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ARTICLE(S) FROM THE SPECIAL ISSUE ON NUTRITIONAL MODULATION OF THE GUT MICROBIOME IN GASTROINTESTINAL AND METABOLIC DISEASES; EDITED BY KRISTINA MARTINEZ-GURYN, PHD, RD, VANESSA LEONE, PHD, AND JOSEPH F. PIERRE, PHD

Nutritional modulation of the intestinal microbiota; future opportunities for the prevention and treatment of neuroimmune and neuroinflammatory disease[☆]Vincent C. Lombardi^{a,b,*}, Kenny L. De Meirleir^a, Krishnamurthy Subramanian^a, Sam M. Nourani^{c,d}, Ruben K. Dagda^e, Shannon L. Delaney^f, András Palotás^{g,h}^aNevada Center for Biomedical Research, University of Nevada, Reno, 1664 N. Virginia St. MS 0552, Reno, NV, 89557, USA^bUniversity of Nevada, Reno, School of Medicine, Department of Pathology, 1664 N. Virginia St. MS 0357, Reno, NV, 89557, USA^cUniversity of Nevada, Reno, School of Medicine, Department of Internal Medicine, 1664 N. Virginia St. MS 0357, Reno, NV, 89557, USA^dAdvanced Therapeutic, General Gastroenterology & Hepatology Digestive Health Associates, Reno, NV, USA^eUniversity of Nevada, Reno, School of Medicine, Department of Pharmacology, 1664 N. Virginia St. MS 0318, Reno, NV, 89557, USA^fColumbia University, Department of Psychiatry, New York, NY, USA^gKazan Federal University, Institute of Fundamental Medicine and Biology, (Volga Region) 18 Kremlyovskaya St., Kazan, 420008, Republic of Tatarstan, Russian Federation^hAsklepios-Med (private medical practice and research center), Kossuth Lajos sgt. 23, Szeged, H-6722, Hungary

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Abstract

The gut–brain axis refers to the bidirectional communication between the enteric nervous system and the central nervous system. Mounting evidence supports the premise that the intestinal microbiota plays a pivotal role in its function and has led to the more common and perhaps more accurate term gut–microbiota–brain axis. Numerous studies have identified associations between an altered microbiome and neuroimmune and neuroinflammatory diseases. In most cases, it is unknown if these associations are cause or effect; notwithstanding, maintaining or restoring homeostasis of the microbiota may represent future opportunities when treating or preventing these diseases. In recent years, several studies have identified the diet as a primary contributing factor in shaping the composition of the gut microbiota and, in turn, the mucosal and systemic immune systems. In this review, we will discuss the potential opportunities and challenges with respect to modifying and shaping the microbiota through diet and nutrition in order to treat or prevent neuroimmune and neuroinflammatory disease.

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Abbreviations: 4EPS, 4-ethylphenylsulfate; 5-HT, 5-hydroxytryptamine; AD, Alzheimer's disease; ASD, autism spectrum disorder; BDNF, brain-derived neurotrophic factor; CA, catecholamines; CD, Crohn's disease; CNS, central nervous system; DHA, docosahexaenoic acid; EAE, experimental autoimmune encephalomyelitis; ENS, enteric nervous system; EPA, eicosapentaenoic acid; FEP, first-episode psychosis; GABA, gamma-aminobutyric acid; GI, gastrointestinal; HIV, human immunodeficiency virus; IBS, irritable bowel syndrome; IL, interleukin; ME, myalgic encephalomyelitis; MIA, maternal immune activation; MS, multiple sclerosis; NMDA, N-methyl-D-aspartate; PD, Parkinson's disease; RRMS, Relapsing–remitting MS; SCFAs, short-chain fatty acids; TNF- α , tumor necrosis factor-alpha; Tregs, regulatory T cells; vA, vitamin A; vD, vitamin D

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