



Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv



Review

The impact of human activities and lifestyles on the interlinked microbiota and health of humans and of ecosystems



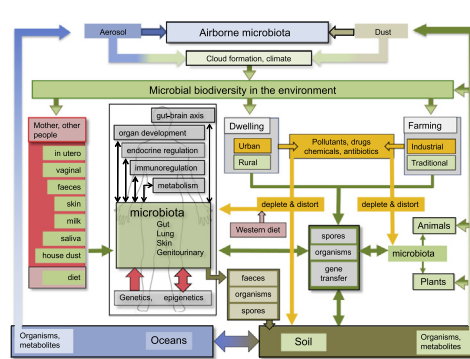
Lucette Flandroy ^{a,1}, Theofilos Poutahidis ^{b,1}, Gabriele Berg ^c, Gerard Clarke ^d, Maria-Carlota Dao ^{e,f,g}, Ellen Decaestecker ^h, Eeva Furman ⁱ, Tari Haahtela ^j, Sébastien Massart ^k, Hubert Plovier ^l, Yolanda Sanz ^m, Graham Rook ^{n,*}

- ^a Federal Public Service Health, Food Chain Safety and Environment, Belgium
- ^b Laboratory of Pathology, Faculty of Health Sciences, School of Veterinary Medicine, Aristotle University of Thessaloniki, Thessaloniki 54124, Greece
- ^c Environmental Biotechnology, Graz University of Technology, Petersgasse 12, A-8010 Graz, Austria
- ^d Department of Psychiatry and Neurobehavioural Science, APC Microbiome Institute, University College Cork, Cork, Ireland
- ^e ICAN, Institute of Cardiometabolism and Nutrition, Assistance Publique Hôpitaux de Paris, Pitié-Salpêtrière Hospital, Paris, France
- ^f INSERM, UMRS U1166 (Eq 6) Nutriomics, Paris 6, France
- ^g UPMC, Sorbonne University, Pierre et Marie Curie-Paris 6, France
- ^h Aquatic Biology, Department Biology, Science, Engineering & Technology Group, KU Leuven, Campus Kortrijk. E. Sabbelaan 53, B-8500 Kortrijk, Belgium
- ⁱ Finnish Environment Institute (SYKE), Helsinki, Finland
- ^j Skin and Allergy Hospital, Helsinki University Hospital, University of Helsinki, Finland
- ^k Laboratory of Integrated and Urban Phytopathology, TERRA, Gembloux Agro-Bio Tech, University of Liège, Passage des deportes, 2, 5030 Gembloux, Belgium
- ^l Metabolism and Nutrition Research Group, Louvain Drug Research Institute, Université Catholique de Louvain, Brussels, Belgium
- ^m Microbial Ecology, Nutrition & Health Research Unit, Institute of Agrochemistry and Food Technology, Spanish National Research Council (IATA-CSIC), Valencia, Spain
- ⁿ Centre for Clinical Microbiology, Department of Infection, UCL (University College London), London, UK

HIGHLIGHTS

- Microbiotas of humans, animals and plants influence the hosts' physiology and health.
- Microbe biodiversity is linked to health and to transgenerational benefit to progeny.
- Humans, animals, plants and the environment continuously exchange microbiota.
- Microbiotas can be damaged by antibiotics, agri/industrial chemicals, and lifestyle.
- The *lifestyle-microbiota-human health* nexus must influence societal decision making.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
 Received 9 November 2017
 Received in revised form 28 January 2018
 Accepted 28 January 2018
 Available online xxxx

Editor: Jay Gan

ABSTRACT

Plants, animals and humans, are colonized by microorganisms (microbiota) and transiently exposed to countless others. The microbiota affects the development and function of essentially all organ systems, and contributes to adaptation and evolution, while protecting against pathogenic microorganisms and toxins. Genetics and lifestyle factors, including diet, antibiotics and other drugs, and exposure to the natural environment, affect the composition of the microbiota, which influences host health through modulation of interrelated physiological systems. These include immune system development and regulation, metabolic and endocrine pathways, brain function

* Corresponding author.
 E-mail address: g.rook@ucl.ac.uk (G. Rook).
¹ These authors contributed equally.

Keywords:
 Microbes
 Natural environment
 Health
 Immunoregulation
 Biodiversity
 Soil

and epigenetic modification of the genome. Importantly, parental microbiotas have transgenerational impacts on the health of progeny.

Humans, animals and plants share similar relationships with microbes. Research paradigms from humans and other mammals, amphibians, insects, planktonic crustaceans and plants demonstrate the influence of environmental microbial ecosystems on the microbiota and health of organisms, and indicate links between environmental and internal microbial diversity and good health. Therefore, overlapping compositions, and interconnected roles of microbes in human, animal and plant health should be considered within the broader context of terrestrial and aquatic microbial ecosystems that are challenged by the human lifestyle and by agricultural and industrial activities.

Here, we propose research priorities and organizational, educational and administrative measures that will help to identify safe microbe-associated health-promoting modalities and practices. In the spirit of an expanding version of “One health” that includes environmental health and its relation to human cultures and habits (EcoHealth), we urge that the *lifestyle-microbiota-human health nexus* be taken into account in societal decision making.

© 2018 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Contents

1.	Introduction	1019
2.	Microbiota and health.	1020
2.1.	Lessons learnt from studies on humans and animals.	1020
2.2.	Mechanisms of health benefits	1021
2.2.1.	Regulation of immune and endocrine systems	1021
2.2.2.	Educating immune system memory	1021
2.2.3.	Metabolism of chemicals, including toxic environmental pollutants.	1022
2.2.4.	Microbial biodiversity	1022
3.	The composition of the human microbiota, and impacts on health: genetics vs lifestyle and lifecycle	1022
3.1.	Genetics and the human microbiota composition	1022
3.2.	Diet and the composition of human microbiota	1022
3.3.	Microbiota and antibiotics	1022
3.4.	Contact with the natural environment and its effects on the microbiota	1023
3.5.	Epigenetic effects of the microbiota	1023
3.6.	The microbiota in early life	1024
3.7.	The microbiota in later life	1024
4.	Use of microbiota in clinical intervention	1024
5.	Biodiversity and the plant and soil microbiota	1025
5.1.	Biodiversity of the plant microbiota	1025
5.1.1.	Plant microbiota and plant health	1025
5.1.2.	Plant microbiota and human health	1026
5.2.	Biodiversity of the soil microbiota	1026
5.2.1.	Soil microbiota and human health; mycobacteria	1026
5.2.2.	Soil microbiota and human health; spores	1026
5.3.	Microbiota in agricultural systems and food production	1026
5.3.1.	Effect of transgenic plants on environmental microbiota	1027
6.	Microbiota, adaptation and evolution: examples in animal species.	1027
7.	The ocean; the planet's microbiome gene bank?	1028
8.	Influence of chemical substances on the microbiota: still a lot to explore	1029
8.1.	Glyphosate	1030
9.	Conclusions	1030
9.1.	Microbiota research and policy in the EU	1030
9.2.	Interdisciplinary transnational research and intersectoral policies	1030
9.3.	Changing behavior among the public, health professionals and other professional sectors	1031
9.4.	Contact with the natural environment: a disease prevention strategy supported by UN	1032
	Acknowledgements	1033
	References	1033

1. Introduction

Animals and plants harbor very diverse and abundant microbial communities that provide specific functions and traits. These communities are called microbiota when referring to the ecological community of microorganisms within a defined environment, or microbiome when referring to the collective genomes of all microorganisms from a given environmental niche. A recent workshop ([Workshop Session, 2016b](#))

discussed correlations between disturbed gut microbiota (dysbiosis) and chronic pathologies (non-communicable diseases – NCDs) including allergies ([Fujimura and Lynch, 2015](#); [Hua et al., 2016](#)), autoimmunity ([Chen et al., 2016](#)), gastrointestinal disorders ([Cenit et al., 2015](#)), obesity, diabetes ([Cani et al., 2014](#); [de Goffau et al., 2013](#); [Knip and Siljander, 2016](#)), and other metabolic and cardiovascular disorders ([Tang and Hazen, 2014](#)), cancer ([Poutahidis et al., 2015](#)), and central nervous system dysfunctions such as learning and memory impairment,

Download English Version:

<https://daneshyari.com/en/article/8860959>

Download Persian Version:

<https://daneshyari.com/article/8860959>

[Daneshyari.com](https://daneshyari.com)