NeuroPhytome

EXECUTIVE REPORT

An integrative scientific initiative on neurodiversity, evolution, and plant-derived biochemical signals

Executive Summary

NeuroPhytome is a multidisciplinary research initiative that seeks to advance the understanding of human neurodiversity by investigating the long-term interaction between the human brain and plant-derived biochemical signals. The project is based on a simple but underexplored premise: **human neurodevelopment has evolved in continuous dialogue with a chemically complex plant environment**, and modern disruptions to this biochemical context may have subtle but far-reaching consequences for brain development, regulation, and resilience.

Positioned at the intersection of neuroscience, plant science, evolutionary biology, and systems medicine, NeuroPhytome aims to generate both **fundamental insight** and **translational opportunities**, with particular relevance for attention-related and neurodevelopmental phenotypes such as ADHD and autism spectrum conditions. The initiative is designed to be scientifically rigorous, conceptually integrative, and strategically aligned with emerging paradigms in **personalized and preventive medicine**.

Scientific Rationale

Despite major advances in genetics and neurobiology, current explanatory models of neurodiversity remain largely fragmented. Genetic predisposition, while important, explains only part of the observed variability, and does not fully account for the rapid rise in diagnosed neurodiverse profiles over recent decades.

NeuroPhytome builds on growing evidence from the **Developmental Origins of Health and Disease (DOHaD)** framework, neuroepigenetics, and evolutionary biology, proposing that **early-life exposure to specific metabolic and bioactive signals plays a modulatory role in neurodevelopmental trajectories**. Historically, these signals were largely provided by diverse, stress-adapted plants rich in secondary metabolites. Modern agriculture, focused on yield, uniformity, and stress minimization, has significantly reduced the diversity and concentration of many of these compounds in the human diet.

Importantly, the absence of such signals does not typically result in acute deficiency syndromes. Instead, we hypothesize that it may **reduce the brain's capacity for adaptive regulation during sensitive developmental windows**, thereby influencing executive function, dopaminergic regulation, neuroinflammatory tone, and cognitive plasticity.

Conceptual Innovation

NeuroPhytome introduces an integrative framework in which neurodiversity is not approached solely as pathology, nor exclusively as genetic variation, but as a **dynamic outcome of evolutionary legacy, developmental plasticity, and biochemical context**.

Within this framework, plant-derived metabolites are considered not merely as nutrients or pharmacological agents, but as **informational signals** that historically contributed to the fine-tuning of human neurobiology. Understanding how these signals interact with genetic background and developmental timing represents a largely untapped opportunity in neuroscience and medicine.

Methodological Approach

The initiative is structured as a modular, interdisciplinary research platform combining:

- **Advanced phytochemical profiling** and agronomic optimization of bioactive plant compounds, with emphasis on Mediterranean and stress-adapted species.

- **Preclinical neurobiological studies** focusing on neurotransmission, monoaminergic systems, neuroinflammation, and epigenetic regulation.
- **Computational and data-driven approaches**, including metabolomics, pharmacogenetics, and systems modeling.
- **Evolutionary and theoretical synthesis**, ensuring conceptual coherence and the generation of testable, biologically plausible models.

This architecture allows NeuroPhytome to evolve flexibly, integrate new partners, and adapt to both academic and translational pathways.

Impact and Translational Potential

Beyond advancing fundamental knowledge, NeuroPhytome is explicitly oriented toward **translation and long-term societal impact**. The insights generated by the project have the potential to:

- Identify **biochemical signatures and modulatory pathways** relevant to neurodevelopment and cognitive regulation.
- Inform the design of **personalized phytochemical and nutritional strategies** tailored to individual neurobiological profiles.
- Contribute to the conceptual foundations of **next-generation personalized medicines**, in which metabolic context, developmental history, and evolutionary compatibility are considered alongside genetics.

In this sense, NeuroPhytome aims to help establish a **new hallmark for personalized medicine**: one that recognizes plant-derived biochemical signals as a missing but essential layer in understanding human brain function and variability.

Strategic Vision

NeuroPhytome is conceived as an international, collaborative initiative promoted by the **Centro Rausenbach de Análisis e Investigación (CRAI)**, designed to attract high-level public funding, private investment, and philanthropic support.

Its strength lies not only in individual experiments or technologies, but in its **integrative vision**: bridging plant biology and neuroscience, evolution and medicine, fundamental research and applied innovation. By doing so, NeuroPhytome seeks to contribute to a more nuanced, preventive, and human-centered approach to brain health.

Closing Perspective

NeuroPhytome does not propose a single solution or a universal treatment. Instead, it offers a **new way of thinking** about the human brain, one that acknowledges its evolutionary history, its biochemical environment, and its remarkable plasticity. In doing so, the project aims to generate knowledge that is scientifically robust, clinically relevant, and socially meaningful, laying groundwork for future advances in personalized and preventive medicine.

Contact

NeuroPhytome
An initiative promoted by the

Centro Rausenbach de Análisis e Investigación (CRAI)
Aptdo. A-37
30890 Puerto Lumbreras – Murcia (Spain)

Scientific & Strategic Lead:
Dr. Daniel A. Raus
draus@crai.es
www.crai.es/neurophytome