

From Microbiome to Mind: APAC's Push to Make the Gut-Brain Axis Clinically Actionable

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The gut-brain axis is moving from an emerging research concept towards a potential platform for precision mental health. Across APAC, researchers are combining microbiome, metabolomic and clinical data to identify functional biomarkers, develop targeted psychobiotics and explore new intervention strategies. The next challenge is translating these diverse findings into reproducible, clinically useful and population-specific applications.



Researchers are now increasingly examining mental health as the product of interactions among the nervous, immune, metabolic, endocrine and microbial systems, bringing the gut firmly into the picture. The research question is therefore no longer simply whether the gut and brain communicate, but whether those connections can be understood precisely enough to become clinically useful.

Asia-Pacific (APAC) is emerging as an important proving ground for this work. Singapore is building a large multi-ethnic cohort; China is examining bacteria, fungi, archaea, viruses and microbial pathways in depression; Taiwan is separating disease-related microbiome signals from antidepressant effects while advancing psychobiotic research; South Korea is integrating microbiome and metabolomics data; Japan brings deep probiotic and fermentation expertise; and Australia is testing dietary intervention and faecal microbiota transplantation (FMT). This diversity matters as diet, genetics, urbanisation, medication exposure, and environment all shape microbial composition and function. Determining which gut-brain signals are universal and which are population-specific will be essential to developing precision mental health applications.

Moving from dysbiosis to functional biomarkers

Early research on the gut-brain axis frequently centred on dysbiosis, universally understood as disruption of the gut microbial ecosystem. As microbiome science has advanced, however, the concept has become less informative. There is no universally accepted definition of a healthy microbiome, and microbial composition varies considerably among healthy individuals according to age, diet, environment, medication use and geography.

A 2025 Taiwanese study involving National Taiwan University, National Taiwan University Hospital and Taipei Medical University compared 106 antidepressant-naïve patients with depressive illness with 151 healthy controls, thereby reducing medication-related confounding. The researchers identified differences in microbial diversity, several altered taxa and multiple predicted functional pathways. They also developed a Depression Dysbiosis Index associated with symptom severity and built a machine-learning model that distinguished cases from controls with moderate accuracy.

A recent South Korean study led by Korea University extended this functional approach by combining gut microbial profiling with plasma and urinary metabolomics in people with major depressive disorder and healthy controls. Although microbial differences were detected, circulating metabolic signatures, particularly plasma metabolites, classified the groups more effectively than gut microbiota alone. This raises an important possibility for future biomarker development. The microbiome may sit upstream of disease biology without necessarily providing the best clinical readout. If microbial activity alters lipid metabolism, inflammatory molecules, acylcarnitines or neuroactive metabolites, downstream blood-based signals may prove more robust and practical than stool profiling. The eventual product could therefore be a blood-based biomarker panel informed by microbial activity rather than a microbiome test itself.

Psychobiotics and emerging gut-brain interventions

Psychobiotics are the most visible commercial expression of the gut-brain axis, generally referring to probiotics or related microbiome interventions investigated for effects on mood, stress, anxiety, cognition and other neurobehavioral outcomes. APAC has played a prominent role because of its advanced microbial research and long-established probiotic and fermentation industries, but the evidence needs greater precision.

Evidence syntheses report a favourable overall signal for probiotics in major depressive disorder, while findings for anxiety remain inconsistent. Studies also vary widely in strain, dose, duration, population and methodological quality. Strain specificity is particularly important: biological effects can depend on the exact strain, formulation and dose, as well as patient characteristics, diet, medication use and the individual's baseline microbiome.

Taiwan's PS128 programme demonstrates both the potential and the limits of current psychobiotic development. An eight-week double-blind, placebo-controlled study in major depressive disorder found improvement in both the PS128 and placebo groups, but no significant additional clinical or biomarker benefit from PS128. A Chinese 12-week study combining escitalopram and PS128, posted as a preprint in August 2026, has reported encouraging results, but the findings have not yet undergone peer review.

Together with Jiangnan University's work on CCFM1025, these studies indicate that psychobiotics are more likely to find a role as defined strains used in selected populations, alongside conventional treatment, than as broadly positioned mood-support products.

Research is also moving beyond live probiotics. Microbial metabolites, postbiotics, and defined consortia offer greater control over biological activity and manufacturing consistency. South Korean metabolomics work, in which circulating metabolites discriminated disease status better than gut microbiota alone, supports the move towards functional outputs rather than microorganisms themselves.

Engineered microbes and bacteriophages represent more distant possibilities. Engineered organisms could be designed to produce or consume specific molecules, while bacteriophages might selectively alter microbial populations associated with undesirable functions. Their use in psychiatry, however, will depend on identifying causal targets that are reproducible in humans and clinically relevant.

Regional advances in gut-brain microbiome research

Across APAC, research programmes are moving from descriptive microbiome studies towards functional biology, targeted intervention and precision applications.

In China, a 2026 Guangzhou study of first-episode, drug-naïve adults with major depressive disorder used shotgun metagenomics to examine bacteria, eukaryotes, archaea, viruses, microbial genes and functional pathways. Models combining multiple microbial kingdoms with functional information performed better within the study cohort than bacteria-only models. The work supports a broader ecological view of depression-related microbiology and widens the search for useful

functional markers beyond bacteria.

Japan contributes a different strength: decades of strain science and microbial manufacturing expertise. Researchers from Yakult Central Institute, Yakult Honsha, and Tokushima University studied *Lacticaseibacillus casei* strain Shirota in medical students experiencing examination stress, assessing physiological responses, gastrointestinal symptoms, microbiome changes, and sleep. These were studies in healthy participants rather than people with major depressive disorder, but they provide an early example of a defined commercial strain being evaluated through controlled human stress paradigms and physiological biomarkers. Japan's experience in strain selection, fermentation, stability and manufacturing could support future development of neuroactive strains, postbiotics and defined microbial metabolites backed by rigorous therapeutic evidence.

Hong Kong is linking multi-omics research with targeted intervention. Researchers at the Chinese University of Hong Kong developed the SCM06 synbiotic for anxiety and sensory hyperresponsiveness in children with autism spectrum disorder. In a 12-week open-label pilot involving 30 children, treatment was associated with exploratory improvements in symptoms and with microbiome and metabolomic changes. The study was small and lacked a placebo control, so efficacy remains unproven. Its value lies in the phenotype-focused design, attention to GABA-related and immune pathways, and the academic-to-commercial development route through GenieBiome.

Singapore is addressing another weakness in microbiome research: scale and population diversity. The Gut Linked Outcomes in Wellbeing (GLOW) programme plans to recruit more than 6,000 Chinese, Malay and Indian participants and integrate microbiome, blood, skin, psychological and lifestyle information using metagenomics, metatranscriptomics and metabolomics. Such a cohort could help separate the effects of ancestry from those of diet, lifestyle and environment, while testing whether microbial signatures identified in one subgroup are reproducible in another.

Australia is examining gut-brain biology through ecosystem-level interventions. Deakin University's Food & Mood Centre is studying diet, mental health and the microbiome through programmes including OPTIMISM, which uses controlled feeding in people with moderate-to-severe depression and combines blood and stool analysis to examine microbial, inflammatory and metabolic pathways. The centre has also explored FMT in a pilot randomised study designed to assess feasibility, safety and acceptability rather than efficacy.

India is beginning to generate controlled clinical evidence. A 2026 multicentre pilot at AIIMS New Delhi and NIMHANS Bengaluru evaluated adjunctive probiotics in older adults with moderate unipolar depression. Larger microbiome-informed trials and longitudinal cohorts remain limited, but India's scale, dietary diversity and regional variation make it an important setting for future studies, particularly those testing whether signatures identified elsewhere in Asia remain relevant across different Indian populations.

Patient stratification may matter more than diagnosis

One of the most promising clinical applications may be microbiome-guided patient stratification rather than diagnosis. Clinicians do not need a stool test to identify major depressive disorder; the greater unmet need is biological information that can help guide treatment decisions.

A microbiome-informed platform would be more useful if it could identify inflammatory or metabolic subtypes, predict response to specific interventions, or identify patients most likely to benefit from microbiome-directed adjuncts. The Taiwanese Depression Dysbiosis Index, Chinese multi-kingdom models and South Korean metabolic signatures all point in this direction, although none is ready for clinical use.

The longer-term opportunity is a composite biomarker system in which microbiome data is analysed alongside metabolites, inflammatory and endocrine markers, genetics, lifestyle and clinical phenotype. In that setting, the microbiome would not be expected to explain depression as a whole; it would help identify which biological processes are most relevant to an individual patient.

AI and machine learning can support this work by integrating complex multi-omics datasets and identifying patterns that single biomarkers may miss. Their value, however, depends on external validation. Models developed in Seoul, Taipei or Guangzhou will need to perform consistently in populations from Singapore, Japan, Australia, India and elsewhere before they can support broader clinical use.

Regulation and clinical pathways for gut-brain microbiome interventions

Across APAC, differences between regulatory systems add complexity. Depending on the market, intended use and claim, products may fall under food, health-supplement, functional-food or therapeutic and biological-product pathways. Regulatory strategy therefore needs to be considered early in product development rather than only at the point of market entry.

Companies must decide whether they are developing a wellness product or a therapeutic intervention. Wellness products can reach consumers more quickly but cannot make the same medical claims. Products intended for diagnosed psychiatric disorders require longer and more demanding clinical development. A change in microbiome composition alone is not evidence of therapeutic benefit; the intervention must ultimately improve a clinically meaningful outcome.

Near-term products are likely to include better-defined psychobiotic or synbiotic adjuncts, personalised dietary interventions guided by microbial or metabolic profiles, and biomarker panels that combine microbial and blood-based signals. Microbial metabolites, postbiotics and rational consortia may offer greater therapeutic precision over the medium term, while programmable microbes and phage-based editing remain longer-term possibilities.

What stakeholders need to do next

Larger longitudinal cohorts, treatment-naïve populations, standardised sampling and multi-omics protocols, and prospective trials are needed to establish whether changes in the microbiome are mechanistically linked to clinically meaningful outcomes. Cross-country validation across diverse APAC populations will be particularly important for separating conserved biology from effects driven by diet, ancestry or environment.

Public-private collaboration will also be essential. Universities and health systems can provide well-characterised patient cohorts, biobanks and longitudinal data, while industry brings capabilities in strain development, metabolomics, biomanufacturing, diagnostics and clinical development. Shared datasets and harmonised protocols would make it easier to reproduce findings across institutions and reduce duplication of effort. Regulatory agencies can support translation by establishing clearer development pathways for foods, supplements, live biotherapeutics, postbiotics and engineered microbes while maintaining appropriate evidence standards.

For companies, the priority should be to establish a defensible biological rationale before expanding product claims. Development should begin with a clearly defined patient population and mechanism, combine microbiome information with metabolomic and clinical markers, and include validation across APAC populations from an early stage.

Commercial advantage will ultimately come from evidence that links a microbial signal to a reproducible mechanism, identifies the patients in whom that mechanism matters, and demonstrates a measurable clinical benefit.

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