The Impact of the Microbiome in HIV Prevention and Pathogenesis

NIH HIV and the Microbiome Research Portfolio

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Overview
What is the microbiome??

We're not ALL BAD!!
Definition of Microbiome

Definition:

**mi·cro·bi·ome**
[ˌmīkrōˈbīōm]
NOUN

the microorganisms in a particular environment (including the body or a part of the body):
"we depend on a vast army of microbes to stay alive: a microbiome that protects us against germs, breaks down food to release energy, and produces vitamins"

the combined genetic material of the microorganisms in a particular environment:
"understanding the microbiome—human, animal, and environmental—is as important as the human genome"

The human microbiota is the aggregate of microorganisms, a microbiome that resides on the surface and in deep layers of skin (including in mammary glands), in the saliva and oral mucosa, in the conjunctiva, and in the respiratory, gastrointestinal, and urogenital tracts. They include bacteria, fungi, archaea, and viruses.
The NIH Common Fund Human Microbiome Project (HMP) was established in 2008 with the mission of generating research resources enabling comprehensive characterization of the human microbiota and analysis of their role in human health and disease. The information generated by HMP is made available worldwide for use by investigators and others in efforts to understand and improve human health.

The first phase of HMP was focused on the development of DNA sequence datasets and computational tools for characterizing the microbiome in healthy adults and in people specific microbiome-associated diseases. An Ethical, Legal and Societal Implications (ELSI) program was also created to address the new and unexplored issues which arise from human microbiome research. The second phase of HMP, integrative HMP or iHMP, is focused on creating integrated datasets of multiple biological properties from both the microbiome and the host over time in specific microbiome associated diseases.
National Microbiome Initiative (NMI)

On May 13, 2016, The White House Office of Science and Technology announced a National Microbiome Initiative to foster the integrated study of microbiomes across different ecosystems. A combined investment of more than $121 million in FY2016 and FY 2017 (NIH commitment of $20M)

Stated Goals of NMI are to;

- Support interdisciplinary research
- Develop platform technologies
- Expand the microbiome workforce
Timeline of OAR Interest Related to the Microbiome

2007  NCI Microbiome, HIV and Cancer Workshop

2008  Microbiome Focus added to the Etiology and Pathogenesis Section of FY 2010 Trans-NIH Plan
       NHLBI RFA Microbiome of the Lung and Respiratory Tract in HIV-Infected Individuals and HIV-Uninfected Controls Released – First RFA specific for HIV

2014  NIH CFAR Supplement on the Impact of the Microbiome in HIV Infection and Pathogenesis
       NIAID RFA Role of the Microbiome in HIV-1 Vaccine Responses released
       OAR Supplemental funds for microbiome research included in several ICs budget allocations for FY2015

2015  NIH supported 1st International Microbiome and HIV Pathogenesis, Prevention and Treatment Meeting
       Release of Advancing Translational and Clinical Probiotic/Prebiotic and Human Microbiome Research RFA – Multi IC

2017  OARAC
NIH Investments in Microbiome Research from FY2012-2016

- 2012: 13.5M
- 2013: 17M
- 2014: 27M
- 2015: 29M
- 2016: 38.5M
Funding by Institute/Center

- **2012**: [Bar chart data]
- **2013**: [Bar chart data]
- **2014**: [Bar chart data]
- **2015**: [Bar chart data]
- **2016**: [Bar chart data]
Investments by the NIH Priority Areas

![Graph showing investments by NIH Priority Areas from 2012 to 2016. The graph indicates the allocation of funds for different areas such as Reducing Incidence, Therapeutics, Cure, Comorbidities/Coinfections, and Basic Research.](image-url)
Current Research

Anaerobic Bacterial Fermentation Products Increase Tuberculosis Risk in Antiretroviral-Drug-Treated HIV Patients, Mar. 2017
Segal LN et al.

HIV Infection and Compromised Mucosal Immunity: Oral Manifestations and Systemic Inflammation, Mar. 2017
Heron and Elhai

How can the gut microbiota affect immune recovery in HIV-infected individuals? Mar. 2017
Serrano-Villar et al

AIDS 2016, R4P 2016, and CROI 2017
Several studies discussing the impact of the genital tract microbiome on HIV transmission, immune activation, vaccine efficacy and Issues regarding the role ART metabolism and prevention (PrEP, microbicides)
Goals of Today’s OARAC Meeting

Outline the gaps and identify high priority opportunities that will address the impact of the microbiome in HIV prevention, treatment, and pathogenesis

• General Overview by Lita Proctor
• Approaches for Interrogating the Microbiome by Rick Bushman
• Influence of Biological Sex on the Microbiome
• Role of the Microbiome in Mucosal and Systemic Immunity and Inflammation
• The impact of the microbiome on the Pharmacokinetics and Pharmacodynamics of ART