



K-FFIG

Special Address

on

Role of Functional Foods in Strengthening Immunity and Gut Microbiome and Gut Brain Axis

Dr. B. Sesikeran
Chairman K-FFIG
Former Director, ICMR- NIN, Hyderabad



**ABOUT K-FFIG
&
OVERVIEW OF K-FFIG ACTIVITIES
2019-2023**

WHAT IS K-FFIG?

❖ **ILSI India launched K-FFIG on 4 October 2019 in New Delhi. The Knowledge Center acts as a Think Tank, involving stakeholders from public and private sector.**

K-FFIG Mandate

1. **Provide a knowledge sharing platform by organizing seminars/ conferences/ workshops on recent advances in the science of human microbiome and functional foods including prebiotics, dietary fiber and probiotics.**
2. **Undertake studies to help fill/ understand gaps in consumer/industry understanding of science of probiotics.**
3. **Share recent developments in research with all stakeholders.**
4. **Look at challenges faced by this sector and encourage all stakeholders - Government including regulatory agencies, Industry and Academia - adopt global best practices.**
5. **Create a Think Tank, involving stakeholders from Government, Academia as well as Industry, who will be guided by a structured set of rules and codes, and will work towards sharing relevant research and technological developments in the area of human microbiome and functional foods.**

ACTIVITIES UNDERTAKEN

2020-2023

Exclusive Website

1. Exclusive K-FFIG Website Created

K-FFIG Website has been created. It provides information on: Activities undertaken in the area of GUT MICROBIOME, PROBIOTICS, PREBIOTICS, ANTIBIOTIC RESISTANCE and FUNCTIONAL FOODS. It has FAQs and Resource Centre.

K-FFIG Website Link:

<http://www.ils-i-india.org/kffig.htm>

2. Data Resource Center

Data Resource Center has been created within K-FFIG Website. Recent studies (2017 onwards) were compiled from more than 35 leading peer reviewed journals and was uploaded in February 2020 on the website. Due permission from all the journals was taken before brief introduction to studies were uploaded on the Website. These studies have been updated throughout 2020-23.

K-FFIG Resource Centre

<http://www.ils-india.org/kffig.htm>

**Total 599 Studies & Publications
(Peer Reviewed Journals)**

- **Microbiome and Gut Health – 244 Studies**
- **Immunity and Probiotics – 128 Studies**
- **Prebiotics – 39 Studies**
- **Functional Foods – 69 Studies**
- **Gut Microbiome and Neurological and Neuropsychiatric Disorders- 59 Studies**
- **Gut Microbiome and Antimicrobial Resistance - 60 Studies**

3. Seminars and Webinars

- ❖ **Seminar on “Recent Knowledge on Nutrients, Health and Immunity”.**
- ❖ **Seminar on “Bioactives and Functional Foods- Safety, Benefits and Challenges”.**
- ❖ **Seminar on “Clinical Evaluation/Intervention Studies for New Foods & Food Ingredients: Current Status and Way Forward – CENFFI”.**

4. Surveys , Studies and Reports

- **Conducted Survey on “Probiotics and Consumer Perception”.** The Survey Report can be downloaded from: <https://tinyurl.com/2p93vf3n>
- **Prepared Status Paper on “Role of Probiotics in Promoting Healthy Microbiome for Health and Immunity” was prepared.** It can be downloaded from: <https://tinyurl.com/2p83dpup>
- **An article on “Role of Probiotics and Vitamins in Maintaining a Healthy Gut Microbiome: Recent Advances” was published in Indian Journal of Community Health. The article can be viewed at:** <https://tinyurl.com/2p8s54k5>
- **A Guidance Document on “Scientific Basis for Labelling Claims and Regulations for Probiotics” was prepared.** It compiles the science and the evolution of this science to products. The Guidance Document can be downloaded from: <https://tinyurl.com/3p8hdnxe>

- **Sponsored “Systematic Review on Use of Probiotics for Nutritional Enrichment of Dairy Product”. Prepared Monograph was prepared on “Nutritional Benefits of Enriching Dairy Foods with Probiotics” It can be downloaded from: <https://tinyurl.com/3uvab29t> . The Study has been published in **Functional Foods in Health and Diseases Journal**. It can be viewed at: <https://tinyurl.com/2p9xprrs>**
- **Sponsored Study on “Risk Assessment of Vitamins , Minerals and Bioactive Compounds” - Under Publication.**
- **Prepared Report on “Bioactives and Functional Foods-Safety, Benefits and Challenges” was prepared. The Report can be downloaded from: <https://tinyurl.com/23pbha68>**
- **Prepared Concept Paper on “Best Practices for Ethical conduct of Human Intervention Studies for Novel Food/ Ingredients/ Processes/ Technology/ Claim Substantiation” It is recently prepared. It is not available online.**

5. Communication - K-FFIG Research Briefs

Earlier an exclusive section had been added on Gut Microbiome and Probiotics in ILSI India Fortnightly Newsletter - News You Can Use.

On July 2022 K-FFIG Launched Monthly Newsletter called “K-FFIG Research Briefs”. This K-FFIG Research Briefs provides latest updates on research in the area of Gut Microbiome and how it can be strengthened through food based approaches for improving health and immunity.

6. AWARDS

ILSI India supports K-FFIG work. Two of Three 2021 ILSI India Young Scientist Award For Outstanding Contributions For Improving Public Health were given to: scientists working on Gut Microbiome and Functional Foods:

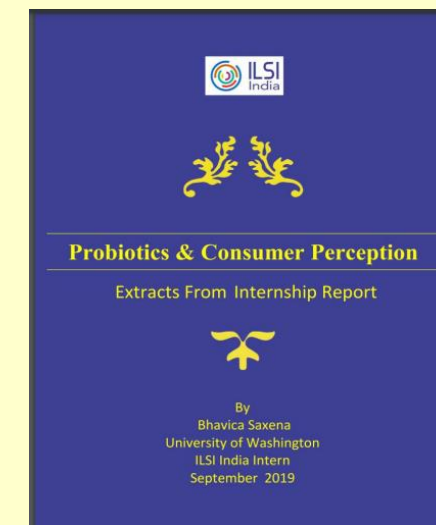
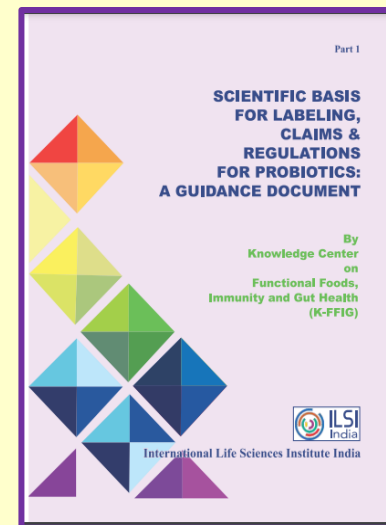
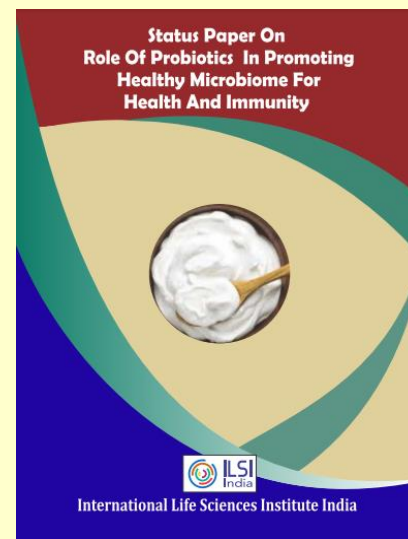
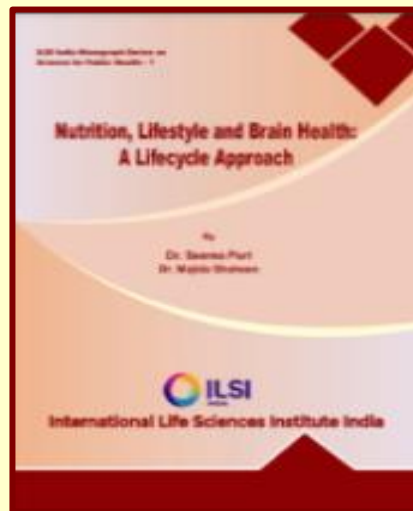
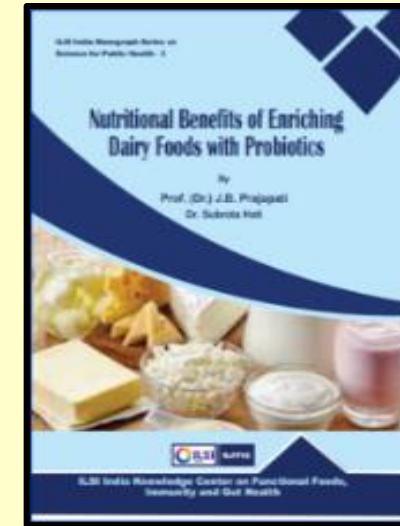
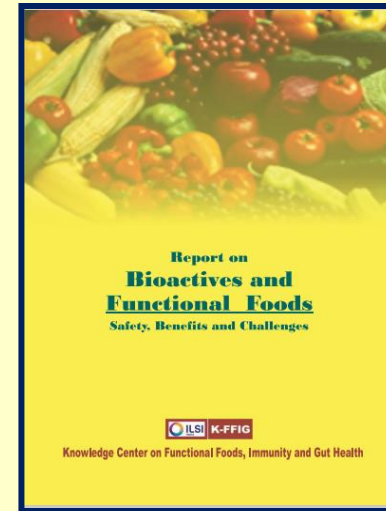
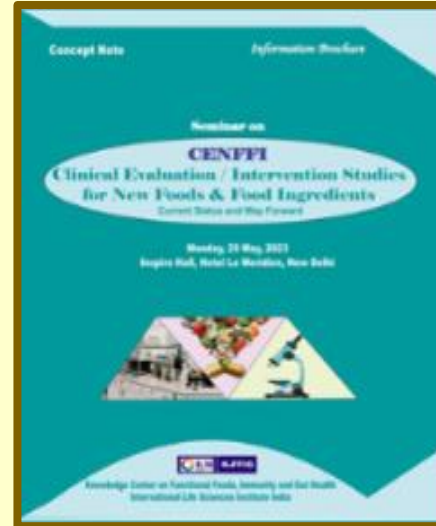
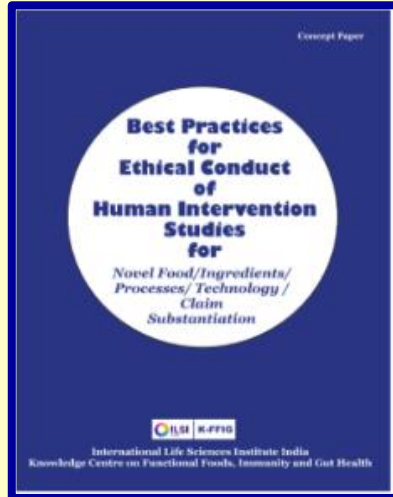
- **Dr. Bhabatosh Das, Associate Professor, Translational Health Science and Technology Institute - for work on Gut Microbiome and Human Health .**
- **Dr. Pradip Behare, Scientist (Sr. Scale),, National Collection of Dairy Cultures (NCDC), Dairy Microbiology Division, ICAR- National Dairy Research Institute (NDRI) - for work on Functional Foods.**

- **ILSI Travel Award 2022- It was given to young researcher Dr. Subrota Hati, Department of Dairy Microbiology, SMC College of Dairy Sciences, Kamdhenu University, Anand, Gujarat - for his work in the area of Probiotics and Gut Health.**

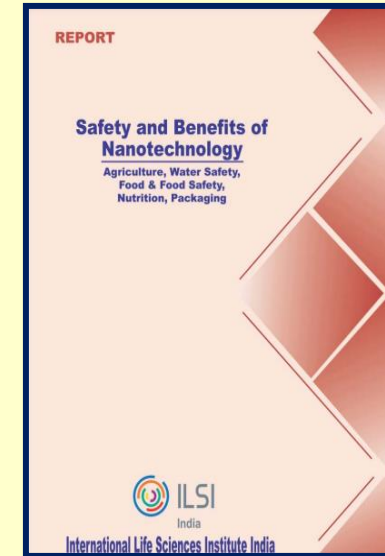
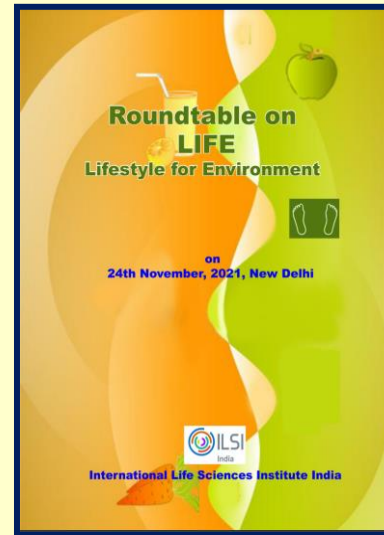
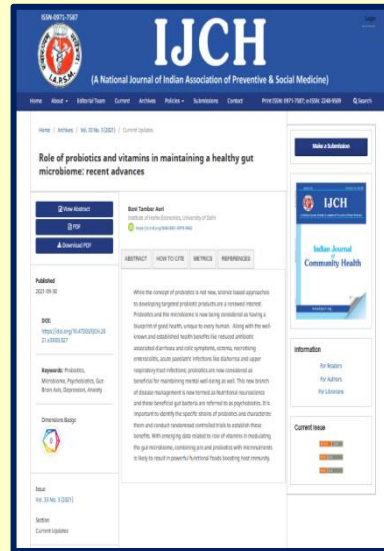
7. UPCOMING

- ❖ **Monograph on “Risk Assessment of Vitamins, Minerals and Bioactive Compounds” prepared by Dr. K. Bhaskarachary and Dr. V. Sudershan Rao from NIN (RETD). It was Reviewed by Dr. Johanna Dwyer, NIH, USA and Dr. Mahtab S. Bamji, Nutrition expert and Dr. Mukul Das, Toxicologist – Under Publication**
- ❖ **Science Symposium on “Nutrient Risk Assessment - Is It A Tool for Ensuring Safe Use & Improving Nutrition Status” – Fourth Quarter**
- ❖ **Survey on Probiotics / – Postbiotics – Under Discussion**
- ❖ **Seminar on Gut Microbiome and Neurodegenerative Diseases – Whether There Is A Role for Functional Foods (Probiotics, Prebiotics, Postbiotics, Nutraceuticals) – Under Discussion**

LATEST PUBLICATIONS



LATEST PUBLICATIONS





**Role of Functional Foods in
Strengthening Immunity & Gut
Microbiome and Gut Brain Axis**

Facts About Strengthening Immunity

- **No single food or nutrient or supplement can boost immunity**
- **Combination of Vitamins, Mineral, Protein**
- **Along with sleep and physical activity**

Nutrients Known To Strengthen Immunity

- **Vitamin C**
- **Vitamin D**
- **Zinc, selenium, iron,**
- **Protein (including the amino acid glutamine)**
- **All through a balanced diet**

Inherent And Food Immune Sensitizer And Stimulant

- **Good Gut Microbiome**
- **Probiotics and foods with probiotic properties**
- **Prebiotics / dietary fiber from Vegetables, fruits and Whole grains**

Do Supplements Help Immune Function

- **Yes If diets are not balanced**
- **Inadequate or deficient in micronutrients and protein**
- **When food intakes are less due to age or disease**
- **When nutrient intakes are inadequate due to wrong foods**

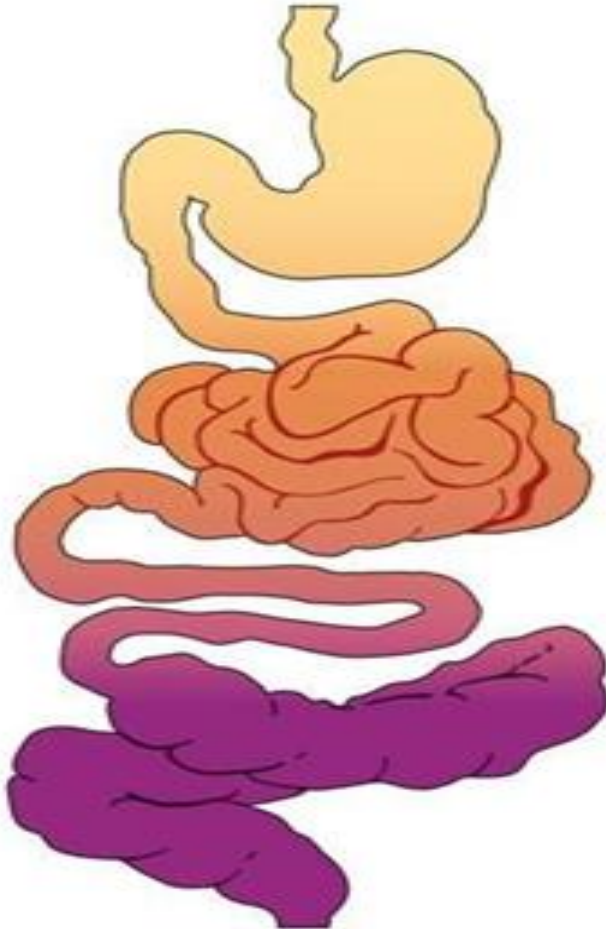
INTESTINAL MICROBES

Stomach 10^3 CFU/ml

Lactobacillus
Streptococcus
Staphylococcus
Enterobacteriaceae
Yeasts

Ileum & Caecum 10^3 - 10^9 CFU/ml

Bifidobacterium
Bacteroides
Lactobacillus
Streptococcus
Enterobacteriaceae
Staphylococcus
Clostridium
Yeasts



Duodenum & Jejunum 10^2 - 10^5 CFU/ml

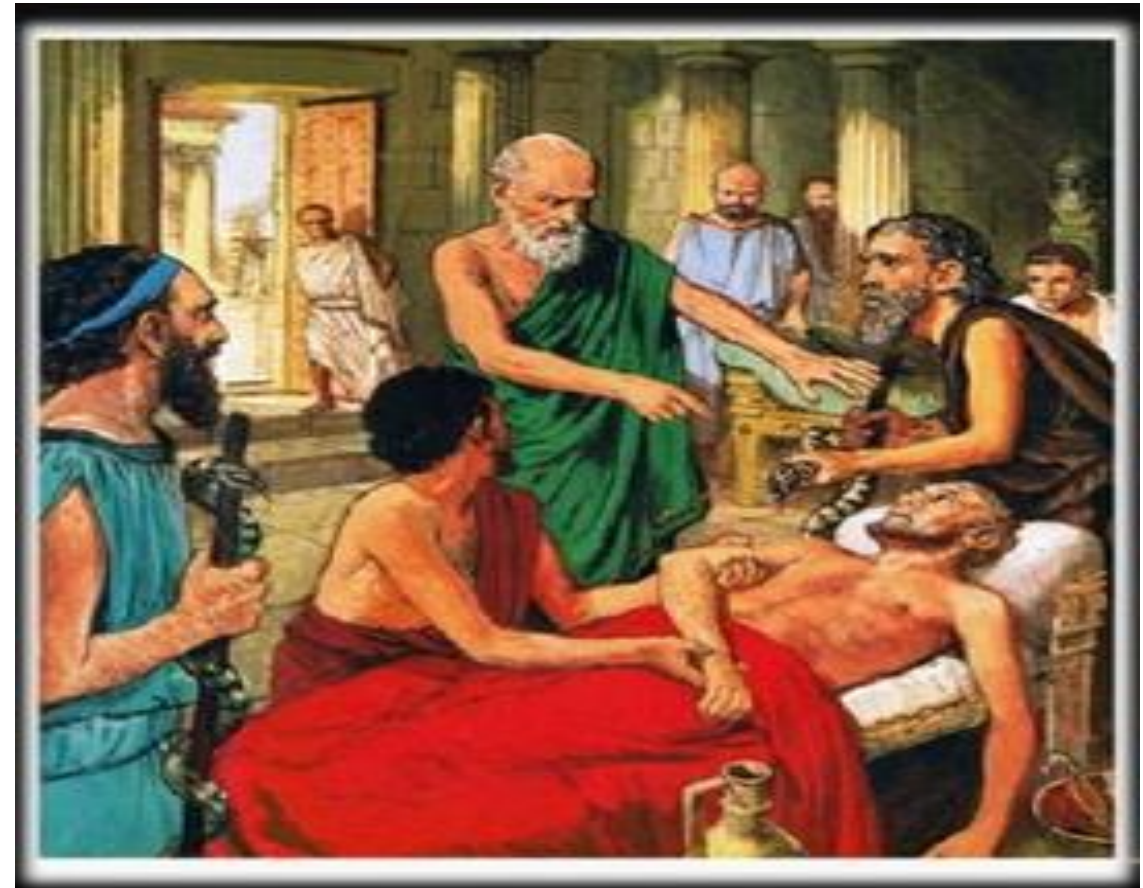
Lactobacillus
Streptococcus
Enterobacteriaceae
Staphylococcus
Yeasts

Colon 10^{10} - 10^{12} CFU/ml

Bacteroides
Eubacterium
Clostridium
Peptostreptococcus
Streptococcus
Bifidobacterium
Fusobacterium
Lactobacillus
Enterobacteriaceae
Staphylococcus



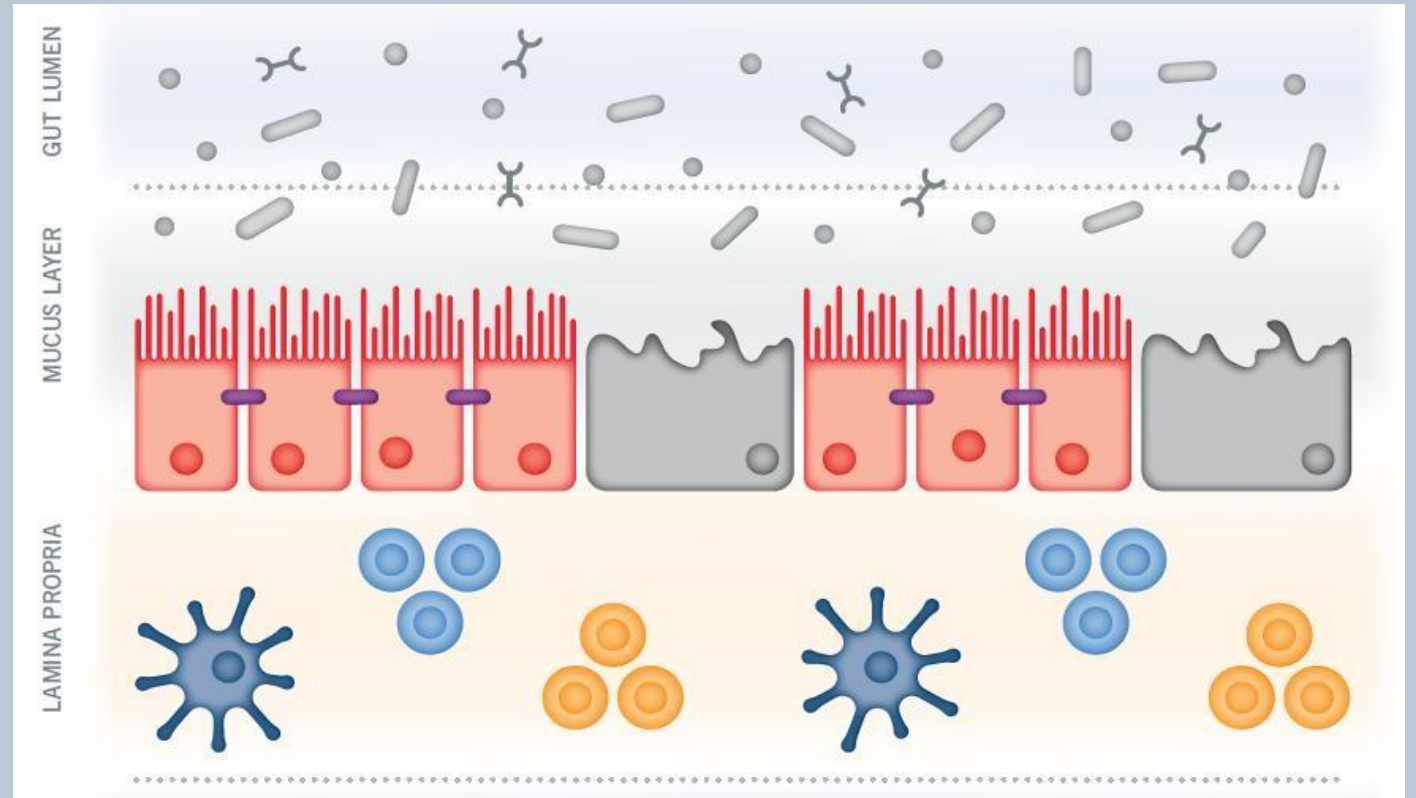
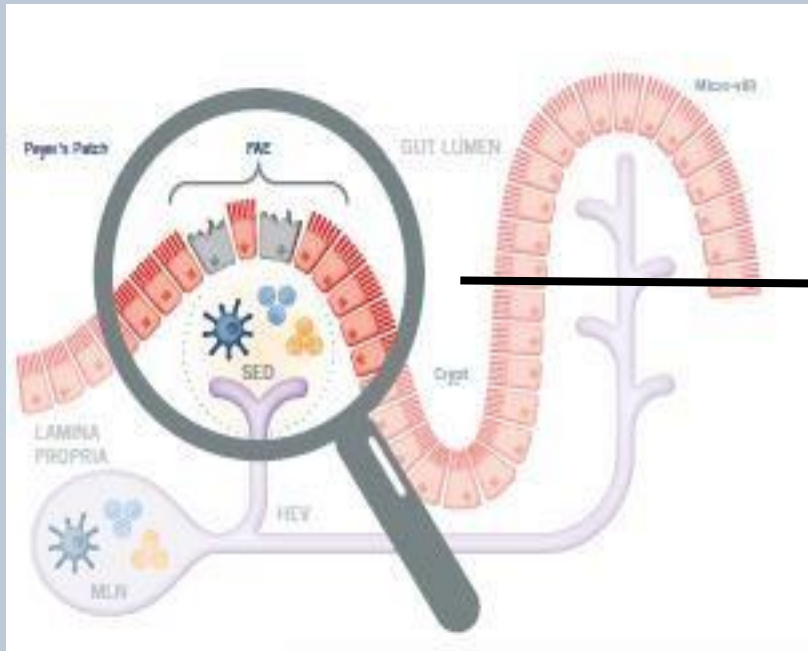
**All
Diseases
Begin in
the Gut**



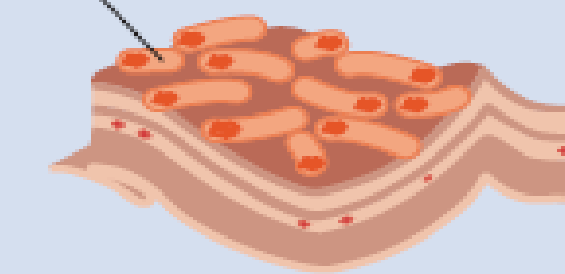
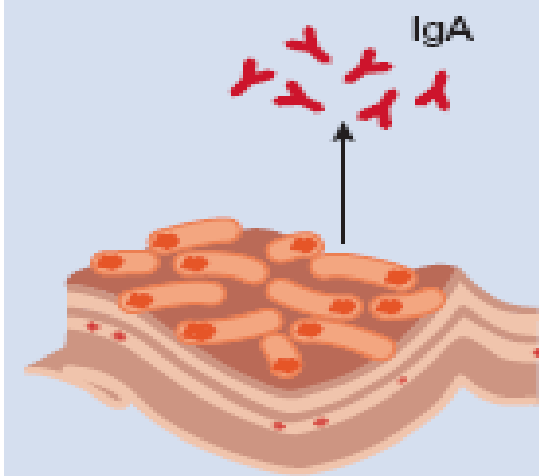
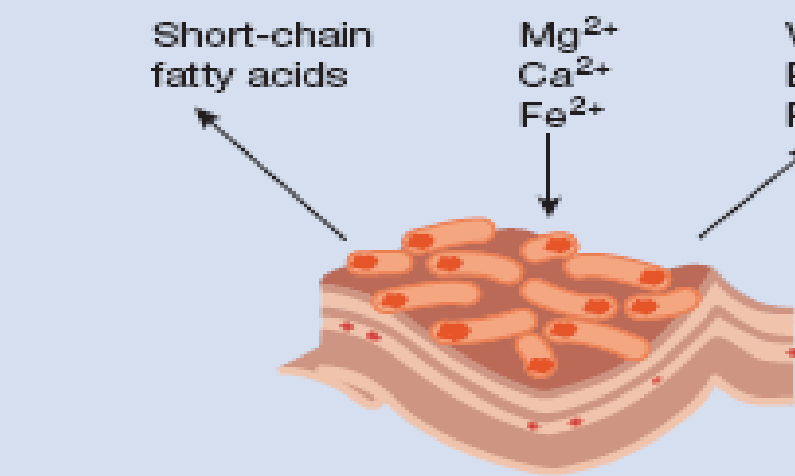
DEATH SITS IN THE BOWELS
**“A bad digestion is the root of all
evil”**

-Hippocrates, 460 BC.

AROUND 70% OF THE IMMUNE SYSTEM IS IN THE GUT



INTESTINAL MICROBES

Protective functions	Structural functions	Metabolic functions
<ul style="list-style-type: none"> Pathogen displacement Nutrient competition Receptor competition Production of anti-microbial factors e.g., bacteriocins, lactic acids 	<ul style="list-style-type: none"> Barrier fortification Induction of IgA Apical tightening of tight junctions Immune system development 	<ul style="list-style-type: none"> Control IEC differentiation and proliferation Metabolize dietary carcinogens Synthesize vitamins e.g., biotin, folate
<p>Commensal bacteria</p> 		



Development of the Gut Microbiota

Gut Microbes

Approx. log₁₀ number bacteria/g faeces

2

Ps. aeruginosa, Proteus

3

Staphylococci

4

Clostridial pathogens

Potential harmful effects

- Intestinal putrefaction
- Production of carcinogens
- Diarrhoea
- Constipation
- Liver damage
- Toxigenesis
- Encephalopathy
- Infections

5

6

7

8

9

10

11

Enterococci

Escherichia coli

Streptococci

Atopobium*

Clostridial Cluster IX*

Clostridial Cluster IV*

Bacteroides

Clostridial Cluster XIVa*

Potential beneficial effects:

- Inhibition of exogenous and/or harmful bacteria
- Aids digestion/absorption of food ingredients and minerals
- Stimulation of immune functions
- Vitamin synthesis
- Anti-carcinogenic effect

Lactobacilli

Bifidobacteria



Types of Dysbiosis

Compositional and / or functional imbalance in the Microbial Ecology – Exceeds Resistance and Resilience

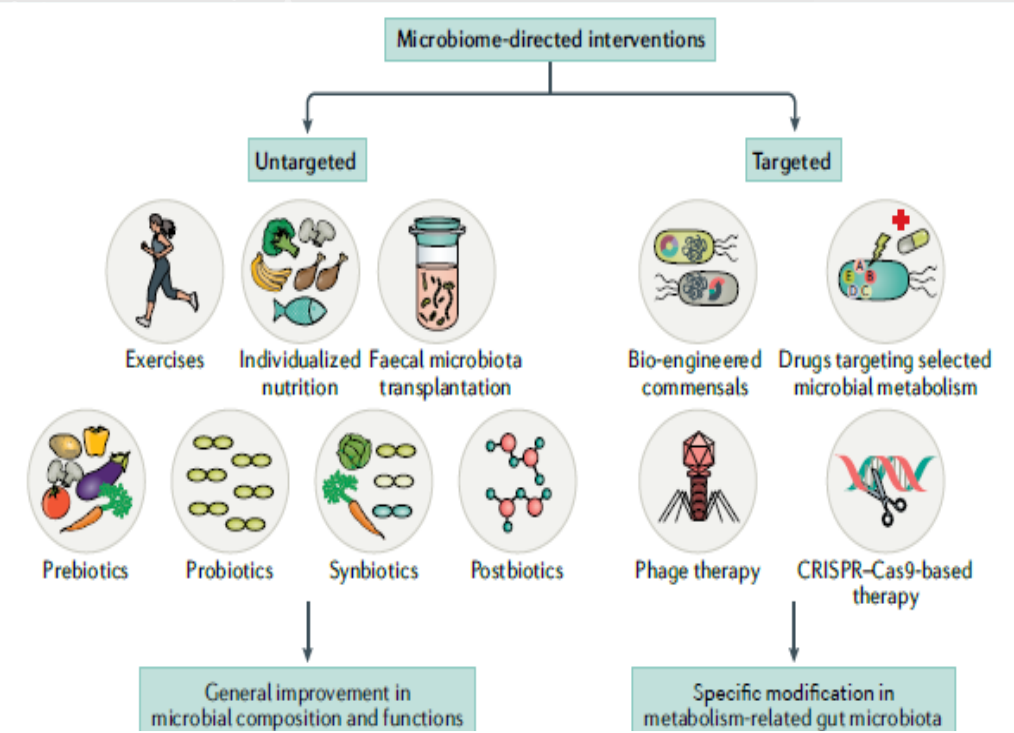
TAXONOMIC DYSBIOSIS - Imbalance of microbial species composition in the ecosystem – altered composition, abnormal constituents, perturbation, reduced diversity and richness – at different taxonomic levels - phylum, class, genus, or even species.

FUNCTIONAL DYSBIOSIS – differences in the level of microbial metabolites in the intestine or blood - distinct between healthy subjects and patients.

The background of the image is a dense field of blue, rod-shaped bacteria, likely representing the microbiota. A large, white, diamond-shaped graphic is centered over the image, containing the text. The text is in a bold, black, sans-serif font.

**MODULATION OF
THE MICROBIOTA**

Interventions for modulating the Microbiota



Targeted interventions

- ❖ Bioengineered commensals
- ❖ Drugs
- ❖ Bacteriophage therapy

Untargeted interventions

- ❖ Diet
- ❖ Exercise
- ❖ Probiotics, Prebiotics and Postbiotics
- ❖ Heterologous and autologous FMT



Food and Agriculture Organization
of the United Nations

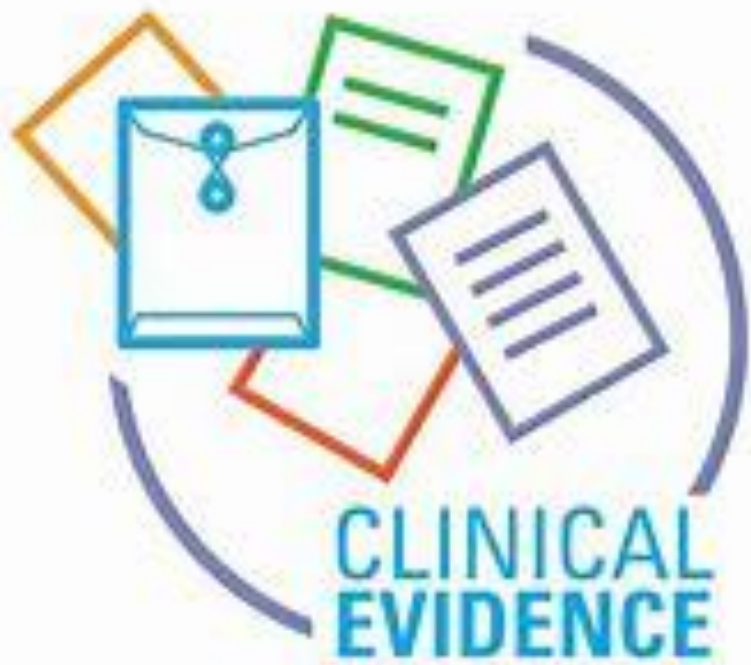


World Health Organization

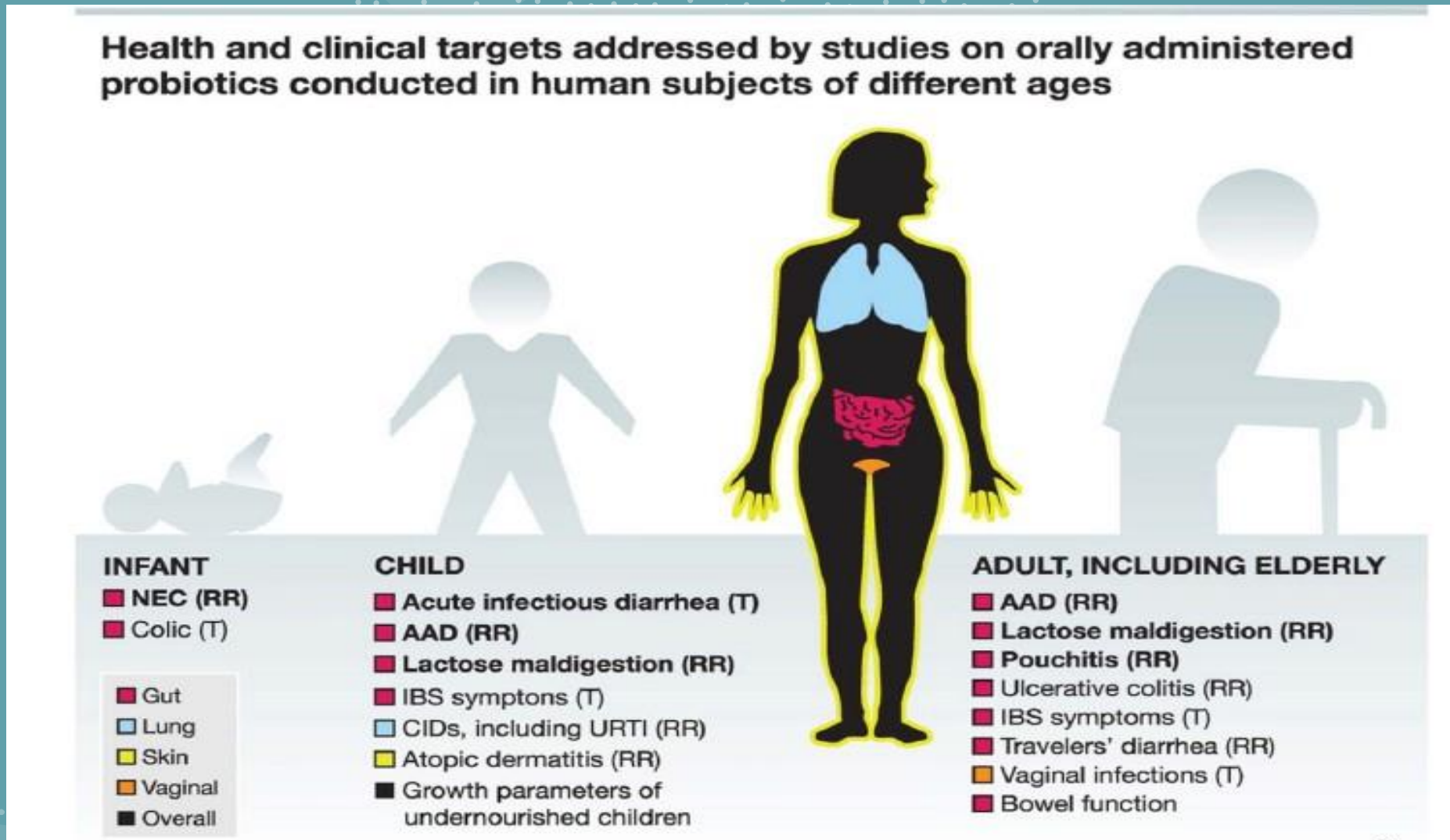
**Health and Nutritional Properties of Probiotics in
Food including Powder Milk with Live Lactic
Acid Bacteria**

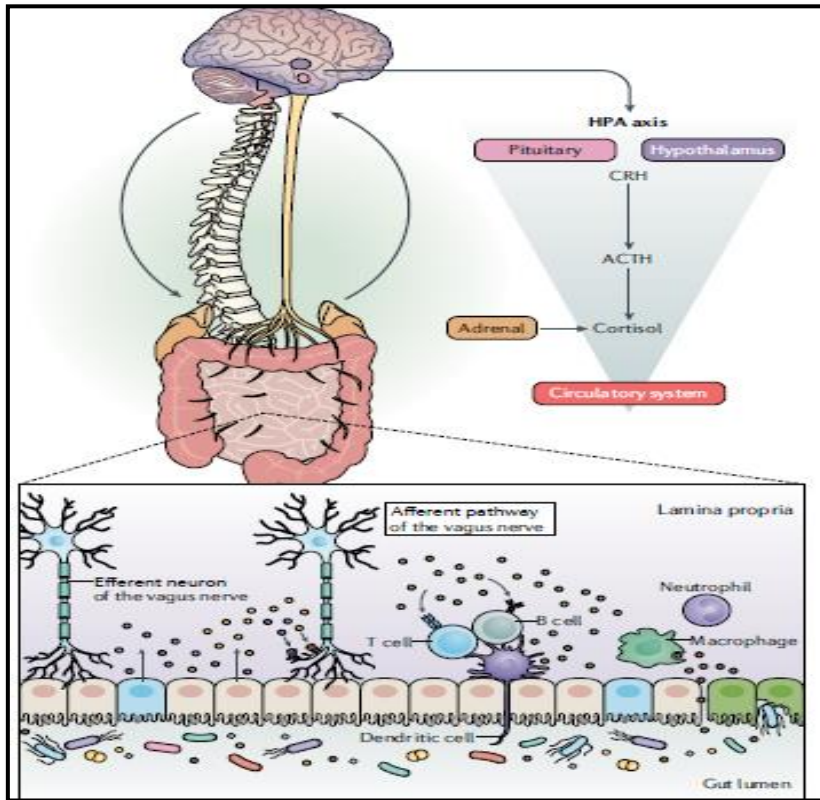
**Report of a Joint FAO/WHO Expert Consultation on
Evaluation of Health and Nutritional Properties of Probiotics in Food Including
Powder Milk with Live Lactic Acid Bacteria**

**‘Live micro-organisms which,
when administered in adequate amounts,
confer a health benefit on the host’**



Health and Clinical Targets for Different Probiotics





- Bi-directional communication between the gut microbiota and the central nervous system (CNS).

- The gut microbiota can produce neuroactive compounds such as neurotransmitters -v- aminobutyric acid (GABA), noradrenaline, dopamine and serotonin, short-chain fatty acids.

- These metabolites can travel through portal circulation to interact with the host immune system, influence metabolism and/or affect local neuron cells of the Enteric Nervous system and afferent pathways of the vagus nerve that signal directly to the brain.



Psychiatry Research
Volume 293, November 2020, 113471



Review article



Effects of gut microbial-based treatments on gut microbiota, behavioral symptoms, and gastrointestinal symptoms in children with autism spectrum disorder: A systematic review

Jiaxin Yang ^{a, b}, Xi Fu ^{a, b}, Xiaoli Liao ^a, Yamin Li ^b  

A systematic review of microbiome changes and impact of probiotic supplementation in children and adolescents with neuropsychiatric disorders.

Anna N. Ligezka ^a, A. Irem Sonmez ^a, Martha P. Corral-Frias ^b, Raphael Golebiowski ^a, Brian Lynch ^c, Paul E. Croarkin ^a, Magdalena Romanowicz ^a  

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<https://doi.org/10.1016/j.pnpbp.2020.110187>

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Journal of Pharmaceutical and Biomedical
Analysis

Volume 194, 5 February 2021, 113681



Review

Metabolomics analysis of microbiota-gut-brain axis in neurodegenerative and psychiatric diseases

Marcela Konjevod ^{a, b}, Matea Nikolac Perkovic ^{a, b, 1}, Jorge Sáiz ^a, Dubravka Svob Strac ^b, Coral Barbas ^a, David Rojo ^a  

Effects Of Gut Microbial-based Treatments On Gut Microbiota, Behavioral Symptoms, And Gastrointestinal Symptoms In Children With Autism Spectrum Disorder: A Systematic Review

[Jiixin Yang](#)¹, [Xi Fu](#)¹, [Xiaoli Liao](#)², [Yamin Li](#)³

Abstract

- **Studies have identified some abnormalities in gastrointestinal (GI) physiology (e.g., increased intestinal permeability, overall microbiota alterations, and gut infection) in children with autism spectrum disorder (ASD).**
- **Changes in the intestinal flora may be related to GI and ASD symptom severity.**
- **Systematically review the effects of gut microbial-based interventions on gut microbiota, behavioral symptoms, and GI symptoms in children with ASD.**

- **16 articles and found that some interventions (i.e., prebiotic, probiotic, vitamin A supplementation, antibiotics, and fecal microbiota transplantation) could alter the gut microbiota and improve behavioral symptoms and GI symptoms among ASD patients.**
- **The gut microbiota could be a novel target for ASD patients in the future.**
- **Suggestive but not conclusive evidence**

A Systematic Review Of Microbiome Changes And Impact Of Probiotic Supplementation In Children And Adolescents With Neuropsychiatric Disorders

[Anna N Ligezka](#)¹, [A Irem Sonmez](#)¹, [Martha P Corral-Frias](#)², [Raphael Golebiowski](#)¹, [Brian Lynch](#)³, [Paul E Croarkin](#)¹, [Magdalena Romanowicz](#)⁴

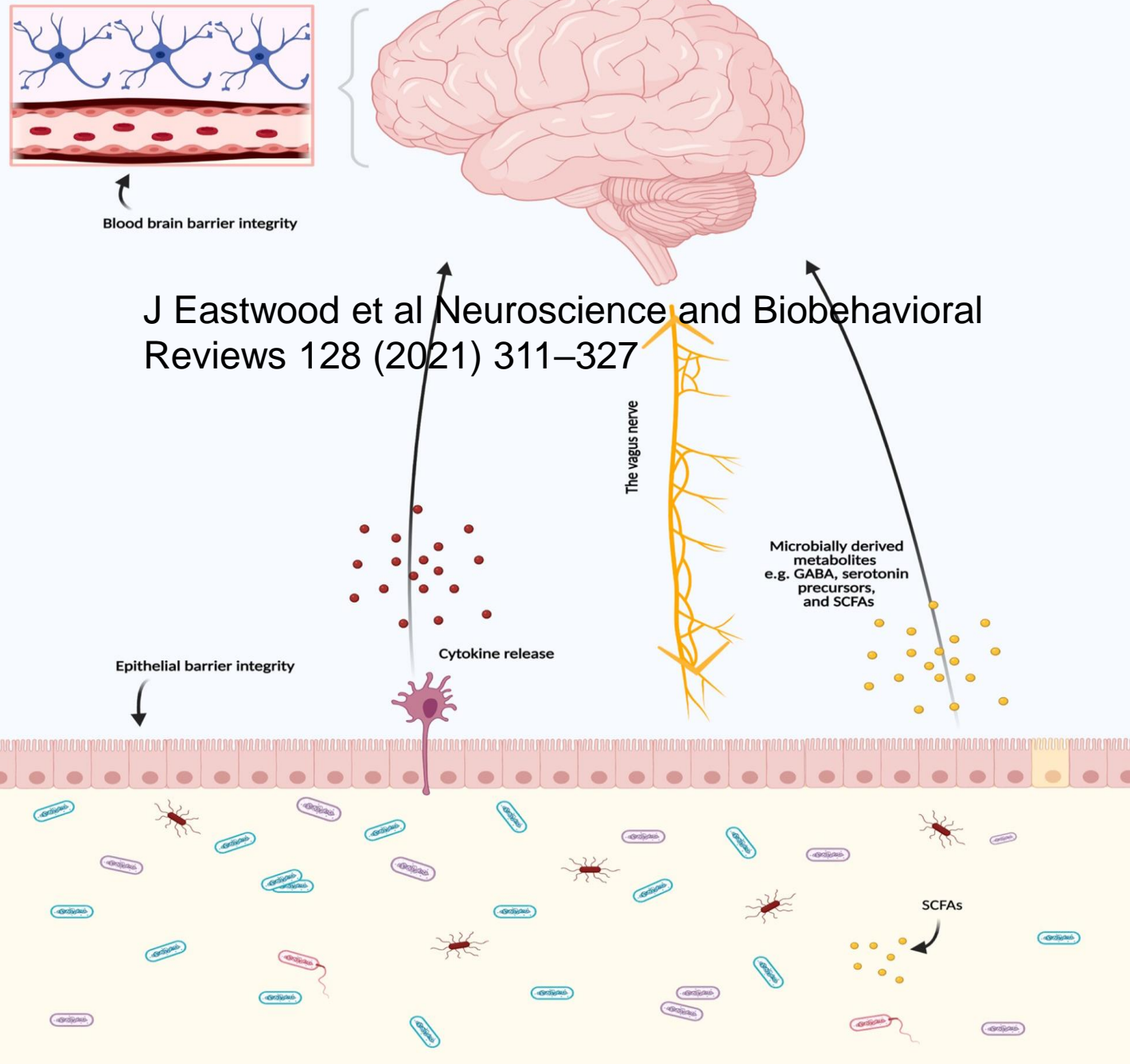
Abstract

Conclusion:

This is a relatively new area of research and the number of included studies is limited.

More studies are needed to determine whether gut dysbiosis leads to the development and/or contributes to the severity of mental disorders or whether gut dysbiosis is a result of other processes that accompany mental disorders.

Clinical significance: A better understanding of the specific bacteria contributions, gut-brain pathways, and role in pathophysiological mechanisms in neuropsychiatric disorders in the child and adolescent populations can possibly provide alternative tools for a clinical psychiatrist. Moreover, it may ultimately aid the clinician with intervention strategies, or detect populations at risk for developing neuropsychiatric disorders.



J Eastwood et al Neuroscience and Biobehavioral Reviews 128 (2021) 311–327

Conclusions

- In summary, the evidence thus far provides some support for enhancing cognition through probiotic intervention.
- Studies in infants and children find very little benefit of early probiotic supplementation to enhance subsequent neurocognitive development.
- However, studies in young and middle-aged adults do provide some support for supplementary probiotics, particularly in clinical populations where cognitive function may be negatively affected.

Conclusions

- **Affective cognition and cognition under stress may be two aspects of cognitive function that are particularly sensitive to any effect of probiotics at this age.**
- **Similarly, studies in older adults provide some consistent evidence for a beneficial effect of probiotics, particularly on memory processes.**

Conclusions 2

- **Number of consistent methodological issues within the current literature that make interpretation of data challenging.**
- **A greater number of well-controlled RCTs are needed.**
- **Such research may then inform exciting opportunities for both clinical and individual practice for those who might see a benefit of supplemental probiotics on cognitive function.**



what do
YOU
expect?

- **Not drugs.**
- **Not alternatives or substitutes for conventional therapy.**
- **Can be used as adjuncts with conventional therapy for better health outcomes.**

Thank You

