The Human Lung Microbiome - A Hidden Link for Human Health and Diseases

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The Human Lung Microbiome

Asthma

COPD

Cystic Fibrosis

Bronchiectasis

Asthma-associated differences in microbial composition of induced sputum

Analysis of the Lung Microbiome in the “Healthy” Smoker and in COPD

Analysis of the Airway Microbiota of Healthy Individuals and Patients with Chronic Obstructive Pulmonary Disease by T-RFLP and Clone Sequencing

Decade-long bacterial community dynamics in cystic fibrosis airways

Sputum paracolon-associated microbial community compositions in adults with bronchiectasis

Lung Microbiome - Summary

### Lung Microbiome - Applications

**COPD**
- Haemophilus
- Moraxella
- Streptococcus
- Gemella
- Granulicatella
- Campylobacter
- Prevotella
- Candida

**Asthma**
- Haemophilus
- Moraxella
- Gemella
- Porphyromonas
- Mogibacteriaceae
- Enterobacteriaceae
- Aspergillus
- Epstein-Barr virus
- Cytomegalovirus

**Bronchiectasis**
- Pseudomonas
- Haemophilus
- Veillonella
- Stenotrophomonas
- Enterobacteriaceae
- Aspergillus
- Cryptococcus
- Penicillium

**Cystic fibrosis**
- Pseudomonas
- Haemophilus
- Stenotrophomonas
- Staphylococcus
- Aspergillus
- Penicillium
- Scedosporium

**Idiopathic pulmonary fibrosis**
- Haemophilus
- Streplococcus
- Staphylococcus
- Veillonella
- Stenotrophomonas
- Campylobacter

**Pneumonia**
- Haemophilus
- Acinetobacter
- Klebsiella
- Streplococcus
- Staphylococcus
- Veillonella
- Leptotrichia

**Sepsis/ARDS**
- Enterobacteriaceae
- Bacteroides
- Lachnospiraceae
- Prevotella
- Fusobacterium
- Staphylococcus
- Pseudomonadaceae

**COVID-19**
- Mycoplasma
- Burkholderia
- Staphylococcus
- Streptococcus
- Stenotrophomonas
- Enterobacteriaceae
- Aneloviridae
- Redondoviridae

**Lung cancer**
- Veillonella
- Megaesphera
- Granulicatella
- Streptococcus
- Staphylococcus
- Abiotrophia
- Acidovorax
- HPV

**Lung transplantation-related**
- Pseudomonas
- Staphylococcus
- Stenotrophomonas
- Corynebacterium
- Candida
- Aspergillus
- Aneloviridae

**HIV**
- Prevotella
- Veillonella
- Treponema
- Streptococcus
- Flavobacterium
- Pneumocystis

**Tuberculosis**
- Mycobacterium
- Porphyromonas
- Cupriavidus
- Streptococcus
- Prevotella
- Candida
- Aspergillus

### Disease Categories
- Chronic lung diseases
- Acute lung diseases
- Other lung diseases

### Taxonomy
- **Proteobacteria**
  - Others
- **Firmicutes**
  - Fungi
- **Bacteroidetes**
  - Virus
- **Actinobacteria**

### Trend
- Positive association with disease
- Positive association with neutrophilic subtype
- Positive association with eosinophilic subtype
- Negative association with disease

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Lung Microbiome - Challenges

**Challenges**
- Oral contamination
- Low microbial-to-host ratio
- Disease heterogeneity
- Microbiome-host interaction
- Microbiome manipulation
- Culturability

**Possible solutions**
- Sample quality control
- Oral sample cross-comparison
- Pre-sequencing host cell depletion
- High depth ‘Holo-biome’ sequencing
- Microbiome-pheno/endotype relations
- ‘Microbial-host’ multi-omic landscape
- Standard procedure for respiratory microbiome manipulation
- Culturomics

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Society: http://www.imeta.science
Publisher: https://onlinelibrary.wiley.com/journal/2770596x
Submission: https://mc.manuscriptcentral.com/imeta

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