

The Brain – Gut Axis in Psychiatry and Neurology: Focus on the Microbiome

ISCTM

February 20, 2020

Washington, DC

Chairs Dr Jill Rasmussen,

Dr Ron Marcus

Declaration of Interests Dr Jill Rasmussen

Royal College of General Practitioners

- ▶ Clinical Representative Dementia
- ▶ Member Learning Disability Special Interest Group
- ▶ Founder of Dementia Roadmap

NHS:

- ▶ Advisor Academic Health Science Network Kent, Surrey, Sussex; Surrey Heartlands ICS
- ▶ Co-developer of MoodHive (Depression Anxiety Pathway)

Consultancy / Advisory Boards / Speakers Bureau:

- ▶ Acadia, Alz Soc UK, Andera partners, Biogen, Cerestim Ltd, ConSynance, ExCiva, Lundbeck, Merck, Nutricia, Wellcome Trust
- ▶ psi-napse

Declaration of Interests Dr Ron Marcus

CMO at Terran Biosciences

The Brain – Gut Axis in Psychiatry and Neurology: Focus on the Microbiome

Brain-gut-microbiota axis: focus on depression and anxiety Prof Ted Dinan

- *Prof of Psychiatry and Researcher at the APC Microbiome Inst Univ College Cork, Ireland*

Microbiome and Schizophrenia and Bipolar Disorder Prof Robert Yolken-

- *Johns Hopkins School of Medicine; Faith Dickerson-Sheppard Pratt Health System*

Microbiome and Alzheimer's Disease Prof Miia Kivipelto:

- *Prof Clin Geriatric Epidemiology Karolinska Inst, Head of Ageing Epidemiology Research Unit Imperial, London*

Microbiome and Parkinson's Disease Prof Peter LeWitt

- *Director, Parkinson's Disease and Movement Disorders Program; Prof of Neurology, Henry Ford Hospital/Wayne State University, Michigan*

Regulatory perspective on approval of probiotic products

- *Dr Paul Carlson, OVRP, CBER, FDA*

Discussant Prof Luca Pani

- *Prof Psych Univ Miami, Prof of Pharmacology at Università di Modena*

The Microbiome - Definitions

The Human Microbiome or human microbiota:

- ▶ Is the collection of microorganisms which live on us; on the skin, in the gut, saliva and mouth, eyes
- ▶ Include bacteria, archaea, fungi and single-celled eukaryotes ('protozoa').
- ▶ The microbiome is "the ecological community of commensal, symbiotic, and pathogenic microorganisms that literally share our body space
- ▶ Many scientific articles distinguish "microbiome" and "microbiota". However, by the original definitions these terms are largely synonymous
- ▶ Although "flora" refers to plants rather than bacteria, the term '**gut flora**' is widely used and familiar to biologists. '**Biota**' refers to the **total collection of organisms in an ecosystem**. The term 'microbiota' is best for bacteria and other microorganisms, but no doubt 'flora' will often be used..

The Microbiome - Definitions

Microbiome: A term often used synonymously with “microbiota” but more precisely used to refer to the collective genome of a given microbiota.

Microbiota: The collection of microorganisms found in/on a particular environment or living host.

Prebiotic: Nondigestible foods (such as fibers) that have a beneficial effect on the microbiome for the host.

Probiotic: Live microbes that have a positive effect on host health when ingested in adequate quantities.

Psychobiotic: Targeted interventions of the microbiome to support mental or brain health.

Synbiotics: Synergistic combination of prebiotics and probiotics. The aim is to optimize treatment effects by providing both the beneficial microbes and the nutrients they need to survive and colonize.

The Brain – Gut Axis in Psychiatry and Neurology: Focus on the Microbiome

The human gastrointestinal tract contains a large and complex neural network called the enteric nervous system, whose main purposes are to:

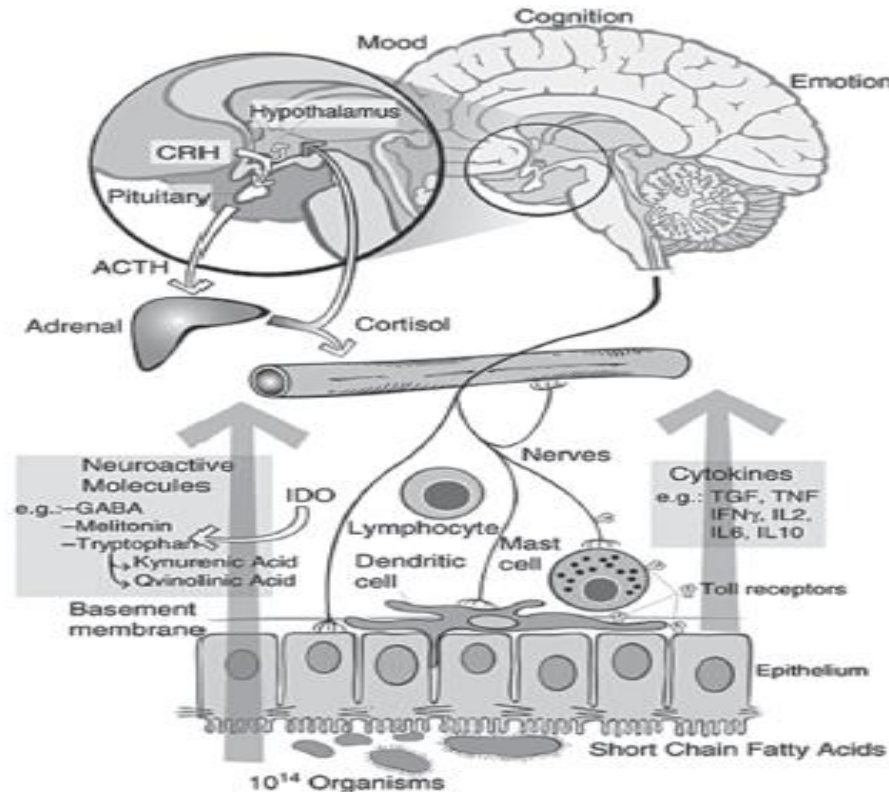
- ▶ Regulate the physiological functions of the gut
- ▶ Modulate communication between the gut and the central nervous system, both in the ascending (gut-to-brain) and descending (brain-to-gut) directions [Sharma et al. 2009].

This communication system is called the **gut–brain axis**,

The gut–brain axis moderates the coordination between the brain, the intestinal tract and endocrine and immune systems involved in maintaining gut function (see figure next slide, Bienenstock and Collins, 2010).

Disruptions of the gut–brain axis have been associated with not only functional gastrointestinal disorders but also **mood / anxiety disorders, neurodevelopmental disorders e.g. autism spectrum disorder, schizophrenia, and neurodegenerative disorders e.g. Alzheimer’s and Parkinson’s disease.**

The Brain – Gut Axis in Psychiatry and Neurology: Focus on the Microbiome

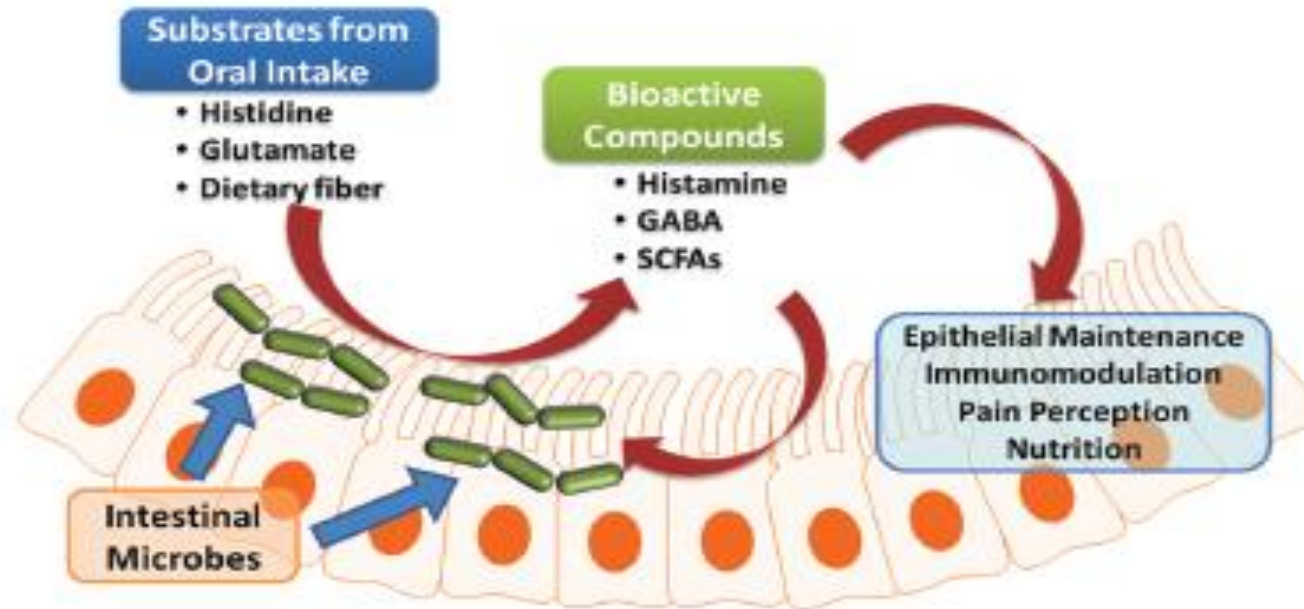


Proposed interactions between the gut microbiota, GI tract, central and peripheral nervous systems and the immune systems.

Intestinal microbes may:

1. Interact with intestinal epithelial cells or immune cells directly
2. Or, produce bioactive compounds and neurotransmitters to modulate immunity or the **“Gut-Brain axis”**

The Brain – Gut Axis in Psychiatry and Neurology: Focus on the Microbiome



Orally consumed nutrients may be converted by intestinal microbes into bioactive compounds

The Brain – Gut Axis in Psychiatry and Neurology: Focus on the Microbiome

Recent discoveries in the structure and function of the microbiome suggest that:

- ▶ Diet may have direct impact on the intestinal microbiota and human or animal health status
- ▶ Disruptions of microbe–man relationships may result in different disease states, including chronic inflammation, autoimmunity and neurological disorders.
- ▶ Probiotics have been proposed as preventive and therapeutic measures to restore the healthy composition and function of the gut microbiome.
- ▶ New types of probiotics, synbiotics or medicinal compounds derived from the microbiome may be used as future strategies to promote health, prevent disease, and treat different disorders.

The Brain – Gut Axis in Psychiatry and Neurology: Focus on the Microbiome

Brain-gut-microbiota axis: focus on depression and anxiety Prof Ted Dinan

- *Prof of Psychiatry and Researcher at the APC Microbiome Inst Univ College Cork, Ireland*

Microbiome and Schizophrenia and Bipolar Disorder Prof Robert Yolken-

- *Johns Hopkins School of Medicine; Faith Dickerson-Sheppard Pratt Health System*

Microbiome and Alzheimer's Disease Prof Miia Kivipelto:

- *Prof Clin Geriatric Epidemiology Karolinska Inst, Head of Ageing Epidemiology Research Unit Imperial, London*

Microbiome and Parkinson's Disease Prof Peter LeWitt

- *Director, Parkinson's Disease and Movement Disorders Program; Prof of Neurology, Henry Ford Hospital/Wayne State University, Michigan*

Regulatory perspective on approval of probiotic products

- *Dr Paul Carlson, OVR, CBER, FDA*

Discussant Prof Luca Pani

- *Prof Psych Univ Miami, Prof of Pharmacology at Università di Modena*