Invited Speaker Abstract

Official Language: English

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Title of Presentation

The AMBROSIAC project - A Menu for Brain Responses Opposing Stress-Induced Alterations in Cognition

1. Abstract

Diet and nutritional habits significantly impact on brain fitness, mental and cognitive health throughout life. The relative abundance of specific dietary nutrients affects mental health and cognitive abilities via direct and indirect mechanisms that modulate neuronal function and synaptic plasticity. It is increasingly recognized that an optimal nutrition is a key determinant in the well-being of a healthy ageing population world-wide. Chronic stress has been shown to negatively impact brain plasticity and cognitive performance, in particular in the ageing brain. Interestingly, the aged brain resembles the stressed brain on both behavioral and cellular levels and stress-induced cognitive alterations are likely to be more pronounced in the elderly. Likewise, poor nutritional habits are hypothesized to correlate with a heightened stress reactivity and susceptibility and greater cognitive decline in elderly, supporting the notion that interactions between nutritional factors and stress susceptibility represent critical determinants of cognitive performance and age-related cognitive decline.

AMBROSIAC investigated how diet through stress-related mechanisms affects cognition across the lifespan using preclinical and clinical approaches. Particular focus was on the influence of nutrition on increased susceptibility for stress-induced cognitive deficits from adulthood to old age (aim 1) and the impact of a nutritional intervention on cognitive ability, stress vulnerability and stress perception (aim 2). Using preclinical models, the molecular mechanisms by which targeted nutritional interventions can improve stress-induced vulnerabilities in cognition were investigated (aim 3). Across these aims, the gut microbiota was investigated as a novel critical signaling mediator between nutrition, stress susceptibility and maintenance of cognitive health in ageing.

From cell to populations, AMBROSIAC revealed clear effects of stress and inflammation on the gut microbiome and subsequent alterations of brain function and behavior which was ameliorated through specifically tailored dietary interventions targeting the gut microbiome.

These novel findings on the bidirectional relationships between nutrition, stress, inflammation and brain function can improve dietary habits leading to improved sustainability in our healthcare systems and can influence government policies to benefit Europe's economy.

2. key references

Cryan JF et al. The Microbiota-Gut-Brain Axis. *Physiological Reviews*

Boehme M et al. Mid-Life Microbiota Crises: Middle age is Associated with Pervasive Neuroimmune Alterations that are Reversed by Targeting the Gut Microbiome in Male Mice. *Molecular Psychiatry,* 2019 May 16. doi: 10.1038/s41380-019-0425-1.

Provensi G et al. Preventing Adolescent Stress-induced Cognitive and Microbiome Changes by Diet. *Proc Natl Acad Sci U S A.* 2019 Apr 22. pii: 201820832. doi: 10.1073/pnas.1820832116.

3. key messages

1. Both, stress and inflammation can alter brain function and behavior.
2. Stress and inflammation can alter the composition of the gut microbiota.
3. Dietary interventions targeting the gut microbiota reversed stress- and inflammation-induced alterations of the composition of the gut microbiota and improved deficits in brain function and cognition.

4. questions

1. What is the impact of diet on the gut microbiota? Can it modify the composition of the gut microbiota?
2. What is known about the interrelationship between diet, stress and brain function/behavior and what is the role of the gut microbiota therein?
3. What are the communication pathways between the gut microbiota and the brain?