

# Microbial Clock, Aging and Probiotics (Beneficial Microbes) Aging and Restorative Microbiology

**John G Thomas, PhD**

Allegheny Healthcare Network, Center of Excellence in Biofilm Research, Allegheny General Hospital, Pittsburgh, PA, USA  
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**INTRODUCTION:**

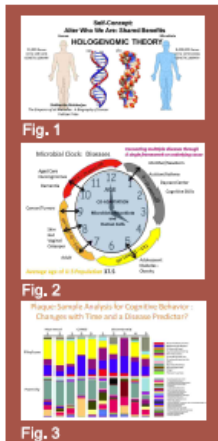
We previously (2015) recognized the theme of 'Dual Citizenship' (Prokaryotes and Eukaryotes) in humans (Hologenomic Theory) (REF 1) (Fig. 1), while introducing the concept of our 'Microbial Clock', (Fig. 2) linking ten diseases in a common pathway in 4 Quad life span (color coded), followed (2016) by our Oral Phylotype Signature as unique markers of dementia and aging (Fig. 3), underscoring potential targets of "Restorative Microbiology" and shared genetic informaton (Probiotics/Beneficial Microbes).

**OBJECTIVE:**

As a completion of our Trilogy, we wanted to expand our Searchable Decision Tree Probiotic Data Base, Partners-4-Life ([www.globalbugs.com/Probiotic Solutions](http://www.globalbugs.com/ProbioticSolutions)) (REF X), as a research adjunct in interventional studies for age and age related co-morbidities, recognizing the NIH has recently proposed that aging is a disease (REF 2)

**RELEVANCE:**

Age related cognition impairment is a global health problem; in US Alzheimer's Disease (AD) effects 5.5 million patients at an annual \$1,5 billion, not including catastrophic family efforts estimated at \$259 billion, yearly, AD is 6th leading cause of deaths in US, highlighting 1 in 3 deaths for seniors over 66 years, Restoring lost microbial driven inflamm-aging functions via age matched probiotics, optimized by a searchable data base linked, ultimately, to Artificial Intelligence (AI), could unmask, evolving, eco-friendly research strategies and benefits of Restorative



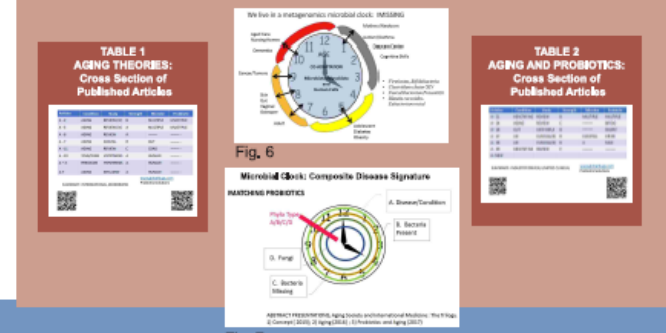
**METHODS:**

In 2013, we introduced the website Bac-2-Health, ([www.globalbugs.com](http://www.globalbugs.com)) highlighting microbiology educational tools, particularly the data from 310 manuscripts on probiotics focusing on 11 diseases/conditions, (Fig. 4) organized into a 7 layered decision tree, (Fig. 5) with each graded as to a) kind and b) strength of research, searchable by 3) user. Here we expanded the data sets to include review of an additional 67 manuscripts addressing aging and probiotics, 35 selected, highlighting the growing awareness of a declining microbiota with age and the unrecognized function of the human mycobiont/ mycobiome (Fungi).



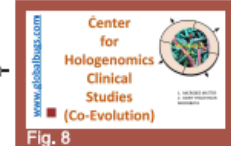
**RESULTS:**

Reviewed manuscripts focused on the Red Zone (>55 Y/O) of our Microbial Clock, unmasking the importance of 4 missing bacterial phylotypes, (Fig. 6) and the unrecognized, unknown significance of 3 fungal phylotypes with aging and the use of probiotics. Most articles were international in nature, focusing on Alzheimer's Disease (AD) and were arbitrarily divided into 1) Microbial Theory of Aging (TABLE 1) and 2) Probiotics in Aging (TABLE 2). Changes were most evident in the GUT microbiota, We constructed a 'Phylo Signature', (Fig. 7) integrating a unique five circle Microbial Construct(A/B/C/D), each circle matching age, disease and the phylotypes present, missing and fungal. A sixth circle matched the probiotic by disease and age, describing composition of 3-11 microbes/probiotic, The limited fungal data highlighted the use of a fungal probiotic, *Saccharomyces bulardi*,



**CONCLUSION:**

By heralding the evolution of our Microbial Clock in three stages (The Trilogy), lastly, the multi-ring "Phylotype Signature", and the importance of the missing microbiota in aging and age related diseases, we wanted to provide a searchable, educational decision tree for developing new strategies and research approaches; this would emphasize tailored (Precision Medicine) (REF 3) "Restorative Microbiology", linkable to AI, while integrating the Hologenomic Theory of "Dual Citizenship" and our new Hologenomic Center (Fig. 8) for intervention and treatment in cognitive impairment via the brain-GUT axial connection.



**REFERENCES:**

1. Borrdenstein S Rand Theis KR. 2015. Host Biology in Light of the Microbiome: Ten principles of Holobionts and Hologenomes 13(8) e 1002226
2. Lustgarten, M. 2016. Classifying aging as a disease: The role of microbes. Frontiers in Genetics, 7:212-219
3. Zmora, N et al. 2016. Taking it Personally: Personalized utilization of the Human Microbiome in Health and Disease. Cell and Host Microbe, 19 (Feb 10)

**CONTACT INFORMATION:**

jpgthomas@hsc.wvu.edu or johnthomas070@gmail.com

Fig. 7