THE ORAL MICROBIOME AND ITS ROLE IN HEALTH

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zendium

BOOST MOUTH'S NATURAL DEFENCES

LEARNING OBJECTIVES

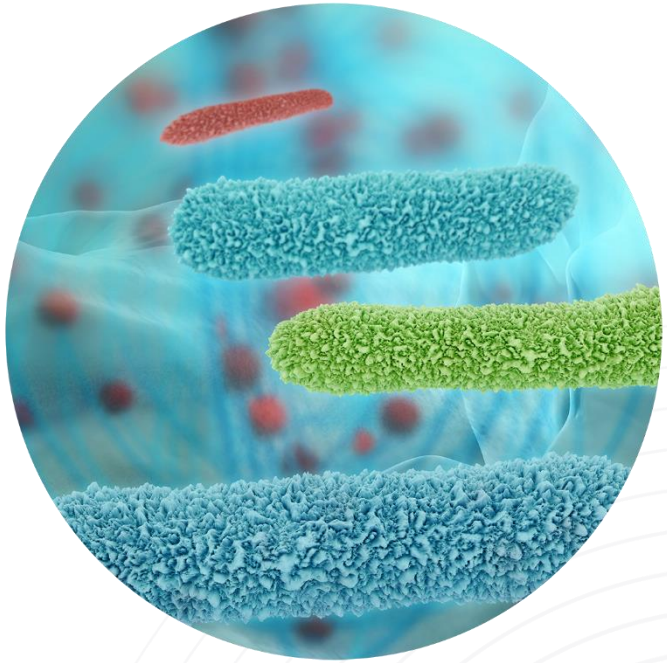
In this module, you will learn about

- Evolution of the human microbiome and how it has changed through time
- The importance of the microbiome in human health
- Role of saliva in maintaining a balanced oral microbiome
- Consequences of dysbiosis

AGENDA

THE MICROBIOME

- The human microbiome
- The oral microbiome



DYSBIOSIS

- Contributing factors
- Consequences of dysbiosis

EFFECTS OF ZENDIUM

- Three relevant clinical studies on the microbiome and gingival health

THE MICROBIOME

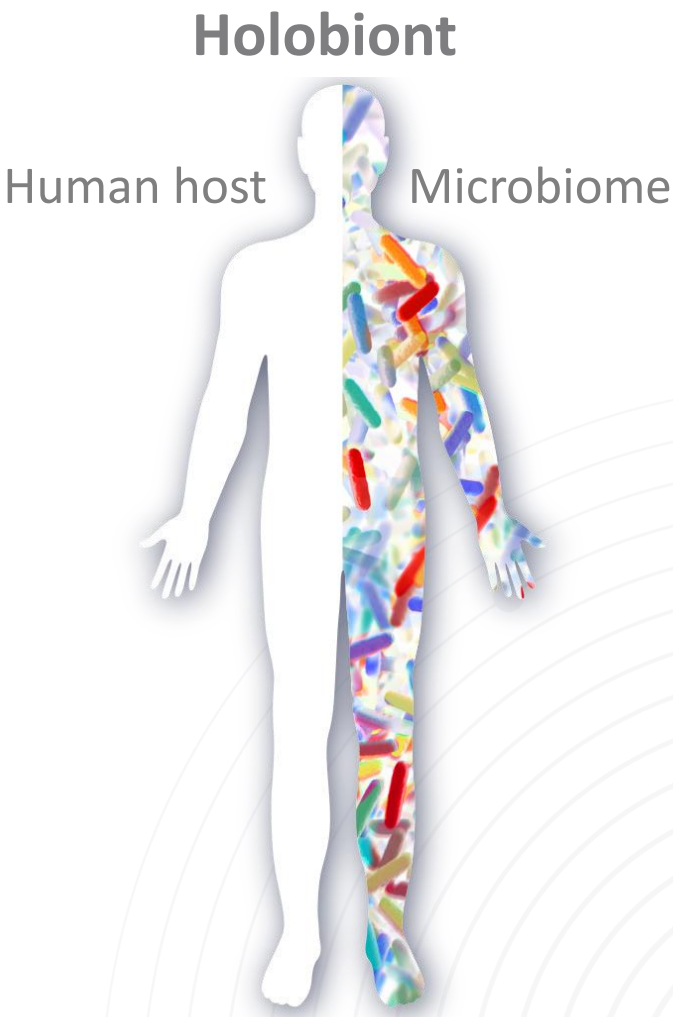
THE HUMAN HOLOBIONT

The human body is colonised by a diverse community of commensal, symbiotic and pathogenic microorganisms and their genetic material, collectively known as the **microbiome**[1]

Together with our microbiome, we form a single entity known as the **holobiont**[2]

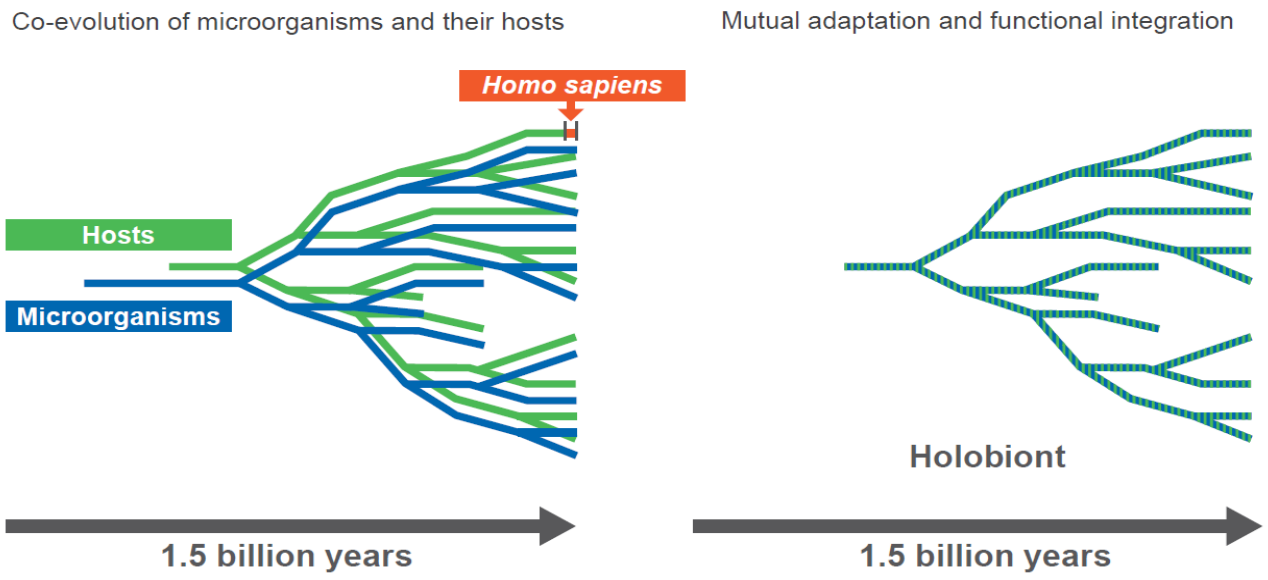
The ratio of microbial:human cells in the holobiont is

at least 1:1[3]



HUMANS AND MICROORGANISMS HAVE CO-EVOLVED

The **co-evolution** between microorganisms (blue lines) and their respective hosts (green lines) over a period of 1.5 billion years has resulted in **mutual adaptation** and **functional integration**[1]

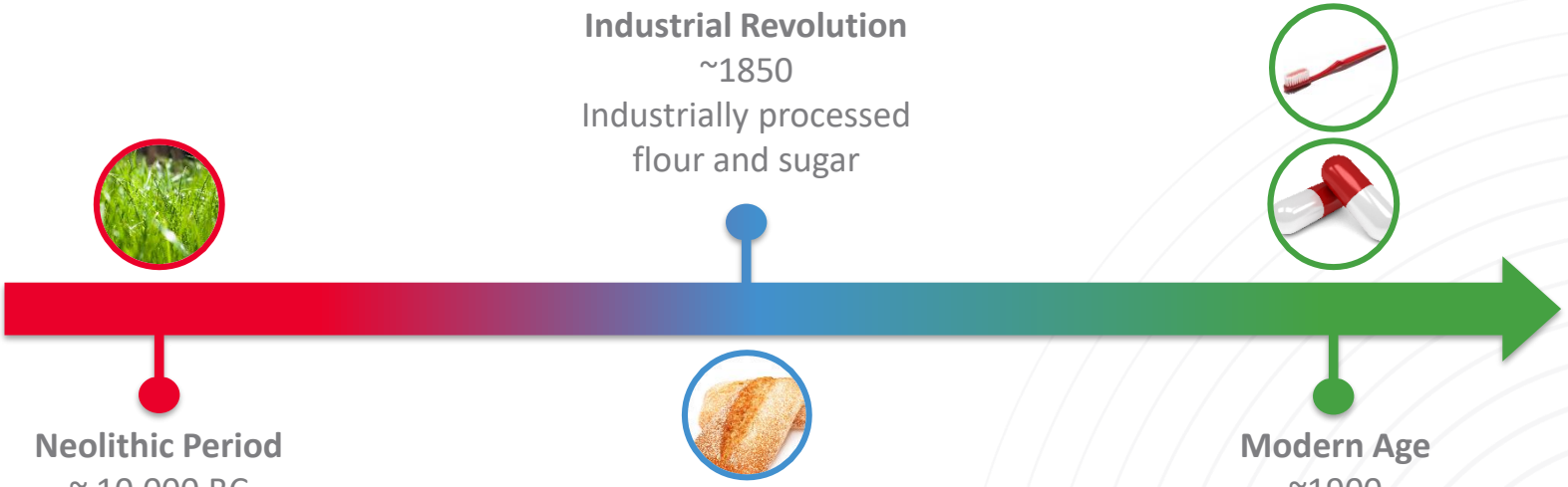


EVOLUTION OF THE HUMAN MICROBIOME

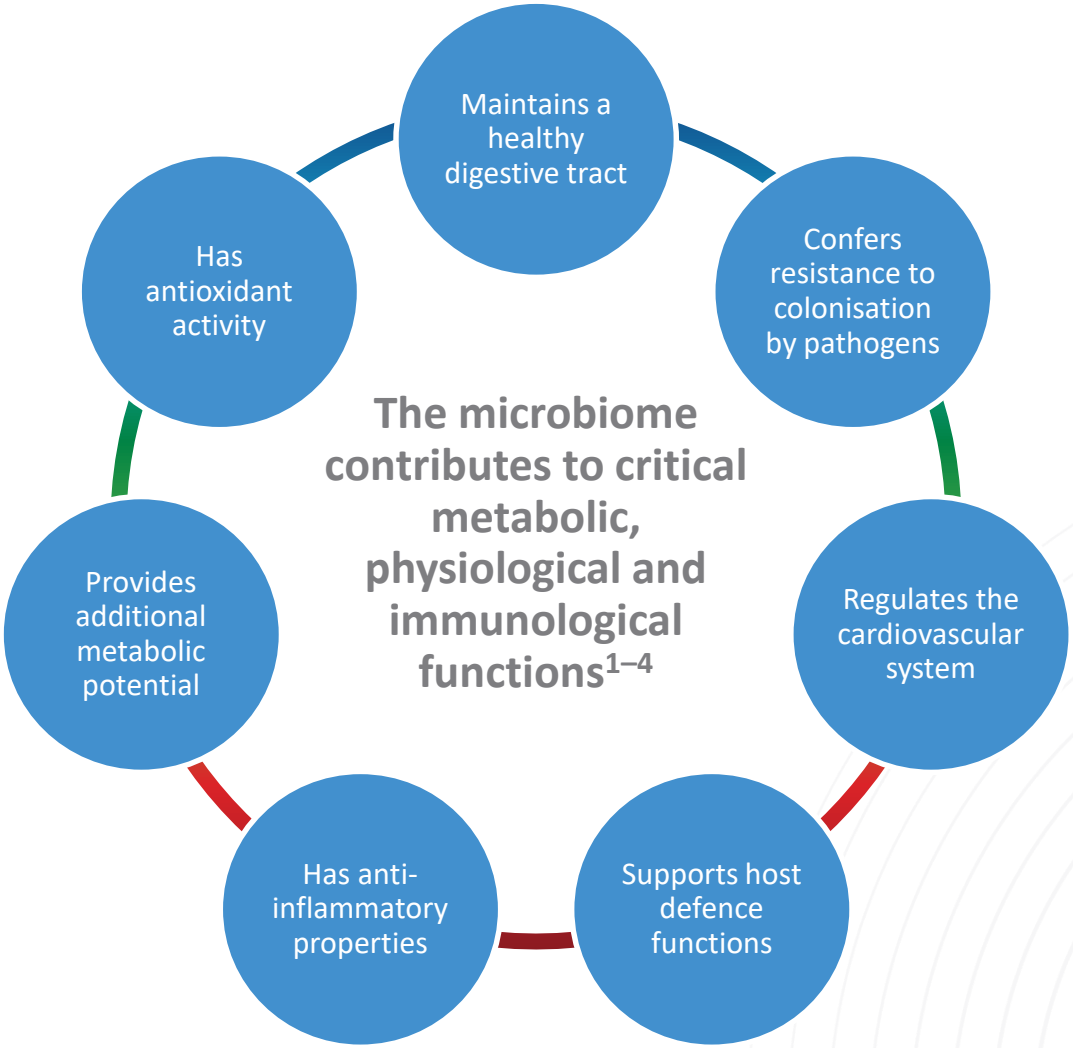
Resident microbes have been performing metabolic functions in animals for at least 500 million years[1]

Throughout human evolution, our environment has continually shaped the composition of our oral and gut microbiomes

Historical periods of oral/gut microbiome evolution[2,3]



A BALANCED MICROBIOME IS ESSENTIAL FOR HEALTH

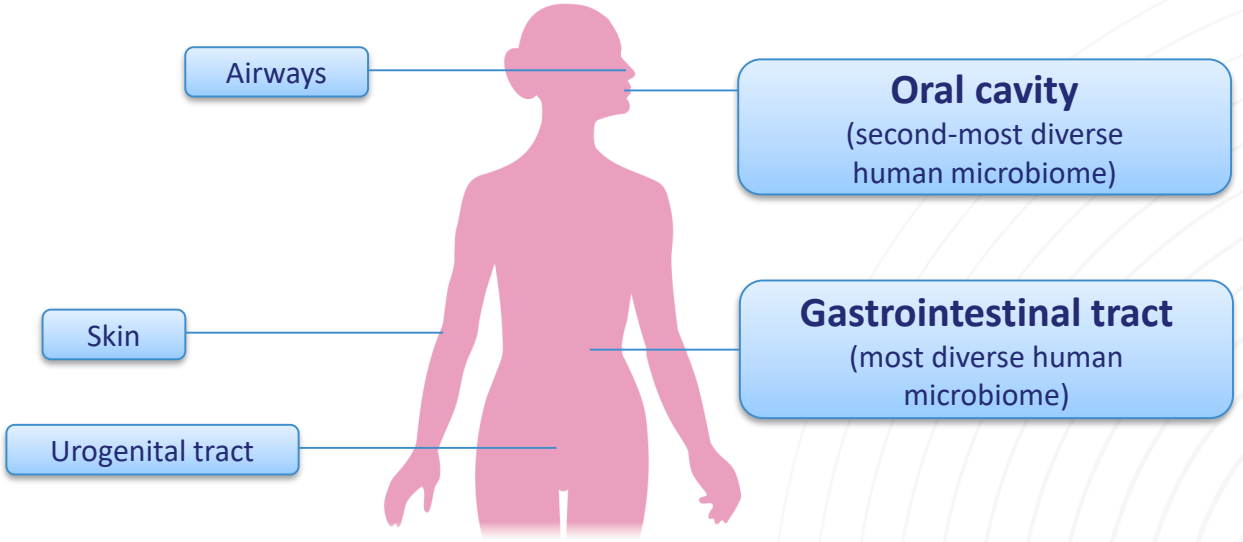


THE HUMAN MICROBIOME IS DIVERSE

The composition of our microbiome shows great diversity and is highly variable within and between people[1]

Different body sites support distinct microbial communities according to the biological and physical properties of each location/habitat[1]

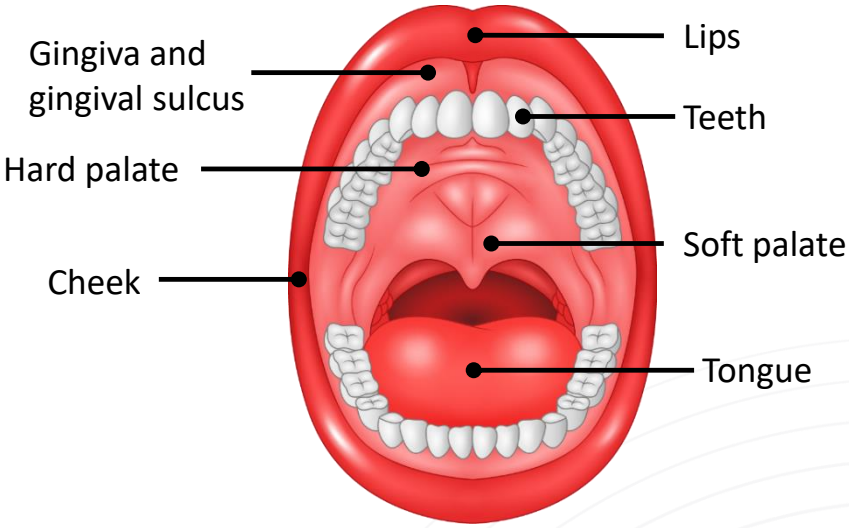
Some human microbiome habitats[2]



THE ORAL HABITAT

The mouth has distinct habitats that form a heterogeneous ecological system[1,2]

The warm, moist environment suits the growth of many microorganisms and offers host-derived nutrients[3]

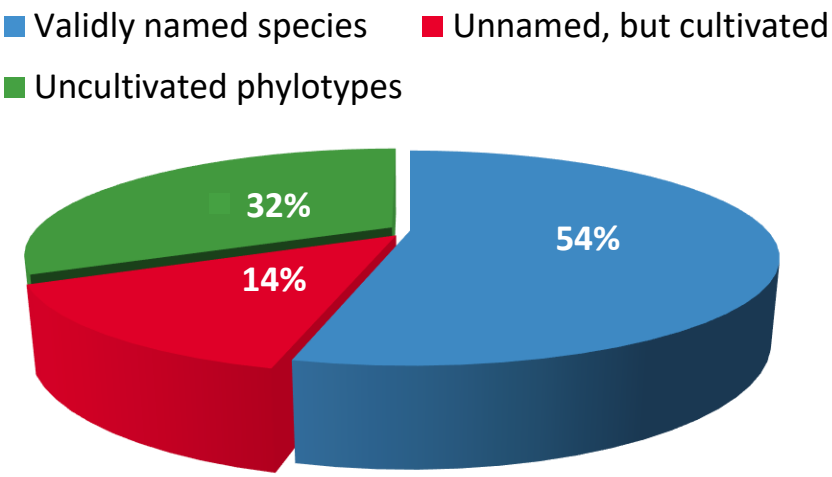


Non-shedding surfaces of teeth provide unique opportunities for biofilm formation[4]

DIVERSITY OF THE ORAL MICROBIOME

To date, **> 700** prokaryote species have been identified that colonise the oral cavity[1]

Oral species detected in the oral cavity (n = 700)[1]



Data from a recent study[2]

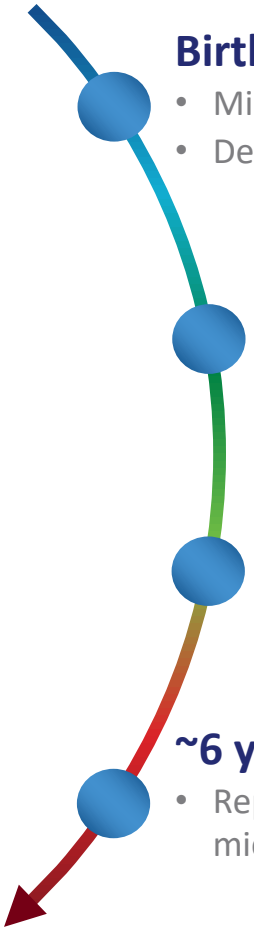
Number of taxa found in 9 oral sites of 26 individuals:

557

Mean number of taxa found in each individual:

296

ACQUISITION OF THE ORAL MICROBIOME



Birth

- Microbes are transmitted from mother to child during birth[1]
- Delivery method (natural vs Caesarean) influences the diversity of the child's oral microbiome[2]

~3 months

- The method of feeding also has an effect, with 3-month-old breast-fed infants showing a higher colonisation with oral lactobacilli than formula-fed infants[3]

~3 years

- Eruption of teeth provides new surfaces for microbial colonisation and constitutes a major ecological event in the mouth of a child[4]
- By the age of 3, the oral microbiome of children is already complex, and becomes increasingly so with age[5]

~6 years

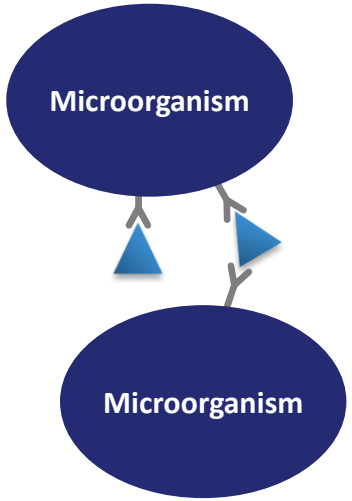
- Replacement of the primary teeth with an adult dentition again significantly alters the oral microbial habitat[6]

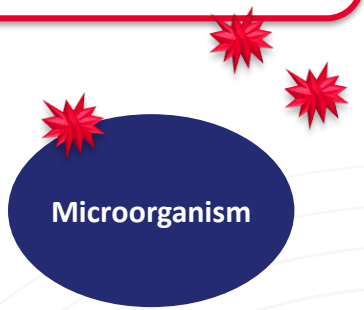
SALIVA MAINTAINS A BALANCED ORAL MICROBIOME

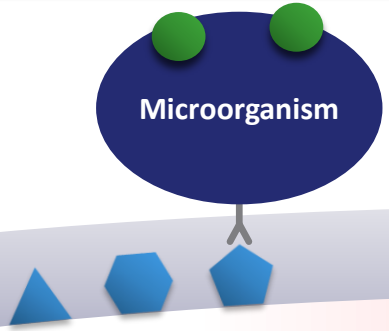
1. **Proteins in saliva bind microorganisms** for rapid clearance by flushing (swallowing, chewing, speaking), preventing colonisation of teeth/soft tissues[1]

2. **Salivary components provide complex nutrients** for microorganisms, enabling the development of a balanced microbiome[1]

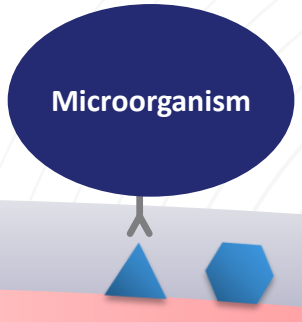
3. Some salivary components have natural **antimicrobial action**[1,2]







Salivary proteins cover the tooth and epithelial surfaces in the form of a **protective pellicle**[3]



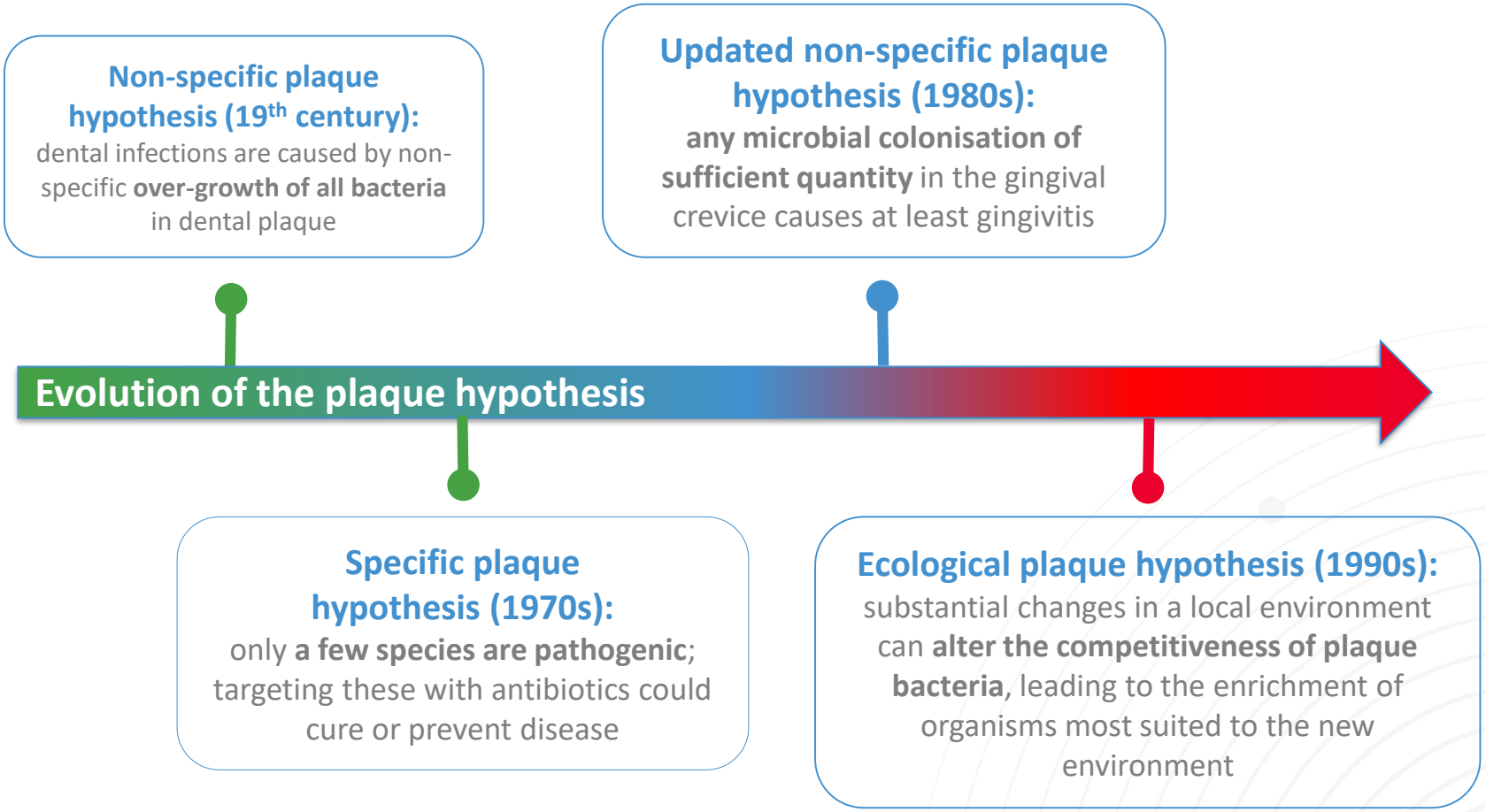
Microorganisms colonise the pellicle by attaching to receptor proteins[3]

Tooth surface

Epithelial surface of soft tissue

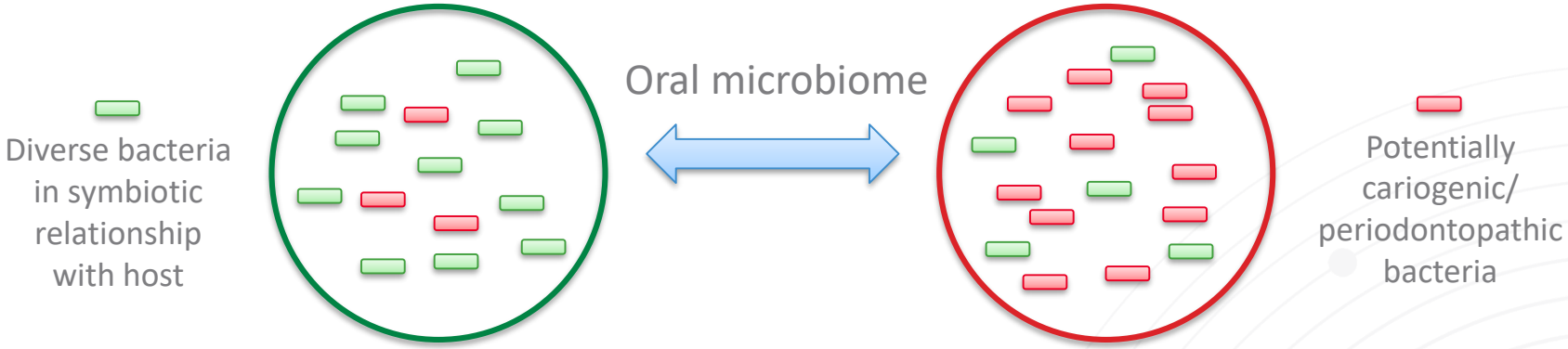
DYSBIOSIS:
THE ORAL MICROBIOME IN DISEASE

HOW DOES PLAQUE LEAD TO DENTAL DISEASE?



A DISTURBANCE IN THE BALANCE OF THE ECOSYSTEM LEADS TO DYSBIOSIS AND DISEASE

The complex equilibrium between resident species in the oral cavity is responsible for the maintenance of a healthy state **(symbiosis)** or a state associated with disease **(dysbiosis)**[1,2]

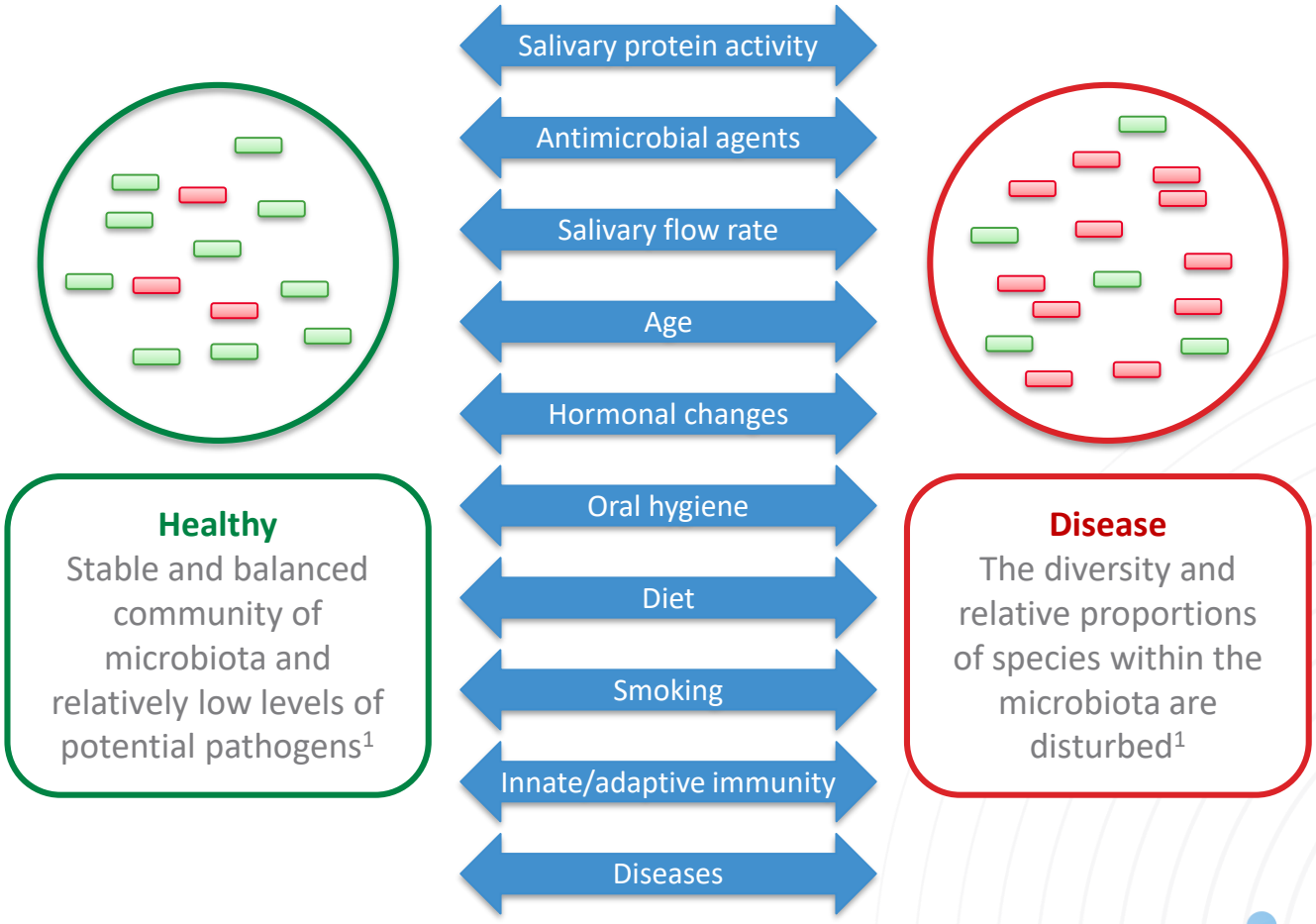


Healthy
Stable and balanced community of microbiota, and relatively low levels of potential pathogens

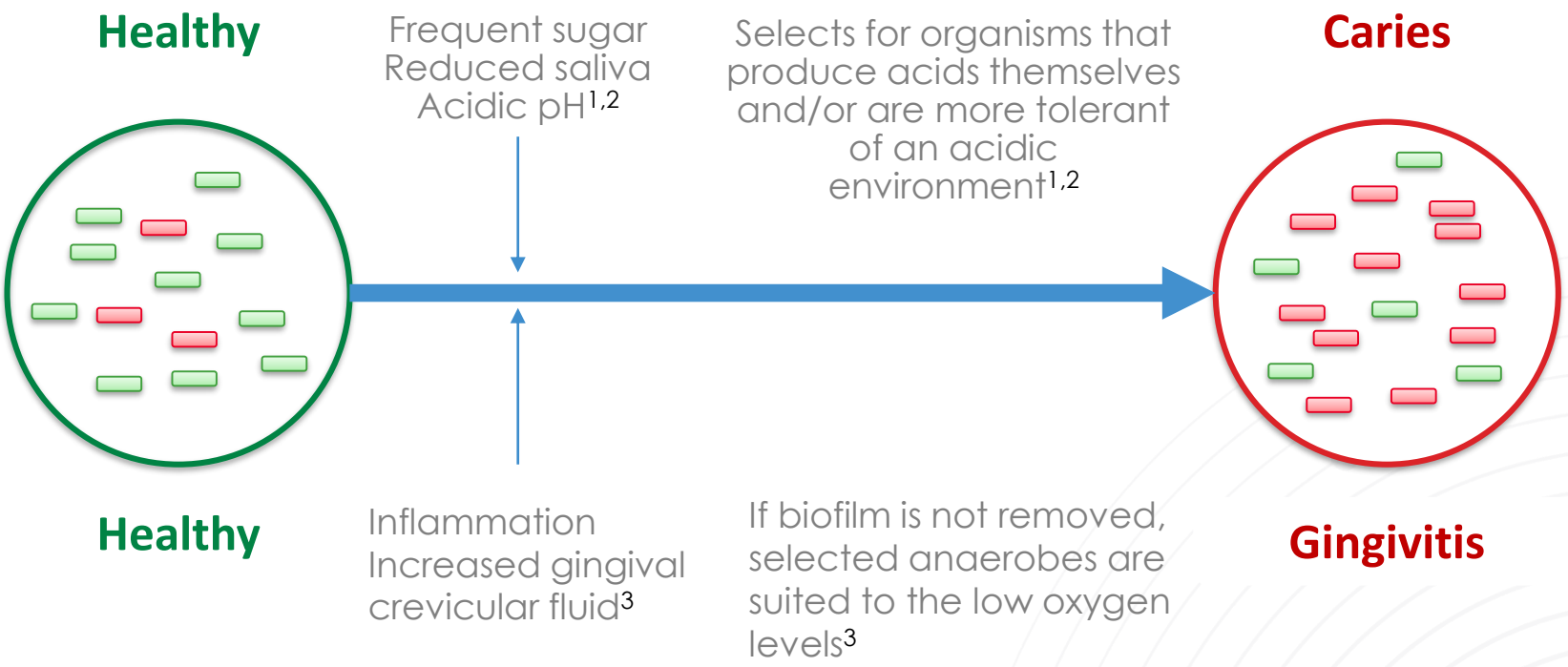
Disease
The diversity and relative proportions of species within the microbiota are disturbed[1]

INTRINSIC AND EXTRINSIC FACTORS CAN TRIGGER A SHIFT TOWARDS DYSBIOSIS

The composition of the healthy oral microbiome is remarkably stable; however, changes in physiological or lifestyle factors can lead to dysbiosis and disease[1]



DYSBIOSIS: LINKED TO CARIES AND GINGIVITIS



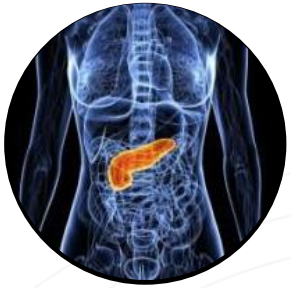
ORAL DYSBIOSIS CAN HAVE SYSTEMIC CONSEQUENCES

Co-evolution to a harmonious co-existence only works as long as microbes remain in their natural habitat and are not disseminated to other body sites, where they can cause a number of diseases[1–3]

Arthritis

Heart disease and stroke

Adverse pregnancy outcomes



Diabetes

Bi-directional relationship with periodontitis

Meningitis and brain abscess

Irritable bowel syndrome and bowel cancer

Respiratory diseases

Alzheimer's Disease*

*New association

CLINICAL GOAL: MAINTAINING A BALANCED ORAL MICROBIOME

Preventative measures that can help to **maintain a healthy symbiotic state**:

Educating patients on appropriate lifestyle choices

Effective plaque control techniques to preserve dental biofilms at levels compatible with oral health

Measures that can be followed to **re-establish symbiosis**:

Avoidance of indiscriminate use of antibiotics

Continued education on oral hygiene and lifestyle strategies to promote symbiosis

ZENDIUM:
A TOOTHPASTE INSPIRED BY SALIVA

BOOSTING NATURAL SALIVARY DEFENCES WITH ENZYMES AND PROTEINS

- 1450ppm sodium fluoride
- Natural enzymes and proteins

The Zendium active systems

Triple Enzyme System[1,2]	Role
Amyloglucosidase	Produces glucose from polyglucans
Glucose oxidase	Oxidises glucose to gluconate and **hydrogen peroxide**
Lactoperoxidase	Catalyses the oxidation of thiocyanate to **hypothiocyanite** by hydrogen peroxide

Protein System[1,3,4]	Role
Lysozyme	Interrupts bacterial cell wall formation, and helps inhibit bacterial glucose metabolism
Lactoferrin	Inhibits growth of iron-dependent bacteria and microbial adhesion
Colostrum as a source of immunoglobulin	In saliva helps to provide resistance against infection