



*Breath of Life: Integrating Oral
and Systemic Health in
Cystic Fibrosis Research
Symposium*

**Outside the oral cavity: Linking the
oral microbiome to respiratory
health outcomes in Cystic Fibrosis**

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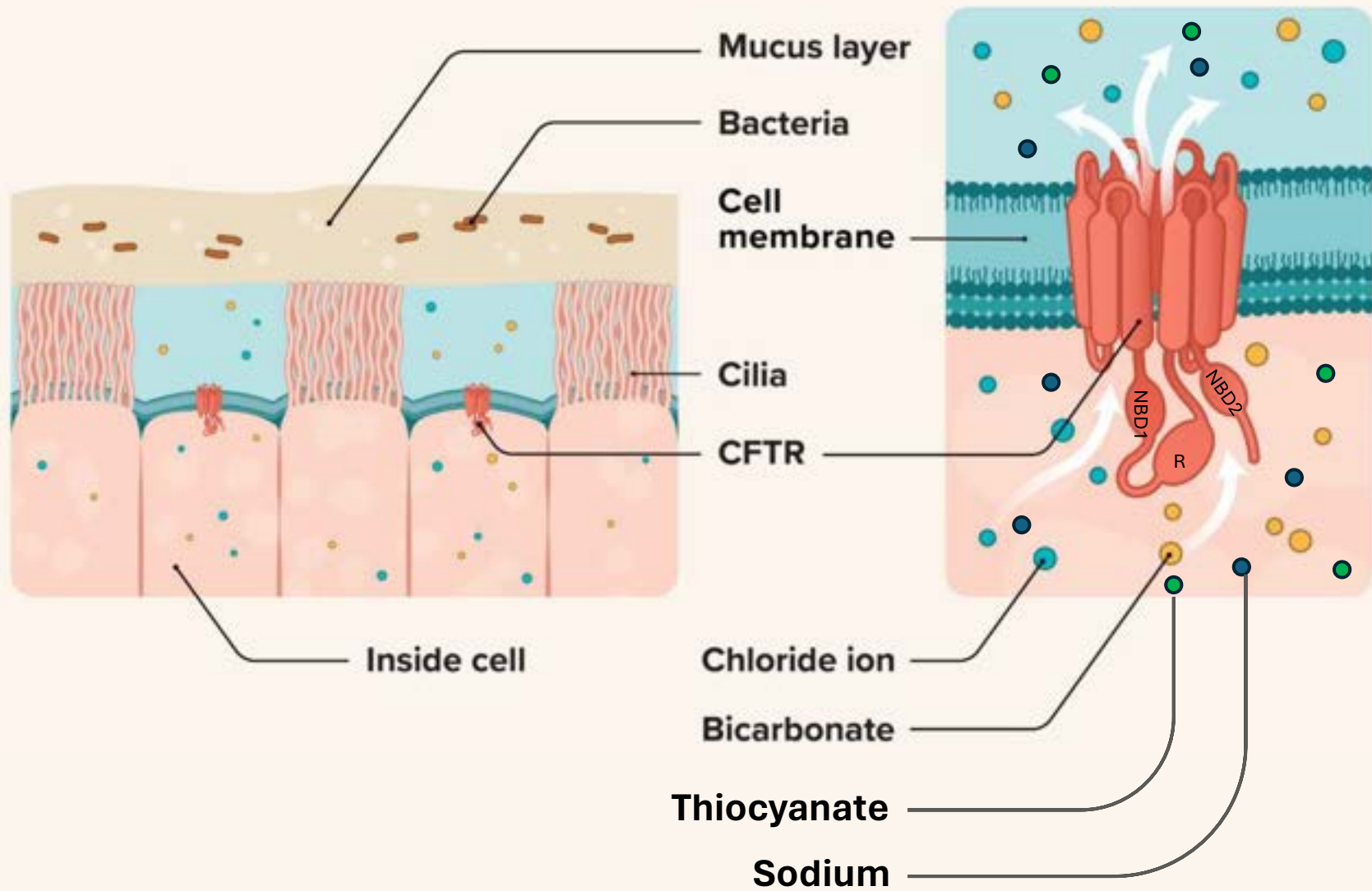


ADAMS SCHOOL
OF DENTISTRY

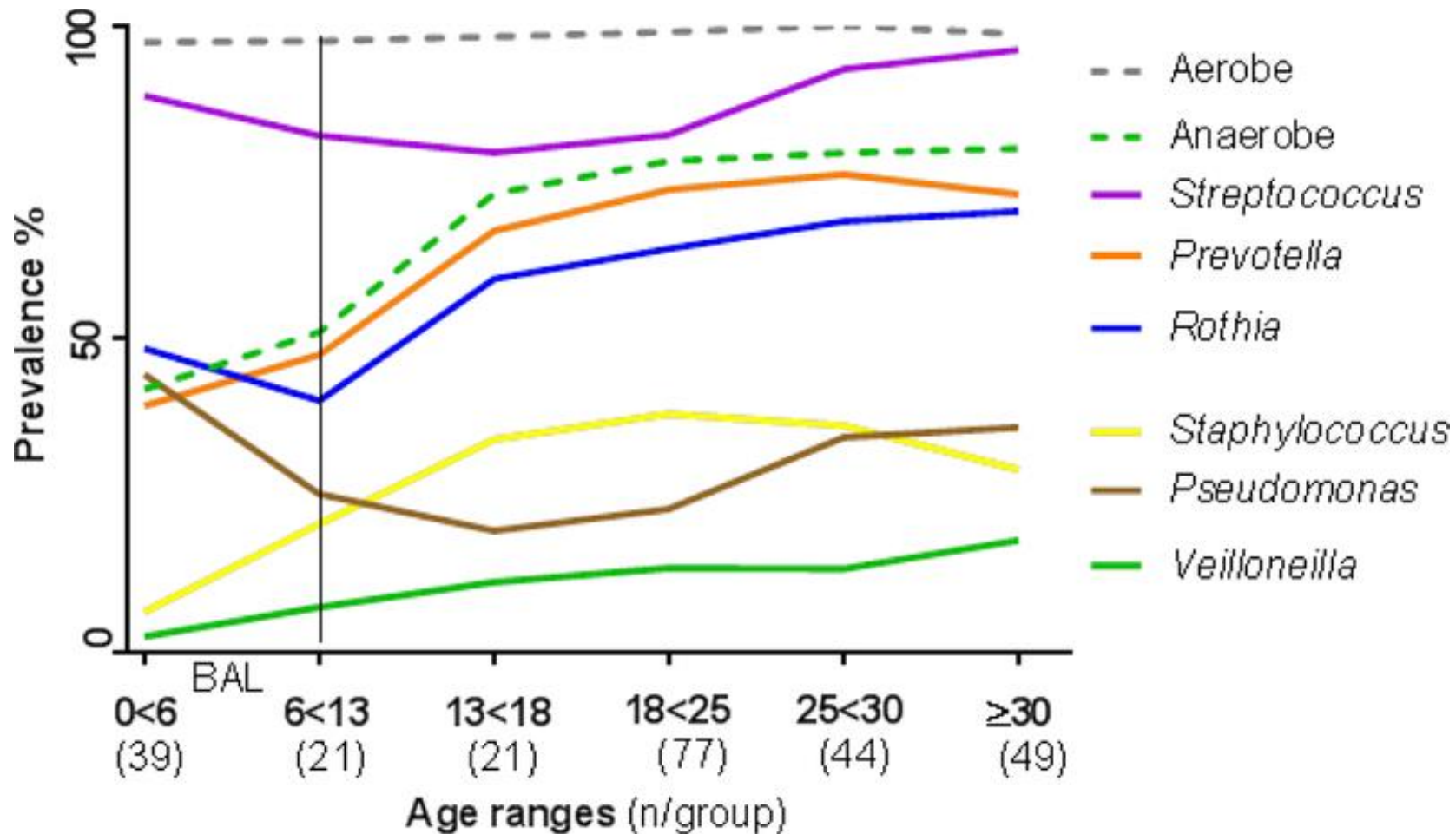
An anatomical illustration of the human respiratory system. The lungs, trachea, and bronchial tree are shown in a glowing red-orange color, set against a translucent blue background of the human torso and skeletal structure. The text "Cystic Fibrosis" is overlaid in white on the left side of the image.

Cystic Fibrosis

Cystic Fibrosis

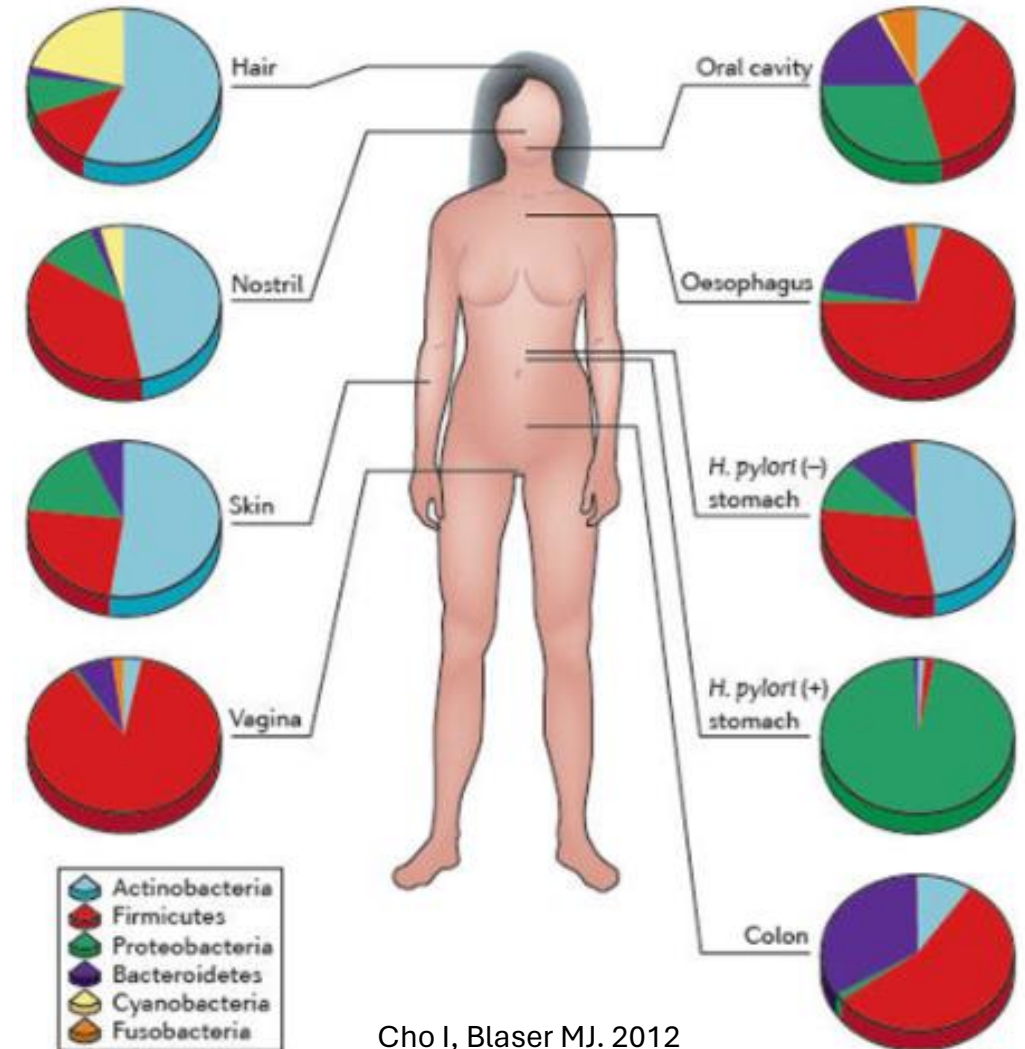
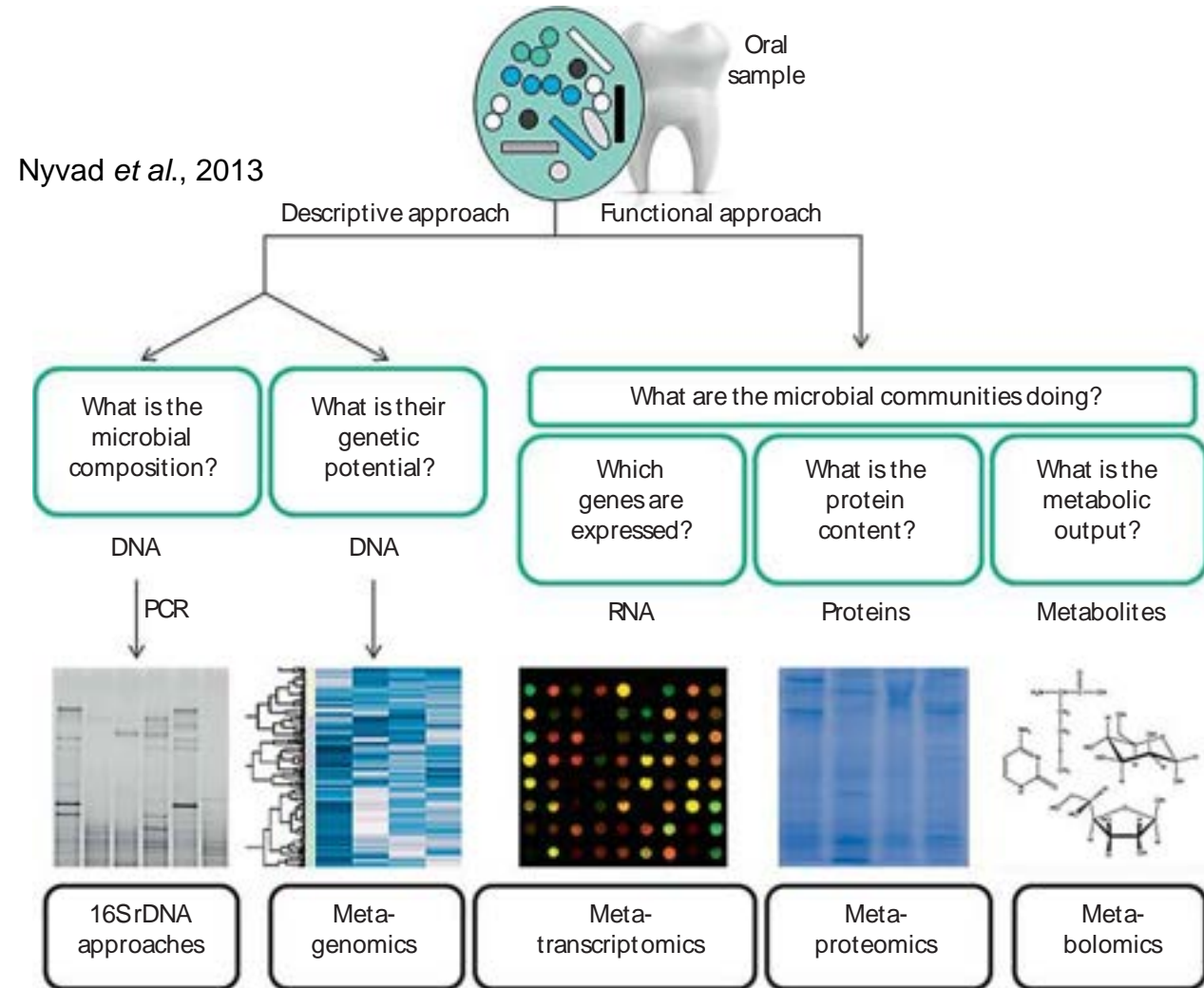


Lung colonization across lifespan

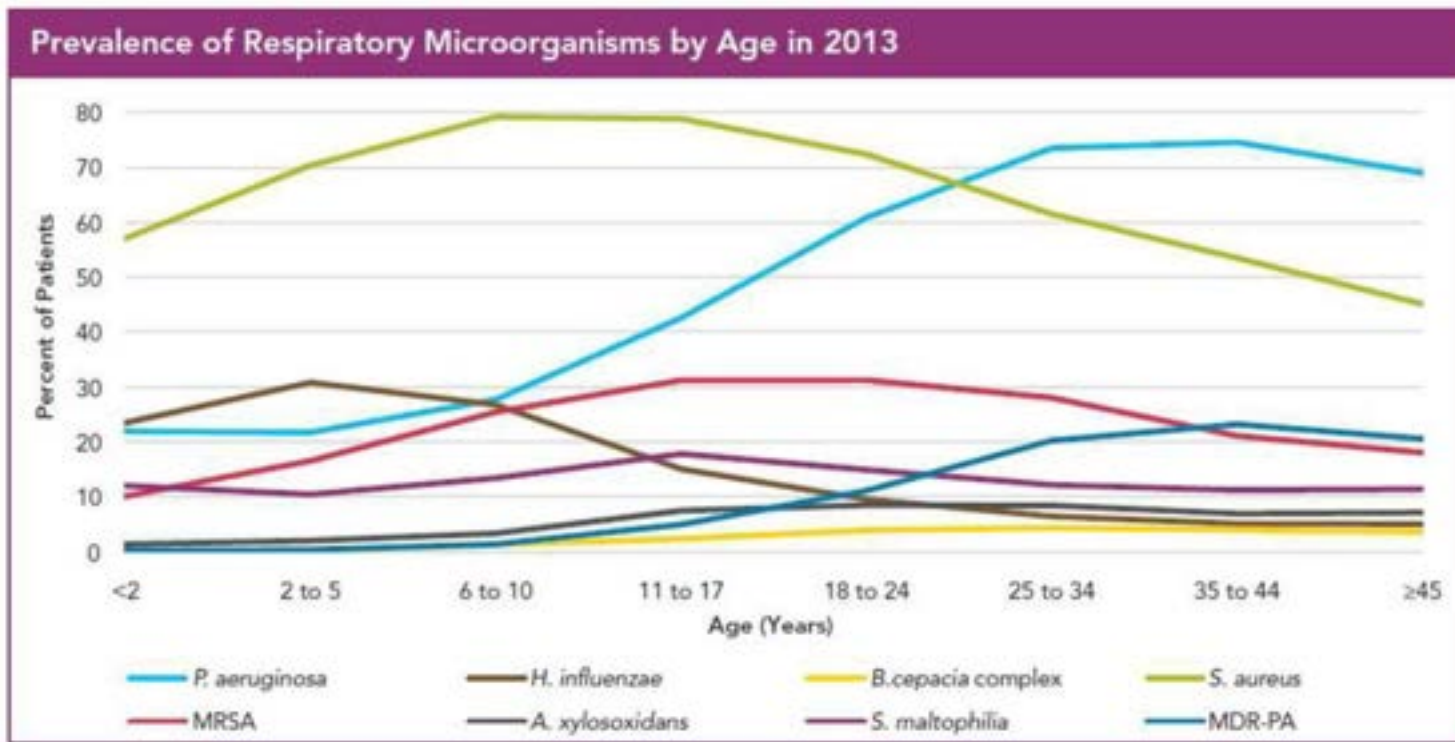


Muhlebach et al., 2019

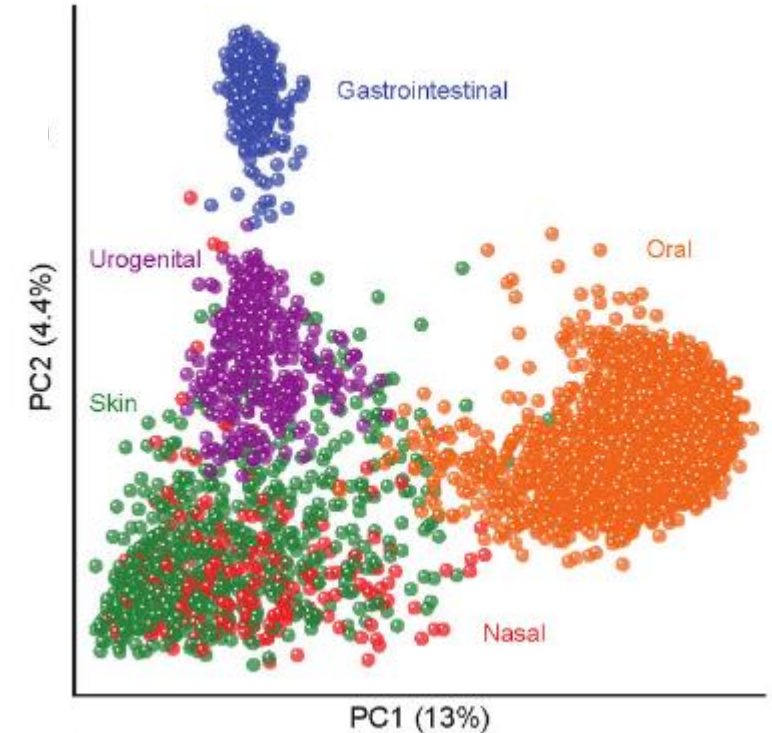
The cystic fibrosis airway microbiome: The “omics” approach



The cystic fibrosis airway microbiome: The “omics” approach



Zemanick and Hoffman, 2016

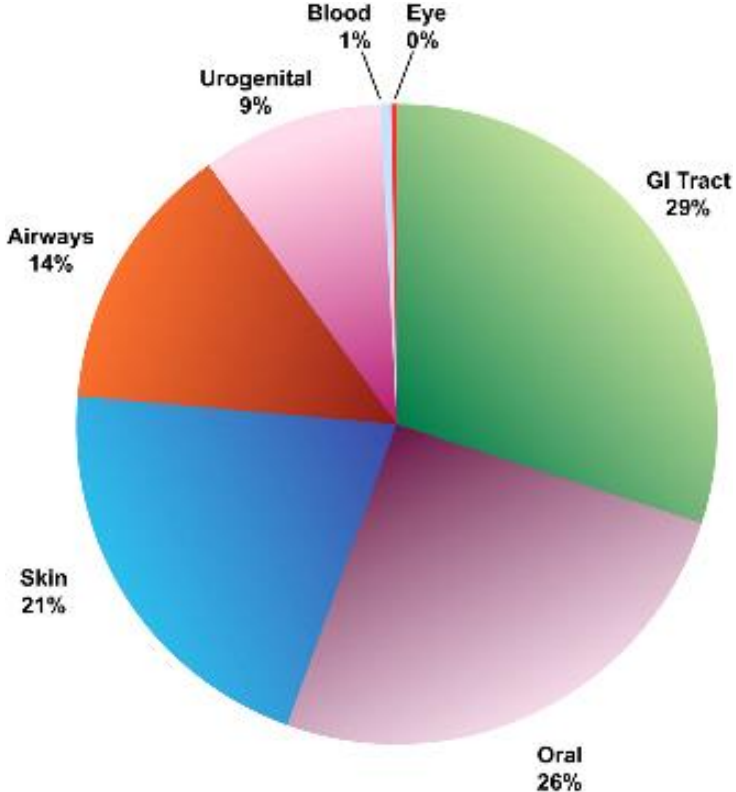


Human Microbiome Project Consortium. 2012

Colonization of human body



- 100 trillion bacterial cells
- 10 trillion human cells



Bacterial distribution by body site.
The NIH HMP Working Group et al.
Genome Res. 2009



Oral Diseases

3.5 billion people

Dental caries

- ✓ 2.5 billion people affected
- ✓ 14.6% increase in dental caries over ten years

Periodontitis

- ✓ Severe periodontal disease: 19% of the global adult population (>1 billion cases)

The oral cavity is a unique ecosystem

PLOS ONE PMID: 28678838

RESEARCH ARTICLE
The oral bacterial microbiome of occlusal surfaces in children and its association with diet and caries

Apoena Aguiar Ribeiro^{1,2*}, Maria Andrea Azcarate-Peril^{3,4}, Maria Belen Cadenas⁴,
 Natasha Butz⁵, Bruce J. Paster^{6,7}, Tsute Chen⁸, Eric Bair⁹, Roland R. Arnold¹⁰

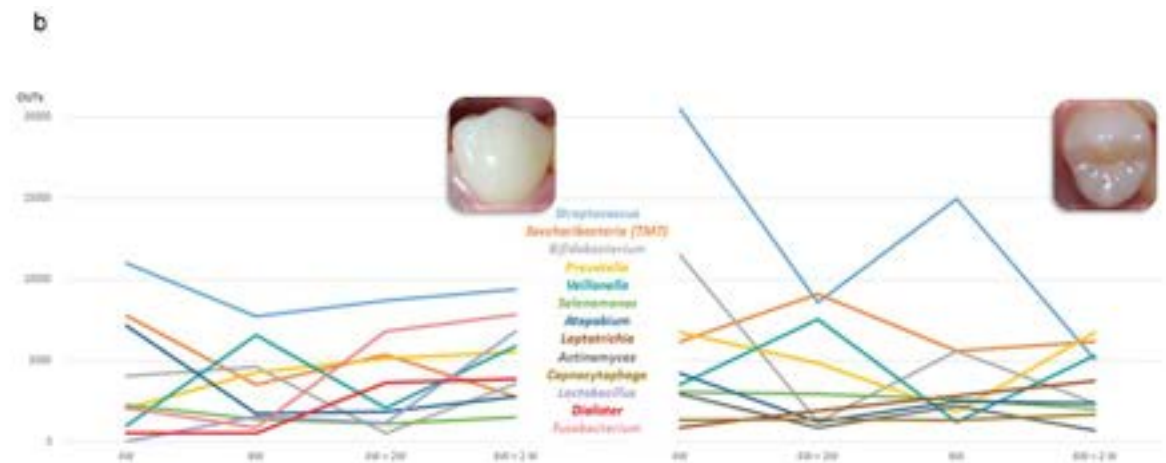
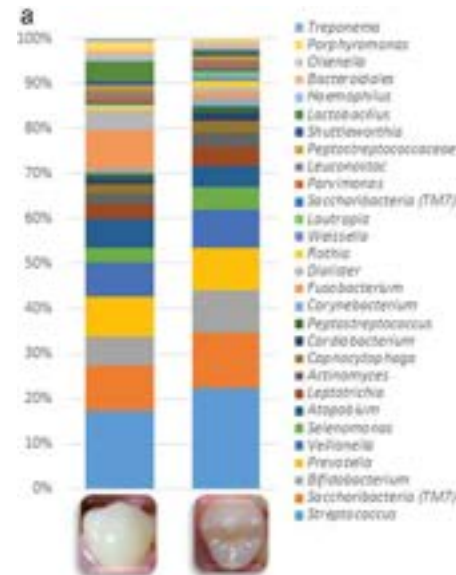
- 723 species assigned in the biofilm from occlusal surfaces.

Journal of Oral Microbiology PMID: 34188775

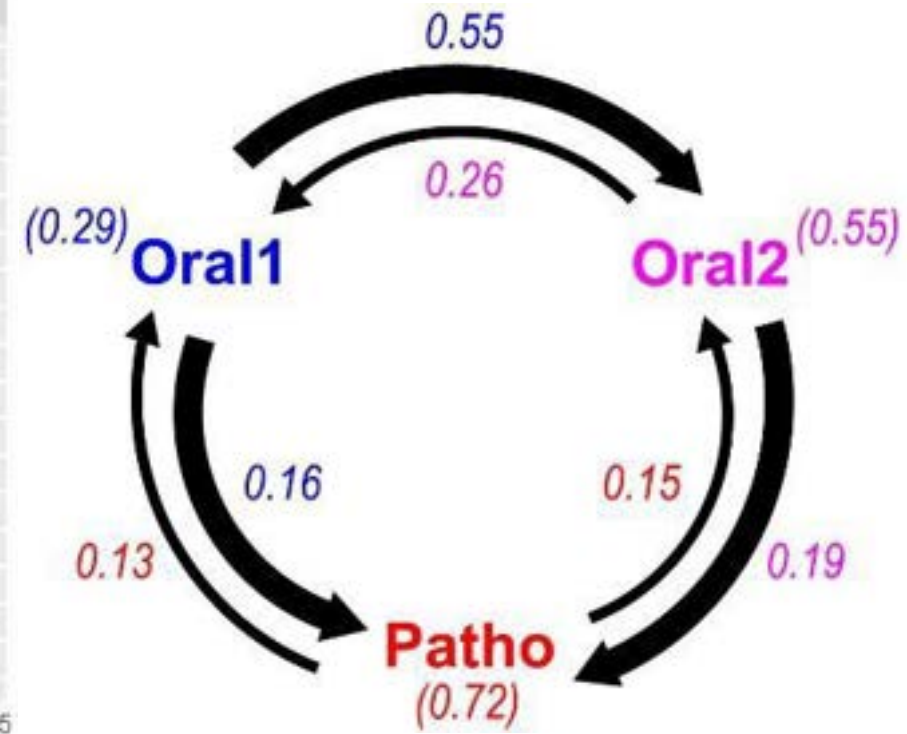
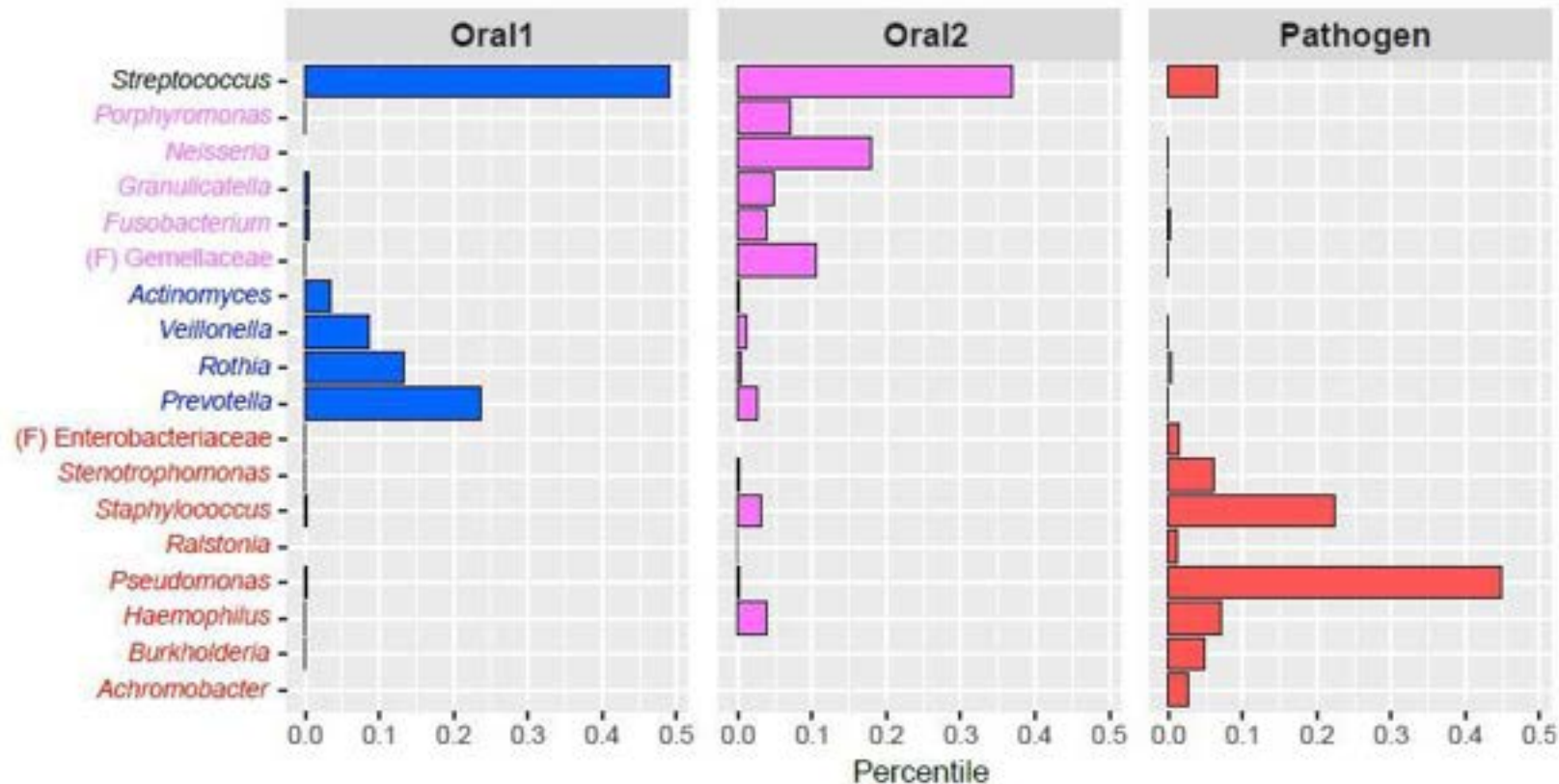
ISSN: (Print) (Online) journal homepage: <https://www.tandfonline.com/loi/ijom20>

The bacterial microbiome and metabolome in caries progression and arrest

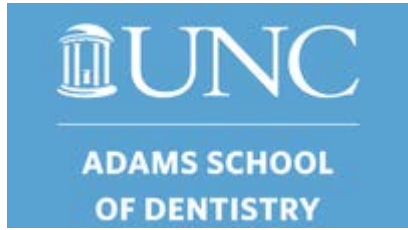
Thamirys da Costa Rosa, Aline de Almeida Neves, M. Andrea Azcarate-Peril, Kimon Divaris, Di Wu, Hunyong Cho, Kevin Moss, Bruce J. Paster, Tsute Chen, Liana B. Freitas-Fernandes, Tatiana K. S. Fidalgo, Ricardo Tadeu Lopes, Ana Paula Valente, Roland R. Arnold & Apoena de Aguiar Ribeiro



Little is known about oral microbiome, oral health and lung disease severity in Cystic Fibrosis



Fodor et al; 2012
Muhlebach et al, 2018



Understanding Oral Diseases in Cystic Fibrosis to Develop Tailored Preventive Dental Interventions

NIH/NIDCR

U01DE030418-01

(Chi and Rosenfeld, MPIs)

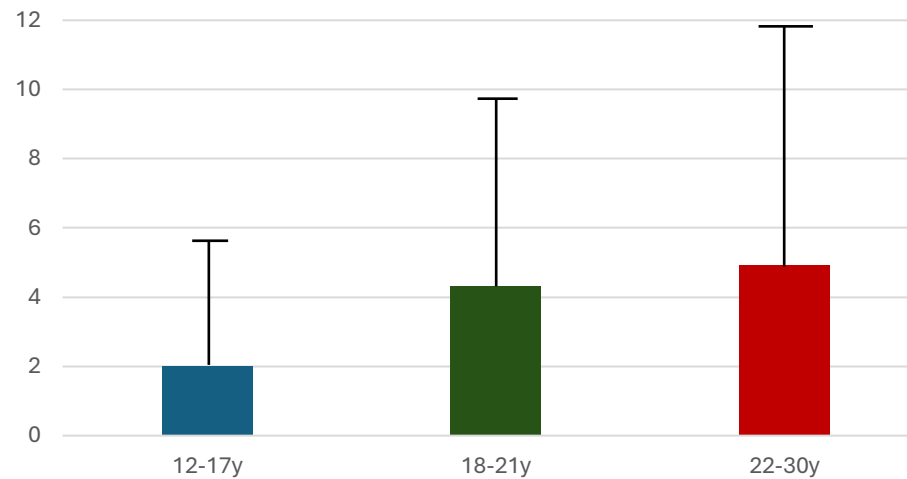


People with CF have better oral health than the general population < age 10 but it gets worse in adulthood

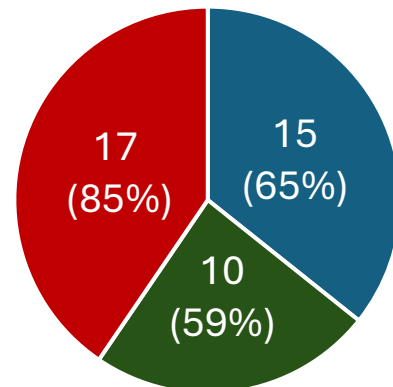
Participants distribution by age

12-17	23
18-21	18
22-30	20

Mean (SD) caries experience (D234MFs)

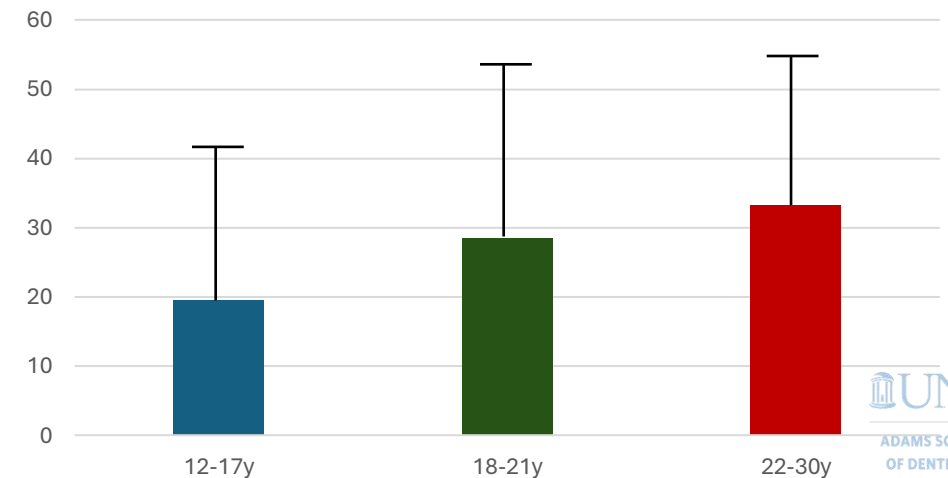


Prevalence of gingivitis by age group



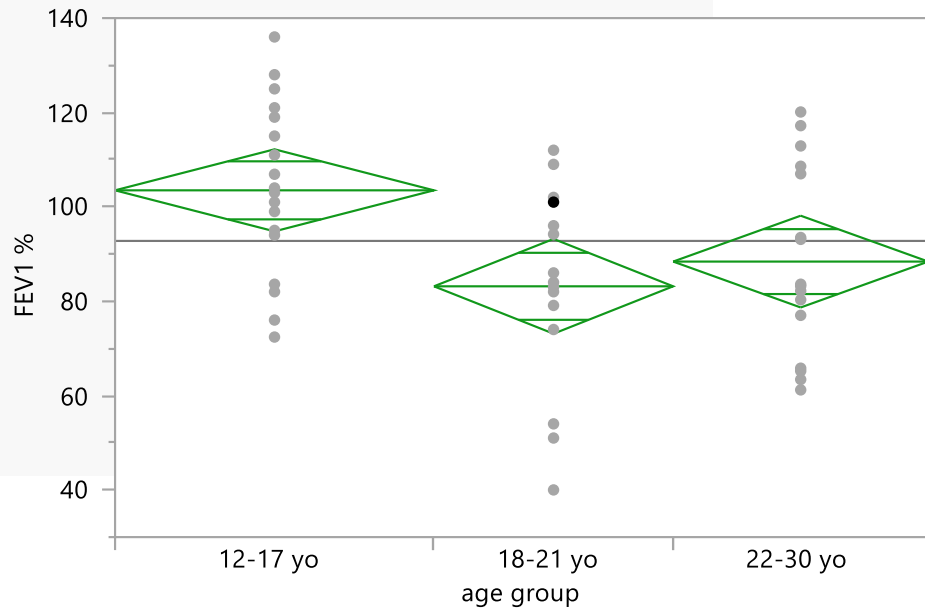
■ 12-17y ■ 18-21y ■ 22-30y

Mean (SD) surfaces bleeding on probing



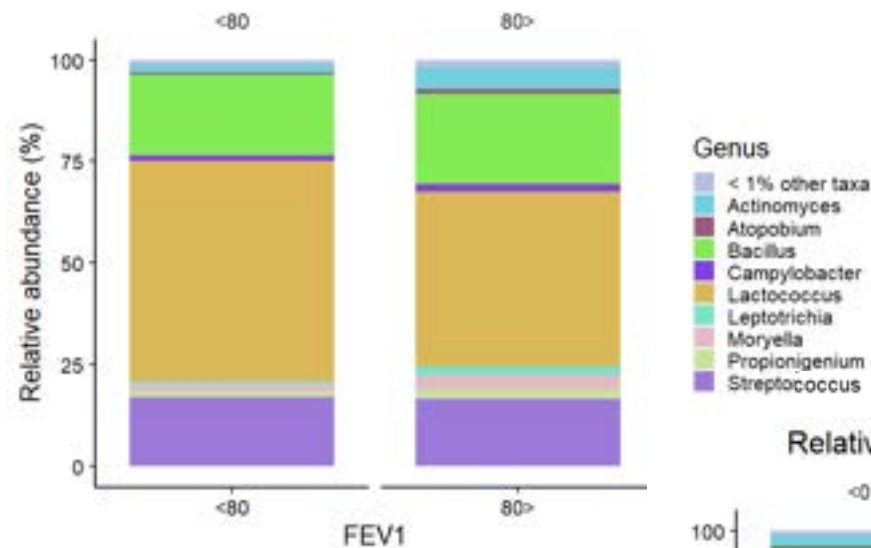
Pulmonary function decreases with age

Forced Expiratory Volume 1 X Age



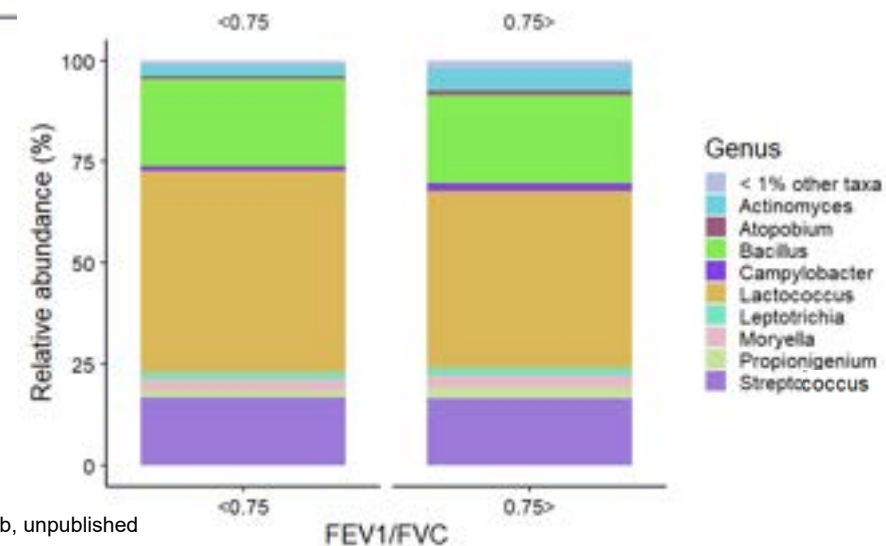
Level	Mean	Std Error	Lower 95%	Upper 95%
12-17 yo	103.495	4.3254	94.798	112.19
18-21 yo	83.153	4.9946	73.111	93.20
22-30 yo	88.394	4.8360	78.670	98.12

Relative abundance by FEV1



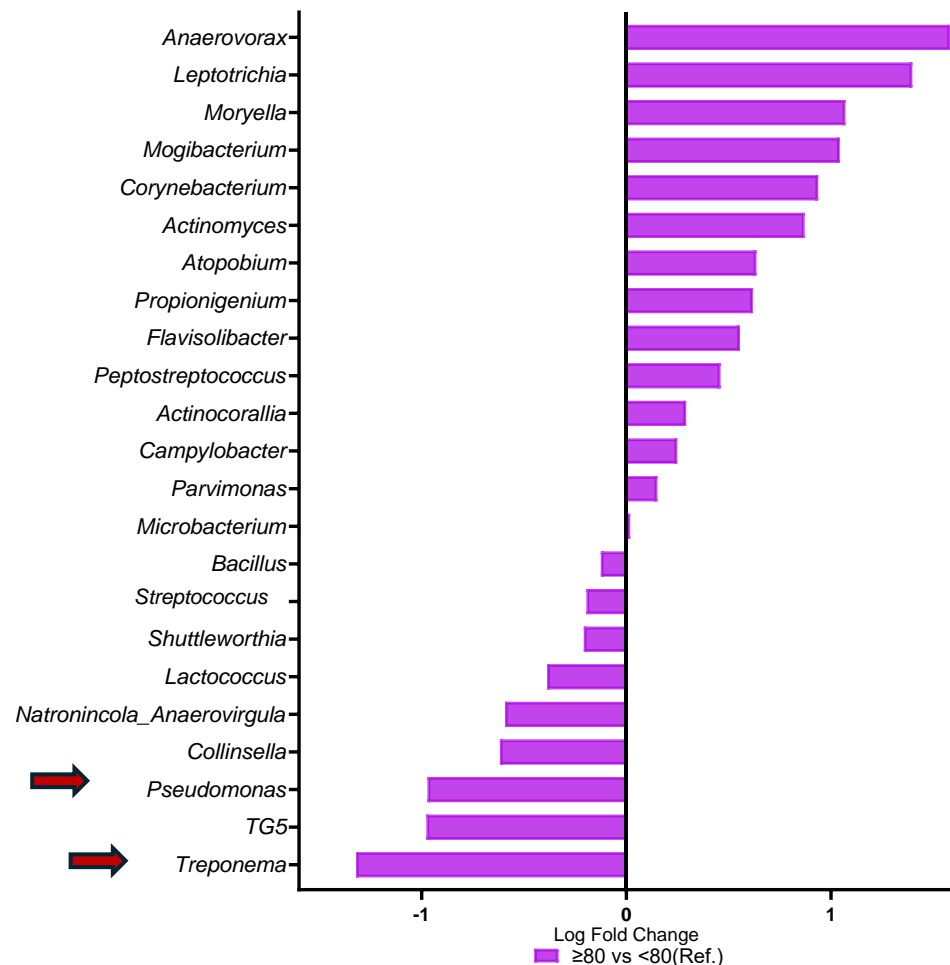
**Forced Expiratory Volume 1/
Forced Vital Capacity**

Relative abundance by FEV1/FVC

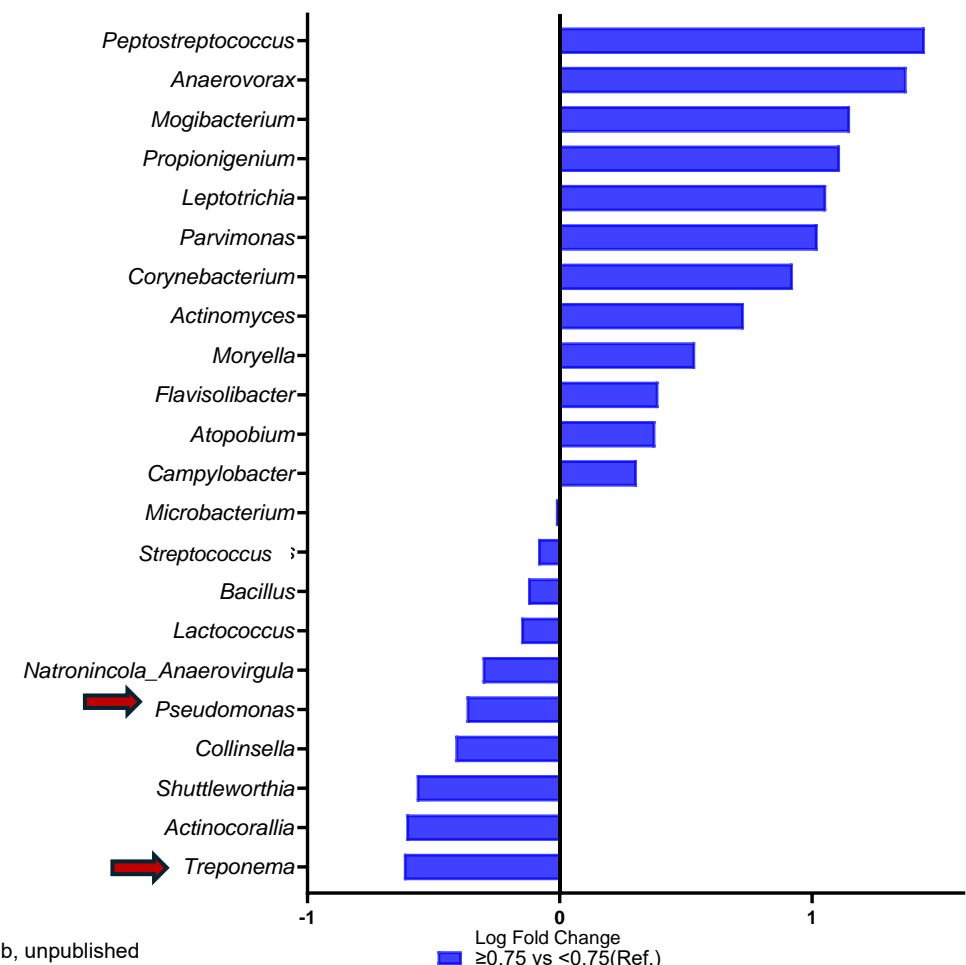


Pulmonary function is associated with salivary microbiome dysbiosis

Differential abundance of taxa by FEV1 in CFTR M. users at Genus level

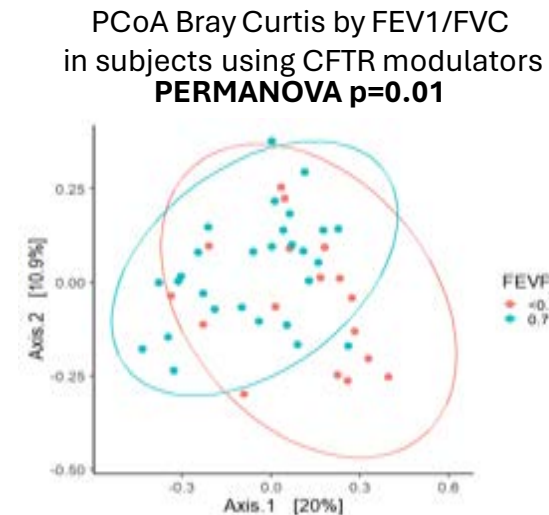
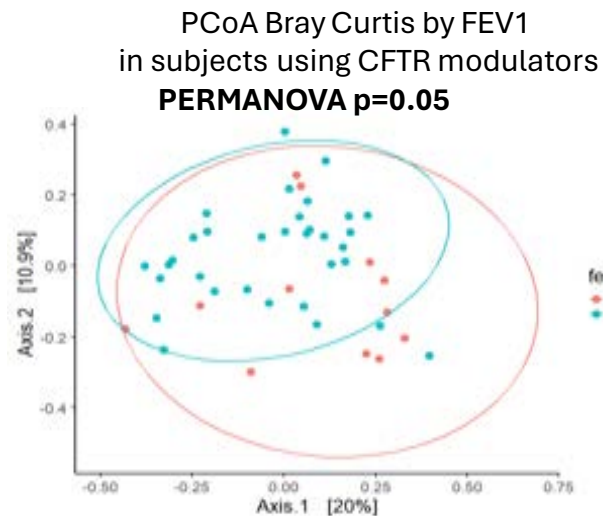
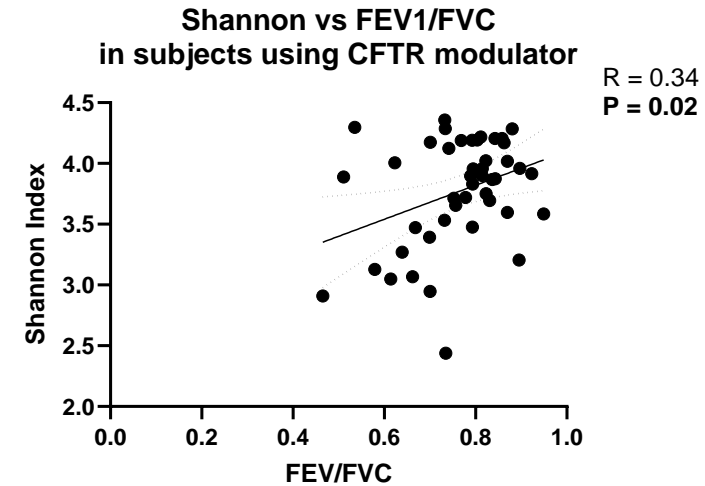
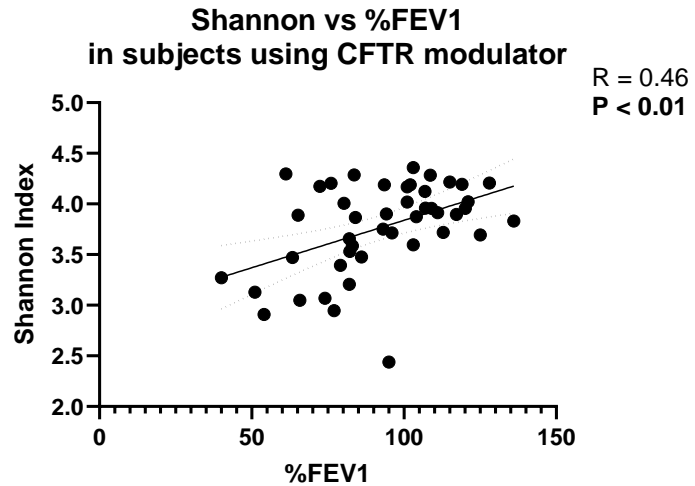


Differential abundance of taxa by FEV1/FVC in CFTR M. users at Genus level

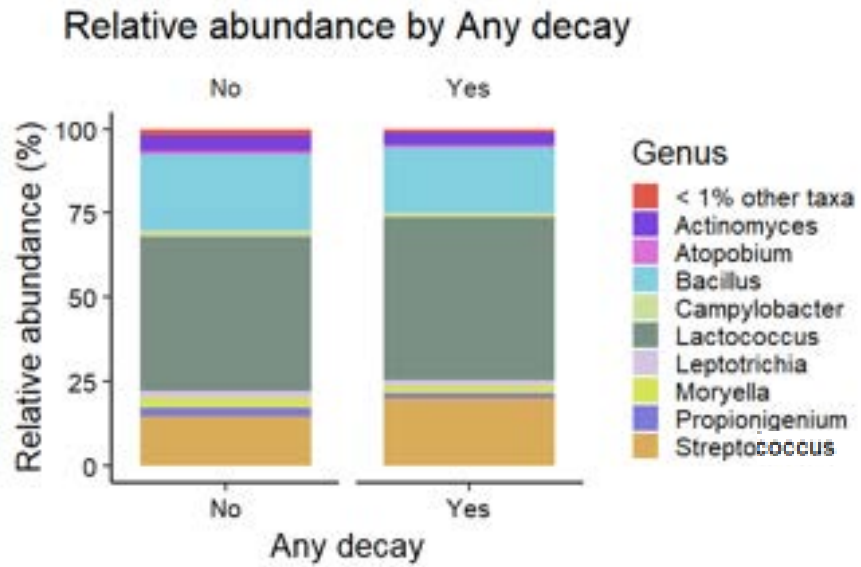


Wolfgang Lab, unpublished

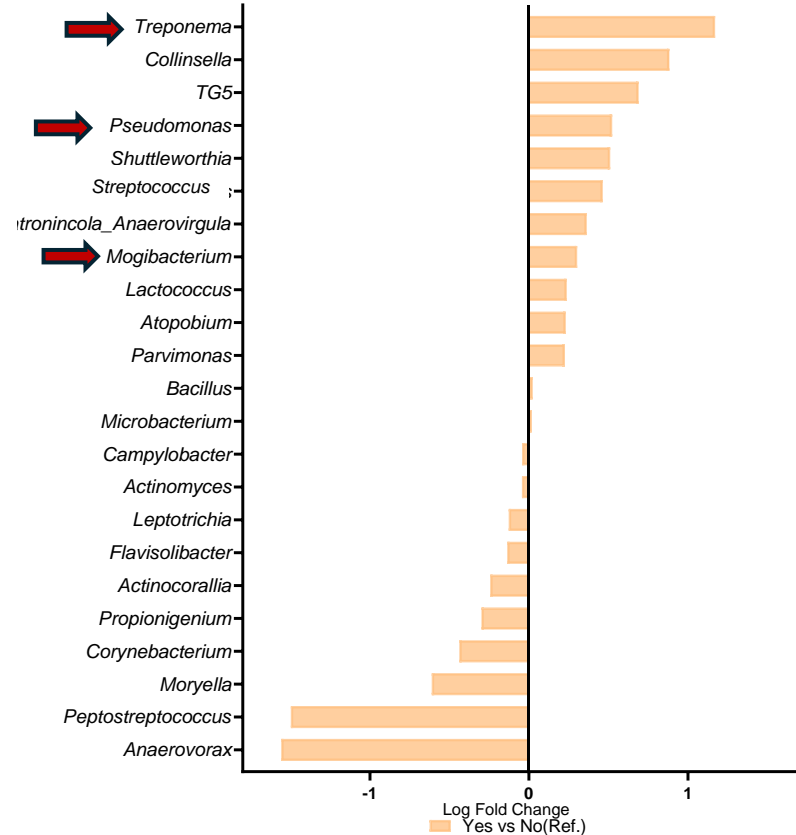
Pulmonary function is associated with salivary microbiome diversity



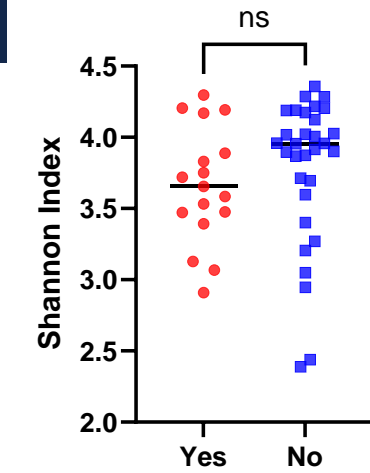
Dental caries increases abundance of pathogenic bacterial species.



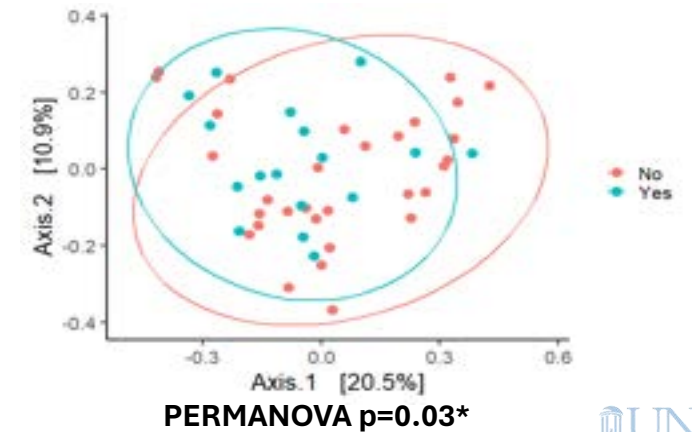
Differential abundance of taxa by Any decay in CFTR M. users at Genus level



Shannon index by Any decay



PCoA Bray Curtis by Any decay in subjects using CFTR modulators

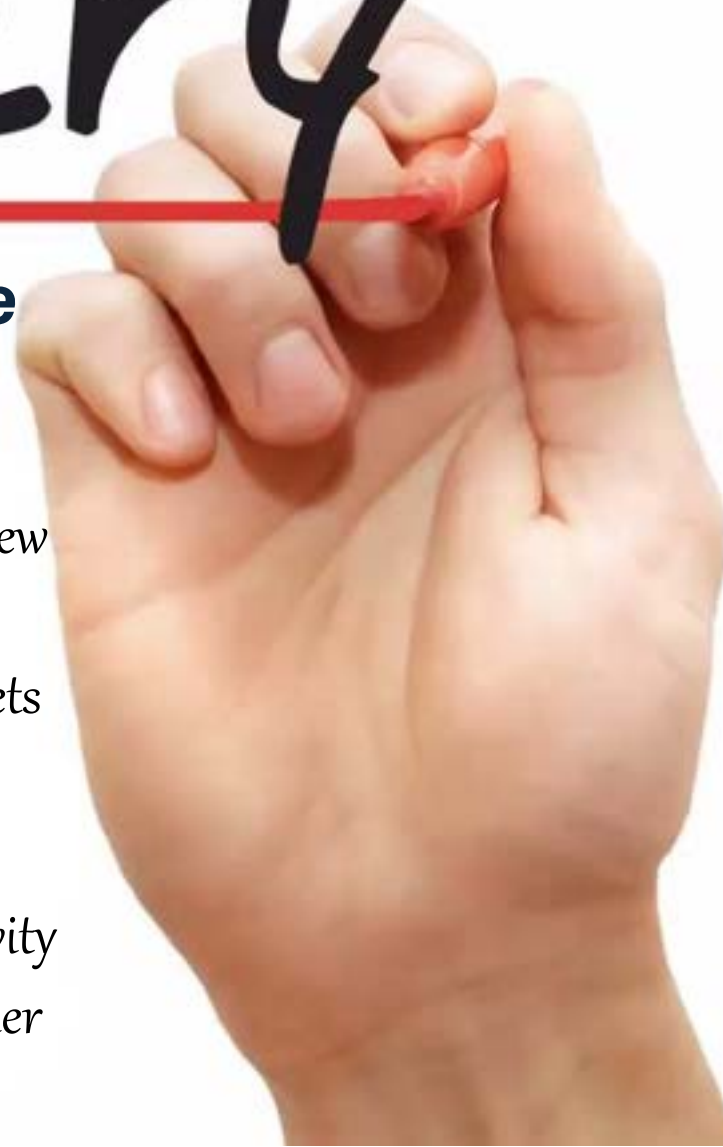




Summary

Outside the oral cavity: Linking the oral microbiome to respiratory health outcomes in Cystic Fibrosis

- ✓ Cf respiratory microbiology has evolved as new technologies have been developed, new treatments have been introduced, and as people have lived longer with this disease.
- ✓ People with CF have better oral health than the general population < age 10 but it gets worse in adulthood.
- ✓ Pulmonary function is associated with salivary microbiome diversity.
- ✓ Dental caries increases the abundance of pathogenic bacterial species in the oral cavity and influences the salivary microbiome diversity in patients with cystic fibrosis under modulator therapy.



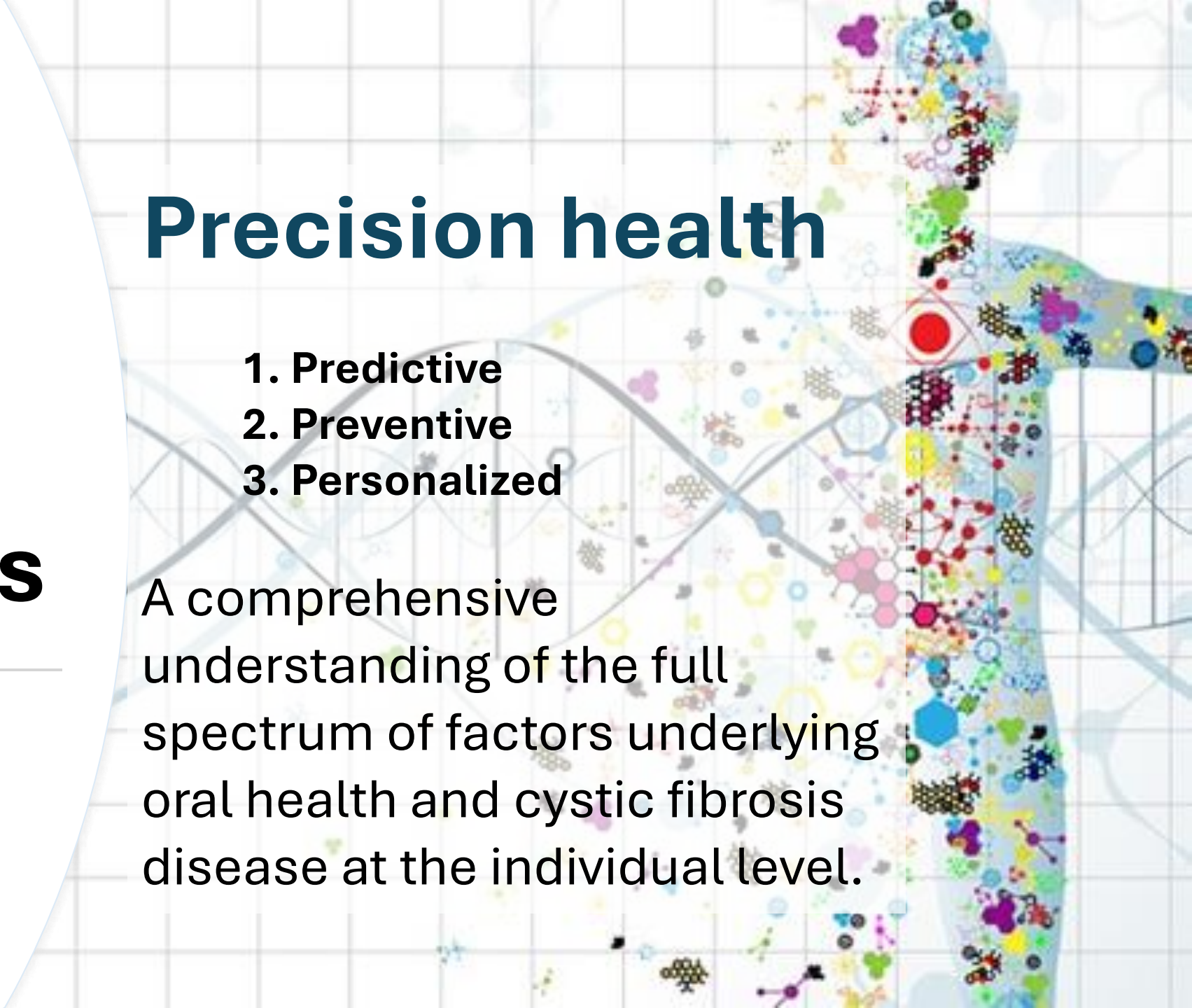


Future perspectives

Precision health

1. Predictive
2. Preventive
3. Personalized

A comprehensive understanding of the full spectrum of factors underlying oral health and cystic fibrosis disease at the individual level.



Acknowledgments



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Thanks!

Any questions?

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