrossRef]
44. Teixeira, A.L.; Colpo, G.D.; Fries, G.R.; Bauer, I.E.; Selvaraj, S. Biomarkers for bipolar disorder: Current status and challenges ahead. *Expert. Rev. Neurother.* **2019**, *19*, 67–81. [CrossRef]
45. Fernandes, B.S.; Dai, Y.; Jia, P.; Zhao, Z. Charting the proteome landscape in major psychiatric disorders: From biomarkers to biological pathways towards drug discovery. *Eur. Neuropsychopharmacol.* **2022**, *61*, 43–59. [CrossRef]
46. Gandal, M.J.; Zhang, P.; Hadjimichael, E.; Walker, R.L.; Chen, C.; Liu, S.; Won, H.; van Bakel, H.; Varghese, M.; Wang, Y.; et al. Transcriptome-wide isoform-level dysregulation in ASD, schizophrenia, and bipolar disorder. *Science* **2018**, *362*, eaat8127. [CrossRef]
47. Mahmoudi, E.; Green, M.J.; Cairns, M.J. Dysregulation of circRNA expression in the peripheral blood of individuals with schizophrenia and bipolar disorder. *J. Mol. Med.* **2021**, *99*, 981–991. [CrossRef]
48. Tasic, L.; Larcerda, A.L.T.; Pontes, J.G.M.; da Costa, T.; Nani, J.V.; Martins, L.G.; Santos, L.A.; Nunes, M.F.Q.; Adelino, M.P.M.; Pedrini, M.; et al. Peripheral biomarkers allow differential diagnosis between schizophrenia and bipolar disorder. *J. Psychiatr. Res.* **2019**, *119*, 67–75. [CrossRef]
49. Bharadwaj, R.; Nath, P.; Phukan, J.K.; Deb, K.; Gogoi, V.; Bhattacharyya, D.K.; Barah, P. Integrative ceRNA network analysis identifies unique and shared molecular signatures in Bipolar Disorder and Schizophrenia. *J. Psychiatr. Res.* **2024**, *176*, 47–57. [CrossRef] [PubMed]

50. Yamada, Y.; Matsumoto, M.; Iijima, K.; Sumiyoshi, T. Specificity and Continuity of Schizophrenia and Bipolar Disorder: Relation to Biomarkers. *Curr. Pharm. Des.* **2020**, *26*, 191–200. [CrossRef] [PubMed]
51. Khatun, M.T.; Rana, H.K.; Hossain, M.A.; Lakshmanna, K.; Rahman, M.M.; Parvin, A.; Rahman, M.H. Bioinformatics and systems biology approaches to identify molecular targets and pathways shared between schizophrenia and bipolar disorder. *Inform. Med. Unlocked* **2024**, *49*, 101556. [CrossRef]
52. Aryal, S.; Bonanno, K.; Song, B.; Mani, D.R.; Keshishian, H.; Carr, S.A.; Sheng, M.; Dejanovic, B. Deep proteomics identifies shared molecular pathway alterations in synapses of patients with schizophrenia and bipolar disorder and mouse model. *Cell Rep.* **2023**, *42*, 112497. [CrossRef]
53. Smeland, O.B.; Bahrami, S.; Frei, O.; Shadrin, A.; O'Connell, K.; Savage, J.; Watanabe, K.; Krull, F.; Bettella, F.; Steen, N.E.; et al. Genome-wide analysis reveals extensive genetic overlap between schizophrenia, bipolar disorder, and intelligence. *Mol. Psychiatry* **2020**, *25*, 844–853. [CrossRef]
54. Karthik, S.; Sudha, M. Predicting bipolar disorder and schizophrenia based on non-overlapping genetic phenotypes using deep neural network. *Evol. Intell.* **2021**, *14*, 619–634. [CrossRef]
55. Ruderfer, D.M.; Ripke, S.; McQuillin, A.; Boocock, J.; Stahl, E.A.; Pavlides, J.M.W.; Mullins, N.; Charney, A.W.; Ori, A.P.; Loohuis, L.M.O. Genomic dissection of bipolar disorder and schizophrenia, including 28 subphenotypes. *Cell* **2018**, *173*, 1705–1715.e16. [CrossRef]
56. Jang, Y.; Park, S.; Won, H.-H.; Myung, W. Identifying the Unique Genetic Architecture of Schizophrenia Distinguished from Bipolar Disorder Using Genomic Structural Equation Modeling. *Int. J. Neuropsychopharmacol.* **2025**, *28*, i362. [CrossRef]
57. Namkung, H.; Yukitake, H.; Fukudome, D.; Lee, B.J.; Tian, M.; Ursini, G.; Saito, A.; Lam, S.; Kannan, S.; Srivastava, R. The miR-124-AMPAR pathway connects polygenic risks with behavioral changes shared between schizophrenia and bipolar disorder. *Neuron* **2023**, *111*, 220–235.e229. [CrossRef] [PubMed]
58. Martos, D.; Lőrinczi, B.; Szatmári, I.; Vécsei, L.; Tanaka, M. Decoupling Behavioral Domains via Kynurenic Acid Analog Optimization: Implications for Schizophrenia and Parkinson's Disease Therapeutics. *Cells* **2025**, *14*, 973. [CrossRef] [PubMed]
59. Tanaka, M.; Szatmári, I.; Vécsei, L. Quinoline Quest: Kynurenic Acid Strategies for Next-Generation Therapeutics via Rational Drug Design. *Pharmaceuticals* **2025**, *18*, 607. [CrossRef] [PubMed]
60. Zhao, W.; Li, Y.; Zhou, Y.; Zhao, J.; Lu, Y.; Xu, Z. AdipoRon attenuates depression-like behavior in T2DM mice via inhibiting inflammation and regulating autophagy. *Brain Res. Bull.* **2025**, *224*, 111308. [CrossRef]
61. Brien, M.E.; Gaudreault, V.; Hughes, K.; Hayes, D.J.L.; Heazell, A.E.P.; Girard, S. A Systematic Review of the Safety of Blocking the IL-1 System in Human Pregnancy. *J. Clin. Med.* **2021**, *11*, 225. [CrossRef]
62. Buckley, L.F.; Abbate, A. Interleukin-1 blockade in cardiovascular diseases: A clinical update. *Eur. Heart J.* **2018**, *39*, 2063–2069. [CrossRef] [PubMed]
63. Gergues, M.M.; Lalani, L.K.; Kheirbek, M.A. Identifying dysfunctional cell types and circuits in animal models for psychiatric disorders with calcium imaging. *Neuropsychopharmacology* **2024**, *50*, 274–284. [CrossRef]
64. Whiteley, J.T.; Fernandes, S.; Sharma, A.; Mendes, A.P.D.; Racha, V.; Benassi, S.K.; Marchetto, M.C. Reaching into the toolbox: Stem cell models to study neuropsychiatric disorders. *Stem Cell Rep.* **2022**, *17*, 187–210. [CrossRef]
65. Price, R.B.; Duman, R. Neuroplasticity in cognitive and psychological mechanisms of depression: An integrative model. *Mol. Psychiatry* **2020**, *25*, 530–543. [CrossRef]
66. Bortolato, B.; Hyphantis, T.N.; Valpione, S.; Perini, G.; Maes, M.; Morris, G.; Kubera, M.; Köhler, C.A.; Fernandes, B.S.; Stubbs, B.; et al. Depression in cancer: The many biobehavioral pathways driving tumor progression. *Cancer Treat. Rev.* **2017**, *52*, 58–70. [CrossRef] [PubMed]
67. Tanaka, M. From Serendipity to Precision: Integrating AI, Multi-Omics, and Human-Specific Models for Personalized Neuropsychiatric Care. *Biomedicines* **2025**, *13*, 167. [CrossRef]
68. Rees, E.; Owen, M.J. Translating insights from neuropsychiatric genetics and genomics for precision psychiatry. *Genome Med.* **2020**, *12*, 43. [CrossRef] [PubMed]
69. Arns, M.; van Dijk, H.; Luykx, J.J.; van Wingen, G.; Olbrich, S. Stratified psychiatry: Tomorrow's precision psychiatry? *Eur. Neuropsychopharmacol.* **2022**, *55*, 14–19. [CrossRef]
70. Kas, M.J.H.; Hyman, S.; Williams, L.M.; Hidalgo-Mazzei, D.; Huys, Q.J.M.; Hotopf, M.; Cuthbert, B.; Lewis, C.M.; De Picker, L.J.; Lalousis, P.A.; et al. Towards a consensus roadmap for a new diagnostic framework for mental disorders. *Eur. Neuropsychopharmacol.* **2025**, *90*, 16–27. [CrossRef]
71. Dhieb, D.; Bastaki, K. Pharmaco-Multiomics: A New Frontier in Precision Psychiatry. *Int. J. Mol. Sci.* **2025**, *26*, 1082. [CrossRef]
72. Foley, É.M.; Slaney, C.; Donnelly, N.A.; Kaser, M.; Ziegler, L.; Khandaker, G.M. A novel biomarker of interleukin 6 activity and clinical and cognitive outcomes in depression. *Psychoneuroendocrinology* **2024**, *164*, 107008. [CrossRef]

73. Solmi, M.; Suresh Sharma, M.; Osimo, E.F.; Fornaro, M.; Bortolato, B.; Croatto, G.; Miola, A.; Vieta, E.; Pariante, C.M.; Smith, L.; et al. Peripheral levels of C-reactive protein, tumor necrosis factor-α, interleukin-6, and interleukin-1β across the mood spectrum in bipolar disorder: A meta-analysis of mean differences and variability. *Brain Behav. Immun.* **2021**, *97*, 193–203. [CrossRef] [PubMed]
74. Mario, A.; Ivana, L.; Anita, M.; Silvio, M.; Claudia, A.; Mariaclaudia, M.; Antonello, B. Inflammatory Biomarkers, Cognitive Functioning, and Brain Imaging Abnormalities in Bipolar Disorder: A Systematic Review. *Clin. Neuropsychiatry* **2024**, *21*, 32–62. [CrossRef] [PubMed]
75. Ruiz-Sastre, P.; Gómez-Sánchez-Lafuente, C.; Martín-Martín, J.; Herrera-Imbroda, J.; Mayoral-Cleries, F.; Santos-Amaya, I.; Rodríguez de Fonseca, F.; Guzmán-Parra, J.; Rivera, P.; Suárez, J. Pharmacotherapeutic value of inflammatory and neurotrophic biomarkers in bipolar disorder: A systematic review. *Prog. Neuropsychopharmacol. Biol. Psychiatry* **2024**, *134*, 111056. [CrossRef] [PubMed]
76. Rosenblat, J.D.; Brietzke, E.; Mansur, R.B.; Maruschak, N.A.; Lee, Y.; McIntyre, R.S. Inflammation as a neurobiological substrate of cognitive impairment in bipolar disorder: Evidence, pathophysiology and treatment implications. *J. Affect. Disord.* **2015**, *188*, 149–159. [CrossRef]
77. Bavaresco, D.V.; da Rosa, M.I.; Uggioni, M.L.R.; Ferraz, S.D.; Pacheco, T.R.; Toé, H.; da Silveira, A.P.; Quadros, L.F.A.; de Souza, T.D.; Varela, R.B.; et al. Increased inflammatory biomarkers and changes in biological rhythms in bipolar disorder: A case-control study. *J. Affect. Disord.* **2020**, *271*, 115–122. [CrossRef]
78. Tanaka, M.; He, Z.; Han, S.; Battaglia, S. Editorial: Noninvasive brain stimulation: A promising approach to study and improve emotion regulation. *Front. Behav. Neurosci.* **2025**, *19*, 1633936. [CrossRef]
79. Figueiredo Godoy, A.C.; Frota, F.F.; Araújo, L.P.; Valenti, V.E.; Pereira, E.; Detregiachi, C.R.P.; Galhardi, C.M.; Caracio, F.C.; Haber, R.S.A.; Fornari Laurindo, L.; et al. Neuroinflammation and Natural Antidepressants: Balancing Fire with Flora. *Biomedicines* **2025**, *13*, 1129. [CrossRef]
80. Barbalho, S.M.; Leme Boaro, B.; da Silva Camarinha Oliveira, J.; Patočka, J.; Barbalho Lamas, C.; Tanaka, M.; Laurindo, L.F. Molecular Mechanisms Underlying Neuroinflammation Intervention with Medicinal Plants: A Critical and Narrative Review of the Current Literature. *Pharmaceuticals* **2025**, *18*, 133. [CrossRef]
81. Lv, S.; Luo, C. Blood-brain barrier dysfunction in schizophrenia: Mechanisms and implications (Review). *Int. J. Mol. Med.* **2025**, *56*, 153. [CrossRef]
82. Najjar, S.; Pahlajani, S.; De Sanctis, V.; Stern, J.N.H.; Najjar, A.; Chong, D. Neurovascular Unit Dysfunction and Blood-Brain Barrier Hyperpermeability Contribute to Schizophrenia Neurobiology: A Theoretical Integration of Clinical and Experimental Evidence. *Front. Psychiatry* **2017**, *8*, 83. [CrossRef] [PubMed]
83. Pong, S.; Karmacharya, R.; Sofman, M.; Bishop, J.R.; Lizano, P. The Role of Brain Microvascular Endothelial Cell and Blood-Brain Barrier Dysfunction in Schizophrenia. *Complex Psychiatry* **2020**, *6*, 30–46. [CrossRef] [PubMed]
84. Arango, C.; Fagiolini, A.; Gorwood, P.; Kane, J.M.; Diaz-Mendoza, S.; Sahota, N.; Correll, C.U. Delphi panel to obtain clinical consensus about using long-acting injectable antipsychotics to treat first-episode and early-phase schizophrenia: Treatment goals and approaches to functional recovery. *BMC Psychiatry* **2023**, *23*, 453. [CrossRef] [PubMed]
85. Verebi, C.; Nectoux, J.; Gorwood, P.; Le Strat, Y.; Duriez, P.; Ramoz, N.; Bienvenu, T. A systematic literature review and meta-analysis of circulating nucleic acids as biomarkers in psychiatry. *Prog. Neuropsychopharmacol. Biol. Psychiatry* **2023**, *125*, 110770. [CrossRef]
86. Salvetat, N.; Checa-Robles, F.J.; Patel, V.; Cayzac, C.; Dubuc, B.; Chimienti, F.; Abraham, J.D.; Dupré, P.; Vetter, D.; Méreuze, S.; et al. A game changer for bipolar disorder diagnosis using RNA editing-based biomarkers. *Transl. Psychiatry* **2022**, *12*, 182. [CrossRef]
87. Hayashi, M.; Salvetat, N.; Cayzac, C.; Checa-Robles, F.; Lozano, C.; Dubuc, B.; Mereuze, S.; Nani, J.; Molina, F.; Brietske, E. The RNA editing patterns are different in blood of euthymic and depressed bipolar patients. *Eur. Psychiatry* **2023**, *66*, S573. [CrossRef]
88. Sathyanarayanan, A.; Mueller, T.T.; Ali Moni, M.; Schueler, K.; Baune, B.T.; Lio, P.; Mehta, D.; Baune, B.T.; Dierssen, M.; Ebert, B.; et al. Multi-omics data integration methods and their applications in psychiatric disorders. *Eur. Neuropsychopharmacol.* **2023**, *69*, 26–46. [CrossRef]
89. Smith, B.J.; Silva-Costa, L.C.; Martins-de-Souza, D. Human disease biomarker panels through systems biology. *Biophys. Rev.* **2021**, *13*, 1179–1190. [CrossRef]
90. Mokhtari, A.; Porte, B.; Belzeaux, R.; Etain, B.; Ibrahim, E.C.; Marie-Claire, C.; Lutz, P.E.; Delahaye-Duriez, A. The molecular pathophysiology of mood disorders: From the analysis of single molecular layers to multi-omic integration. *Prog. Neuropsychopharmacol. Biol. Psychiatry* **2022**, *116*, 110520. [CrossRef]
91. Liu, B.; Liu, J.; Wang, J.G.; Liu, C.L.; Yan, H.J. AdipoRon improves cognitive dysfunction of Alzheimer's disease and rescues impaired neural stem cell proliferation through AdipoR1/AMPK pathway. *Exp. Neurol.* **2020**, *327*, 113249. [CrossRef] [PubMed]

92. Wang, C.; Chang, Y.; Zhu, J.; Wu, Y.; Jiang, X.; Zheng, S.; Li, G.; Ma, R. AdipoRon mitigates tau pathology and restores mitochondrial dynamics via AMPK-related pathway in a mouse model of Alzheimer's disease. *Exp. Neurol.* **2023**, *363*, 114355. [CrossRef] [PubMed]
93. Youngstein, T.; Hoffmann, P.; Gül, A.; Lane, T.; Williams, R.; Rowczenio, D.M.; Ozdogan, H.; Ugurlu, S.; Ryan, J.; Harty, L.; et al. International multi-centre study of pregnancy outcomes with interleukin-1 inhibitors. *Rheumatology* **2017**, *56*, 2102–2108. [CrossRef] [PubMed]
94. Carnovale, C.; Tombetti, E.; Battini, V.; Mazhar, F.; Radice, S.; Nivuori, M.; Negro, E.; Tamanini, S.; Brucato, A. Inflammasome Targeted Therapy in Pregnancy: New Insights from an Analysis of Real-World Data from the FAERS Database and a Systematic Review. *Front. Pharmacol.* **2020**, *11*, 612259. [CrossRef]
95. Chen, Z.S.; Kulkarni, P.P.; Galatzer-Levy, I.R.; Bigio, B.; Nasca, C.; Zhang, Y. Modern views of machine learning for precision psychiatry. *Patterns* **2022**, *3*, 100602. [CrossRef]
96. Lin, E.; Lin, C.H.; Lane, H.Y. Precision Psychiatry Applications with Pharmacogenomics: Artificial Intelligence and Machine Learning Approaches. *Int. J. Mol. Sci.* **2020**, *21*, 969. [CrossRef]
97. Wright, S.N.; Anticevic, A. Generative AI for precision neuroimaging biomarker development in psychiatry. *Psychiatry Res.* **2024**, *339*, 115955. [CrossRef]
98. Tanaka, M.; Battaglia, S. Dualistic Dynamics in Neuropsychiatry: From Monoaminergic Modulators to Multiscale Biomarker Maps. *Biomedicines* **2025**, *13*, 1456. [CrossRef]
99. Johnson, K.B.; Wei, W.Q.; Weeraratne, D.; Frisse, M.E.; Misulis, K.; Rhee, K.; Zhao, J.; Snowdon, J.L. Precision Medicine, AI, and the Future of Personalized Health Care. *Clin. Transl. Sci.* **2021**, *14*, 86–93. [CrossRef]
100. Tossici, G.; Zurloni, V.; Nitri, A. Stress and sport performance: A PNEI multidisciplinary approach. *Front. Psychol.* **2024**, *15*, 1358771. [CrossRef]
101. Milani, A.; Saiani, L.; Misurelli, E.; Lacapra, S.; Pravettoni, G.; Magon, G.; Mazzocco, K. The relevance of the contribution of psychoneuroendocrinoimmunology and psychology of reasoning and decision making to nursing science: A discursive paper. *J. Adv. Nurs.* **2024**, *80*, 2943–2957. [CrossRef]
102. Gökyayla, E.; Türel Ermertcan, A.; Bilaç, C. Functional medicine with dermatology insite: A systematic approach for diagnosis and treatment of chronic diseases. *Dermatol. Ther.* **2020**, *33*, e13729. [CrossRef]
103. Ee, C.; Lake, J.; Firth, J.; Hargraves, F.; de Manincor, M.; Meade, T.; Marx, W.; Sarris, J. An integrative collaborative care model for people with mental illness and physical comorbidities. *Int. J. Ment. Health Syst.* **2020**, *14*, 83. [CrossRef] [PubMed]
104. Warren, A. An integrative approach to dementia care. *Front. Aging* **2023**, *4*, 1143408. [CrossRef]
105. Parsons, M.W.; Dietrich, J. Assessment and Management of Cognitive Symptoms in Patients With Brain Tumors. *Am. Soc. Clin. Oncol. Educ. Book* **2021**, *41*, e90–e99. [CrossRef] [PubMed]
106. Schipmann, S.; Suero Molina, E.; Frasch, A.; Stummer, W.; Wiewrodt, D. Initial psycho-oncological counselling in neuro-oncology: Analysis of topics and needs of brain tumour patients. *J. Neuro-Oncol.* **2018**, *136*, 505–514. [CrossRef] [PubMed]
107. Loughan, A.R.; Reid, M.; Willis, K.D.; Davies, A.; Boutté, R.L.; Barrett, S.; Lo, K. The burden of a brain tumor: Guiding patient centric care in neuro-oncology. *J. Neuro-Oncol.* **2022**, *157*, 487–498. [CrossRef]
108. Agiananda, F.; Aninditha, T.; Sofyan, H.R.; Savitri, I.; Karnasih, A.; Puspaseruni, P.A.; Putri, C.K. AB068. Psychiatric disorder in central nervous system tumor patients and its related factors. *Chin. Clin. Oncol.* **2024**, *13*, AB068. [CrossRef]
109. van Kessel, E.; Baumfalk, A.E.; van Zandvoort, M.J.E.; Robe, P.A.; Snijders, T.J. Tumor-related neurocognitive dysfunction in patients with diffuse glioma: A systematic review of neurocognitive functioning prior to anti-tumor treatment. *J. Neuro-Oncol.* **2017**, *134*, 9–18. [CrossRef]
110. Fox, A.; Zarrella, G.V.; Loughan, A.R.; Lanoye, A.; Palesh, O.; Moeller, F.G.; Braun, S.E. QOL-28. Cancer-Related Distress in Neuro-Oncology: Patients Inform Program Development for Enhancing Quality of Life. *Neuro-Oncology* **2024**, *26*, viii268–viii269. [CrossRef]
111. Ali, F.S.; Hussain, M.R.; Gutiérrez, C.; Demireva, P.; Ballester, L.Y.; Zhu, J.J.; Blanco, A.; Esquenazi, Y. Cognitive disability in adult patients with brain tumors. *Cancer Treat. Rev.* **2018**, *65*, 33–40. [CrossRef]
112. Han, V.X.; Patel, S.; Jones, H.F.; Dale, R.C. Maternal immune activation and neuroinflammation in human neurodevelopmental disorders. *Nat. Rev. Neurol.* **2021**, *17*, 564–579. [CrossRef]
113. Gumusoglu, S.B.; Stevens, H.E. Maternal Inflammation and Neurodevelopmental Programming: A Review of Preclinical Outcomes and Implications for Translational Psychiatry. *Biol. Psychiatry* **2019**, *85*, 107–121. [CrossRef]
114. Kim, E.; Huh, J.R.; Choi, G.B. Prenatal and postnatal neuroimmune interactions in neurodevelopmental disorders. *Nat. Immunol.* **2024**, *25*, 598–606. [CrossRef] [PubMed]
115. Corradini, I.; Focchi, E.; Rasile, M.; Morini, R.; Desiato, G.; Tomasoni, R.; Lizier, M.; Ghirardini, E.; Fesce, R.; Morone, D.; et al. Maternal Immune Activation Delays Excitatory-to-Inhibitory Gamma-Aminobutyric Acid Switch in Offspring. *Biol. Psychiatry* **2018**, *83*, 680–691. [CrossRef] [PubMed]

116. Kelly, S.B.; Tran, N.T.; Polglase, G.R.; Hunt, R.W.; Nold, M.F.; Nold-Petry, C.A.; Olson, D.M.; Chemtob, S.; Lodygensky, G.A.; Robertson, S.A.; et al. A systematic review of immune-based interventions for perinatal neuroprotection: Closing the gap between animal studies and human trials. *J. Neuroinflamm.* **2023**, *20*, 241. [CrossRef]
117. Tarhini, S.; Crespo-Quiles, C.; Buhler, E.; Pineau, L.; Pallesi-Pocachard, E.; Villain, S.; Saha, S.; Silvagnoli, L.; Stamminger, T.; Luche, H.; et al. Cytomegalovirus infection of the fetal brain: Intake of aspirin during pregnancy blunts neurodevelopmental pathogenesis in the offspring. *J. Neuroinflamm.* **2024**, *21*, 298. [CrossRef]
118. Bauman, M.D.; Van de Water, J. Translational opportunities in the prenatal immune environment: Promises and limitations of the maternal immune activation model. *Neurobiol. Dis.* **2020**, *141*, 104864. [CrossRef]
119. Careaga, M.; Murai, T.; Bauman, M.D. Maternal Immune Activation and Autism Spectrum Disorder: From Rodents to Nonhuman and Human Primates. *Biol. Psychiatry* **2017**, *81*, 391–401. [CrossRef] [PubMed]
120. Jeremic, D.; Jiménez-Díaz, L.; Navarro-López, J.D. Past, present and future of therapeutic strategies against amyloid-β peptides in Alzheimer's disease: A systematic review. *Ageing Res. Rev.* **2021**, *72*, 101496. [CrossRef]
121. Ramesh, M.; Govindaraju, T. Multipronged diagnostic and therapeutic strategies for Alzheimer's disease. *Chem. Sci.* **2022**, *13*, 13657–13689. [CrossRef] [PubMed]
122. Mattsson-Carlgren, N.; Salvadó, G.; Ashton, N.J.; Tideman, P.; Stomrud, E.; Zetterberg, H.; Ossenkoppele, R.; Betthauser, T.J.; Cody, K.A.; Jonaitis, E.M.; et al. Prediction of Longitudinal Cognitive Decline in Preclinical Alzheimer Disease Using Plasma Biomarkers. *JAMA Neurol.* **2023**, *80*, 360–369. [CrossRef] [PubMed]
123. Hampel, H.; Hu, Y.; Cummings, J.; Mattke, S.; Iwatsubo, T.; Nakamura, A.; Vellas, B.; O'Bryant, S.; Shaw, L.M.; Cho, M.; et al. Blood-based biomarkers for Alzheimer's disease: Current state and future use in a transformed global healthcare landscape. *Neuron* **2023**, *111*, 2781–2799. [CrossRef]
124. Hampel, H.; Au, R.; Mattke, S.; van der Flier, W.M.; Aisen, P.; Apostolova, L.; Chen, C.; Cho, M.; De Santi, S.; Gao, P.; et al. Designing the next-generation clinical care pathway for Alzheimer's disease. *Nat. Aging* **2022**, *2*, 692–703. [CrossRef] [PubMed]

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