

Els bacteris de la nostra boca: amics o enemics?

Dr. Jordi Mas

FACULTAT D'ODONTOLOGIA

UNIVERSITAT INTERNACIONAL DE CATALUNYA, UIC

UIC
barcelona



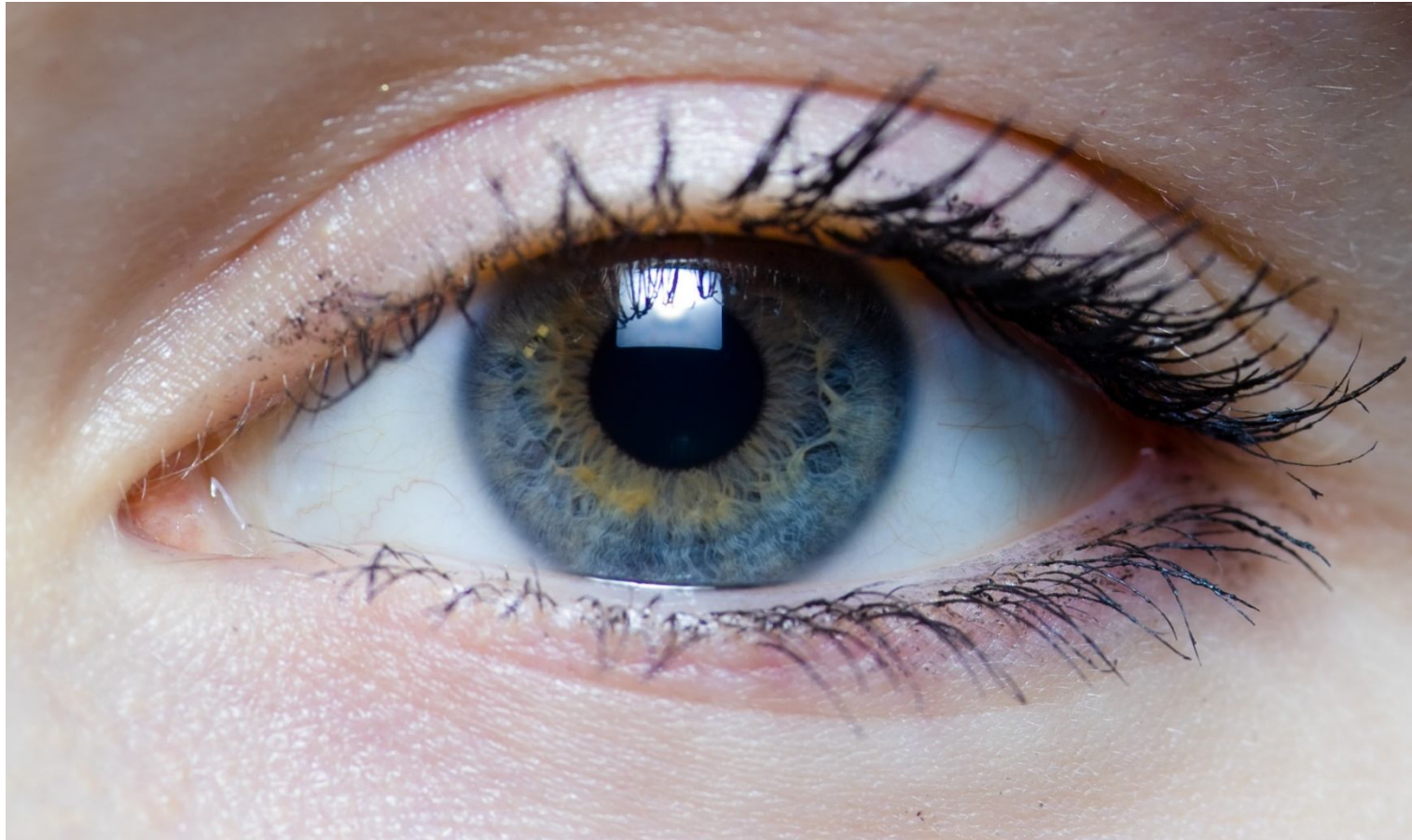
IES Can Puig

St Pere de Ribes

26 de setembre de 2019



Existeix el que no es veu?



Eines per veure millor

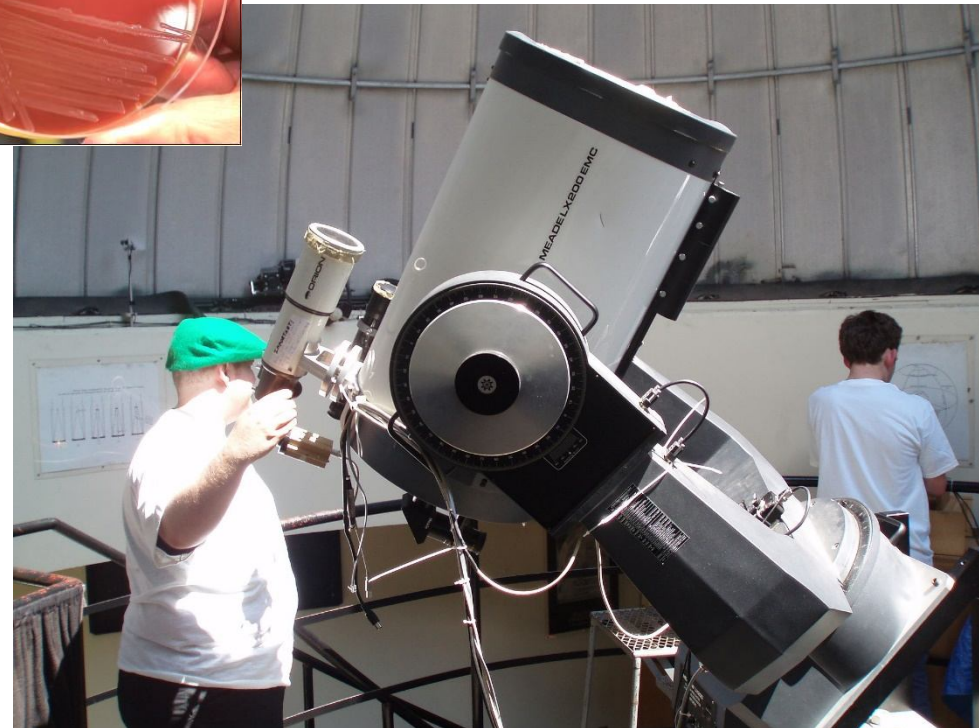
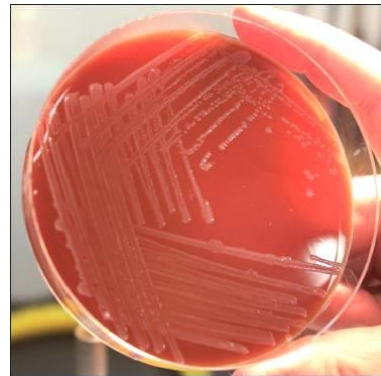
microbe 

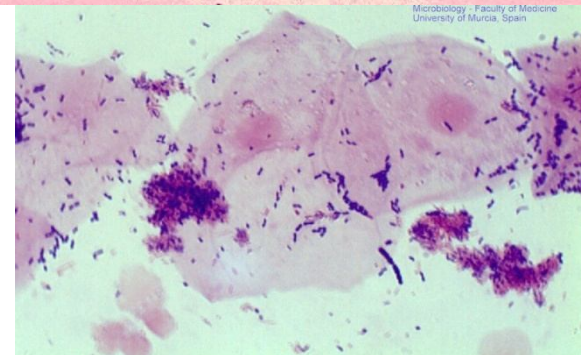
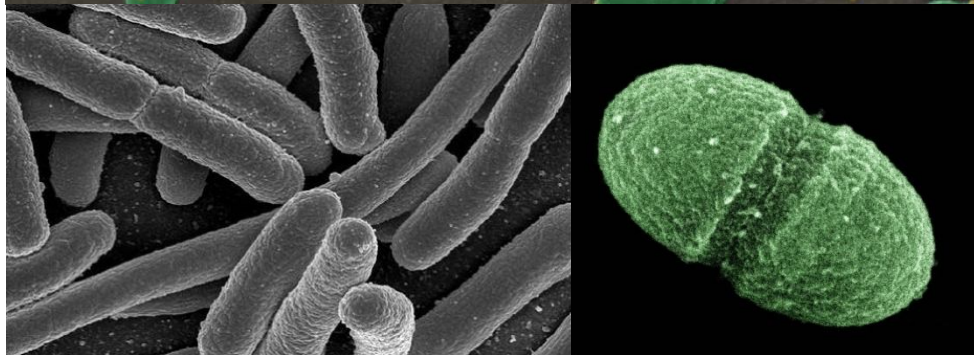
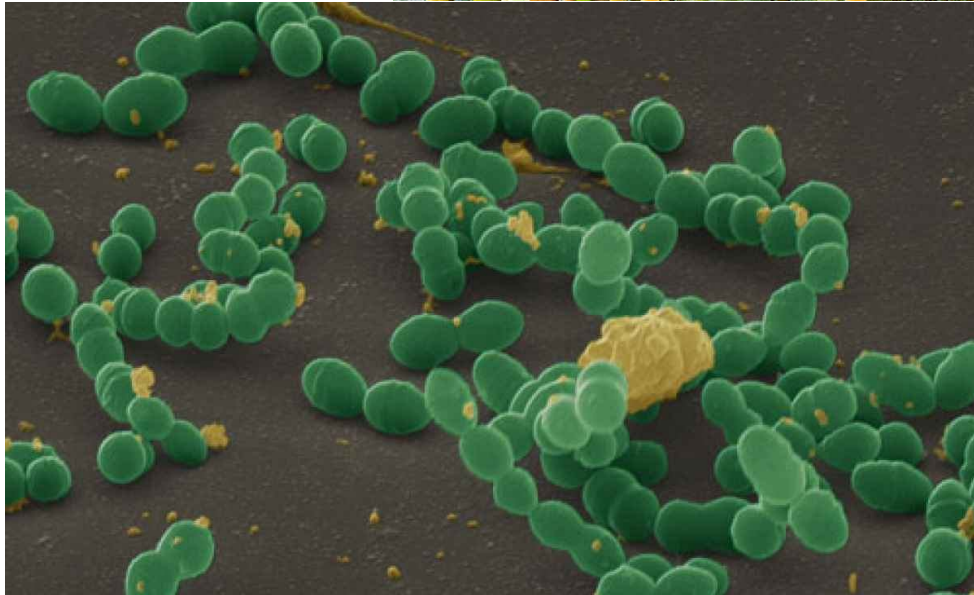
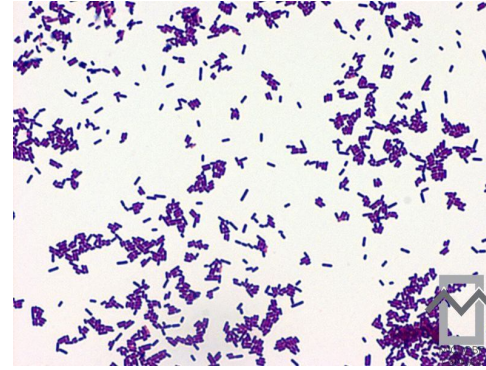
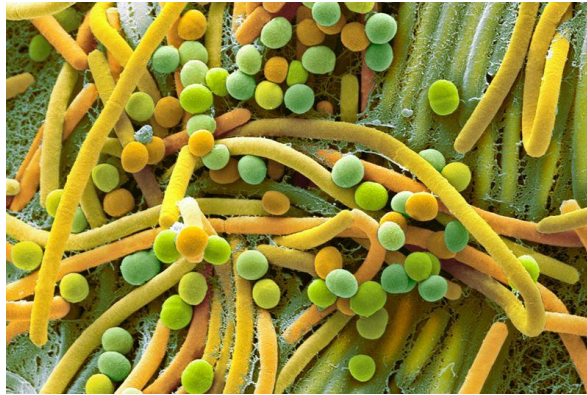
noun | mi-crobe | ˈmī-krōb

Simple Definition of MICROBE

Populari

: an extremely small living thing that can only be seen with a microscope

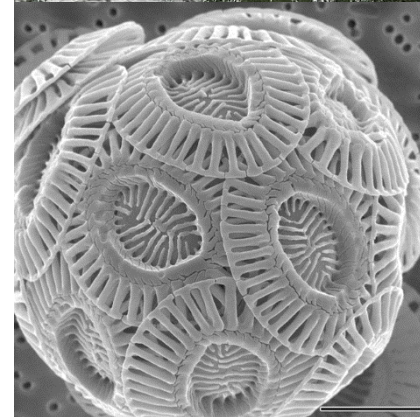
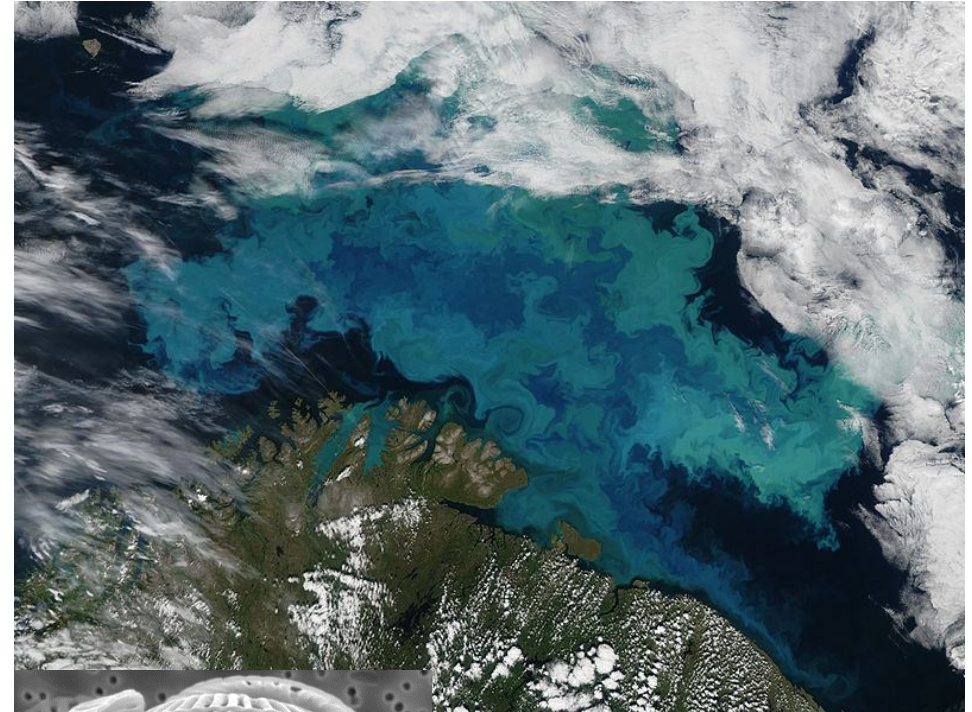




Microbiology - Faculty of Medicine
University of Murcia, Spain

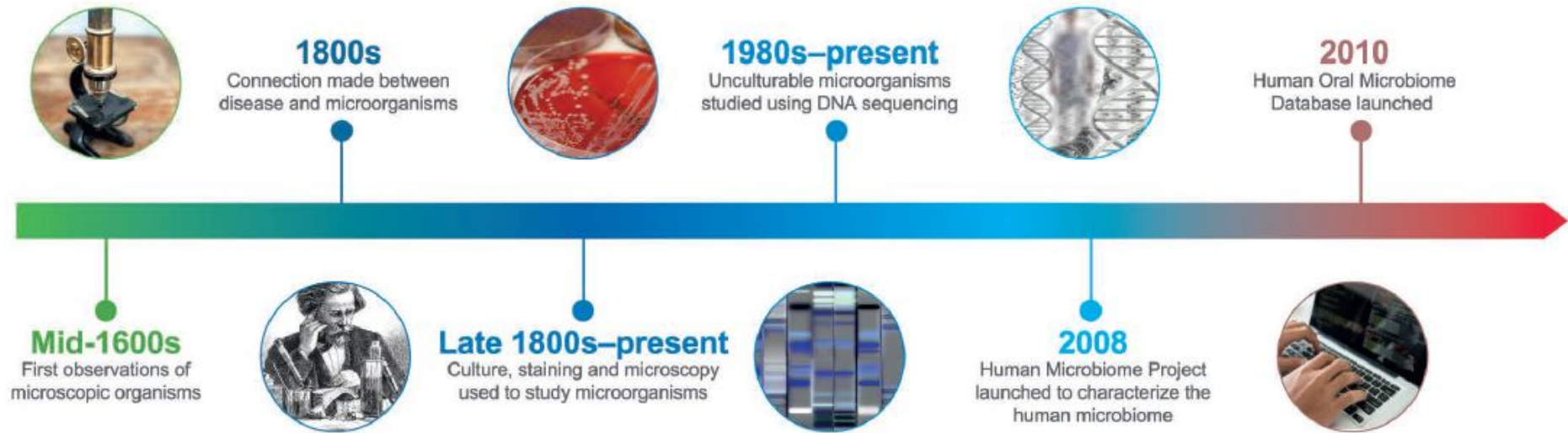


Emiliana huxleyi & satellites



LANDSAT Satellite image of *Emiliana huxleyi* bloom in the English Channel (Latitude $50^{\circ}11'1''$ N and longitude $0^{\circ}31'52''$ W) off the coast of Plymouth (Cornwall) 24, July 1999
(Photo: NASA, image courtesy of Andrew Wilson and Steve Groom)

Oral Microbiology: Past, Present and Future



First observations

- van Leeuwenhoek (1632 – 1723)
- In his notebook, he recorded *"I didn't clean my teeth for three days and then took the material that has lodged in small amounts on the gums above my front teeth..... I found a few living animalcules."*

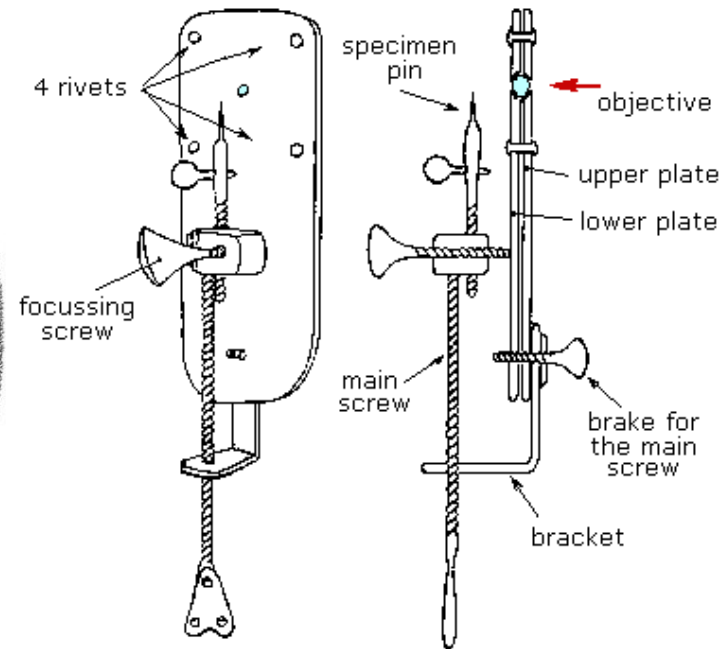
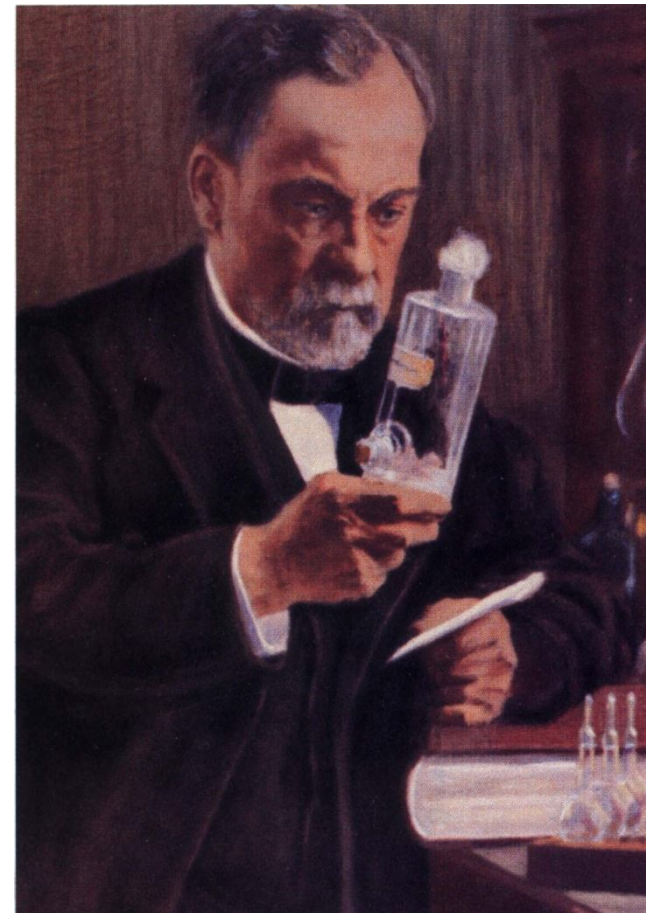
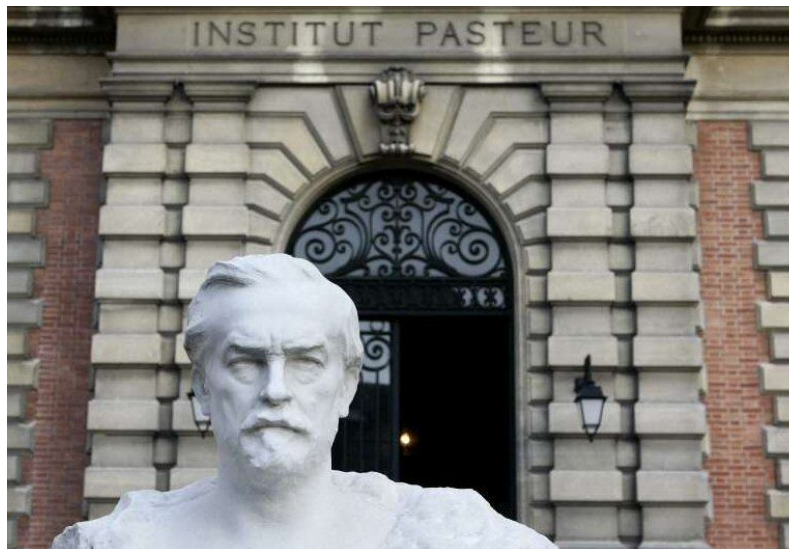


Figure 1 - Diagram of the microscope constructed by Antoni van Leeuwenhoek in the XVII century

Louis Pasteur (1822 – 1895)

- Pasteur (1857) demonstrated that lactic acid fermentation is due to the activity of microorganisms
- Pasteur (1861) conflict over spontaneous generation – birth of microbiology as a science
- Pasteur (1881) developed anthrax vaccine
- Pasteurization



Pasteur (1861)

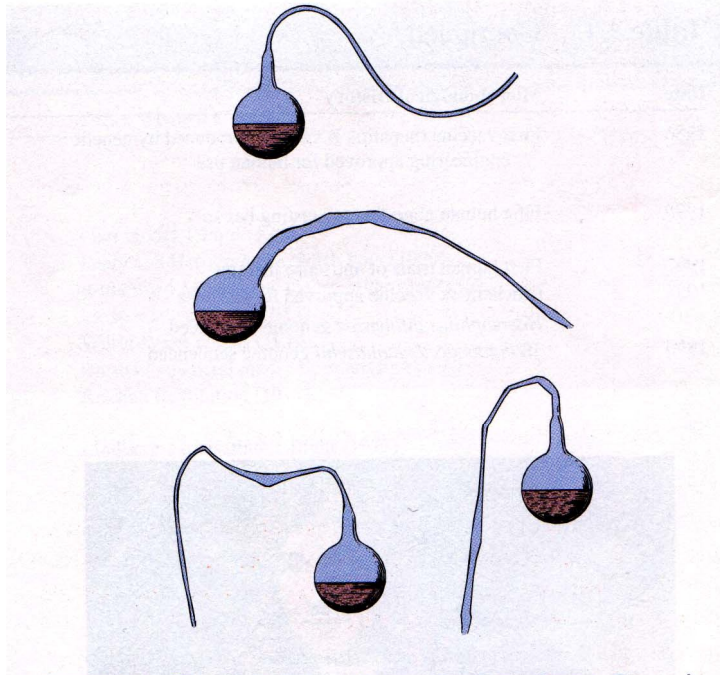
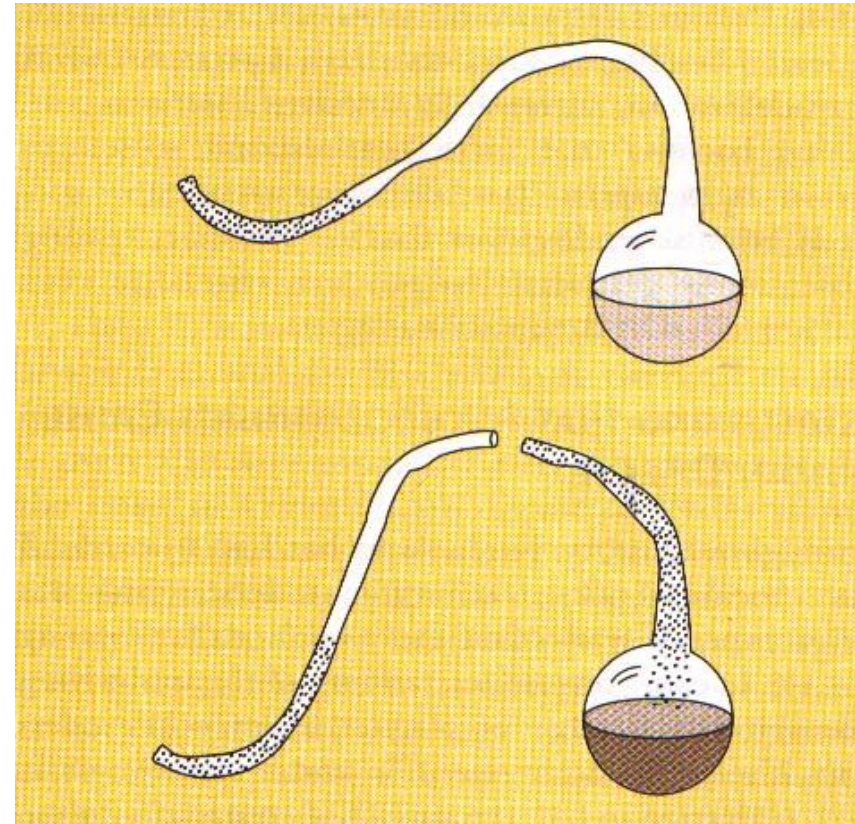


Figure 1.3 The Spontaneous Generation Experiment. Pasteur's swan neck flasks used in his experiments on the spontaneous generation of microorganisms. *Source: Annales Sciences Naturelle, 4th Series, Vol. 16, pp. 1-98, Pasteur, L., 1861, "Mémoire sur les Corpuscules Organisés Qui Existents Dans L'Atmosphère: Examen de la Doctrine des Générations Spontanées."*

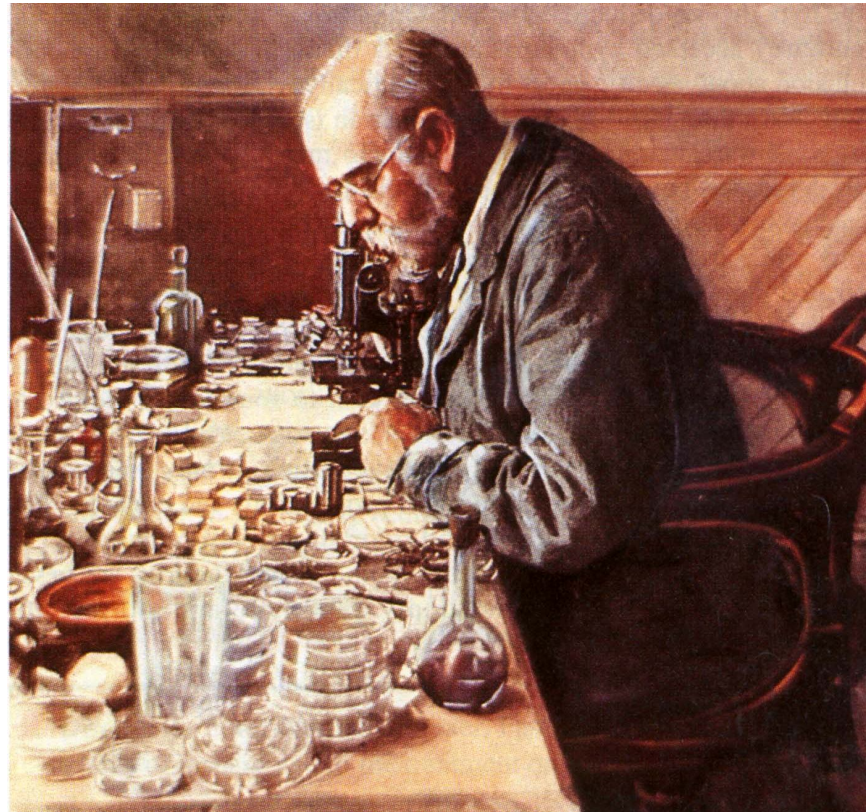


Pasteur's swan neck flasks used in his experiments on the spontaneous generation of microorganisms.

Microorganisms are not spontaneously generated from inanimate matter, but are produced by other microorganisms.

Robert Koch (1843 – 1910)

The recognition of microbial role in disease



(1884)

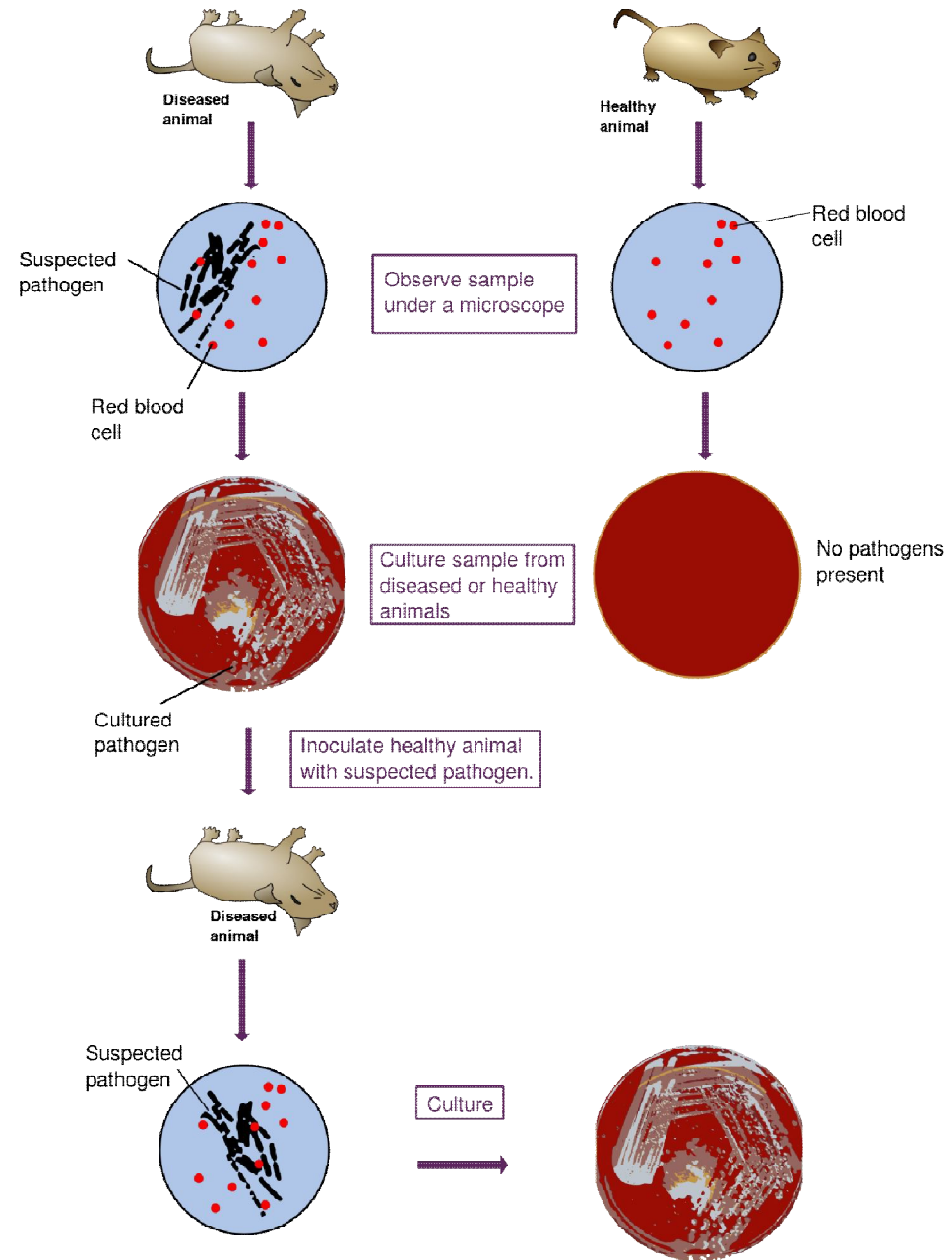
Koch's Postulates:

① The microorganism must be found in abundance in all organisms suffering from the disease, but should not be found in healthy organisms.

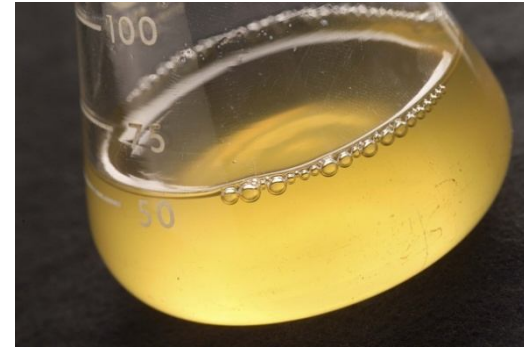
② The microorganism must be isolated from a diseased organism and grown in pure culture.

③ The cultured microorganism should cause disease when introduced into a healthy organism.

④ The microorganism must be reisolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.



CULTIU PUR (AXÈNIC)



By de:Benutzer:Brudersohn - German Wikipedia:
<http://de.wikipedia.org/wiki/Bild:Serrmarckol.jpg>, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=732821>

Bacterial growth

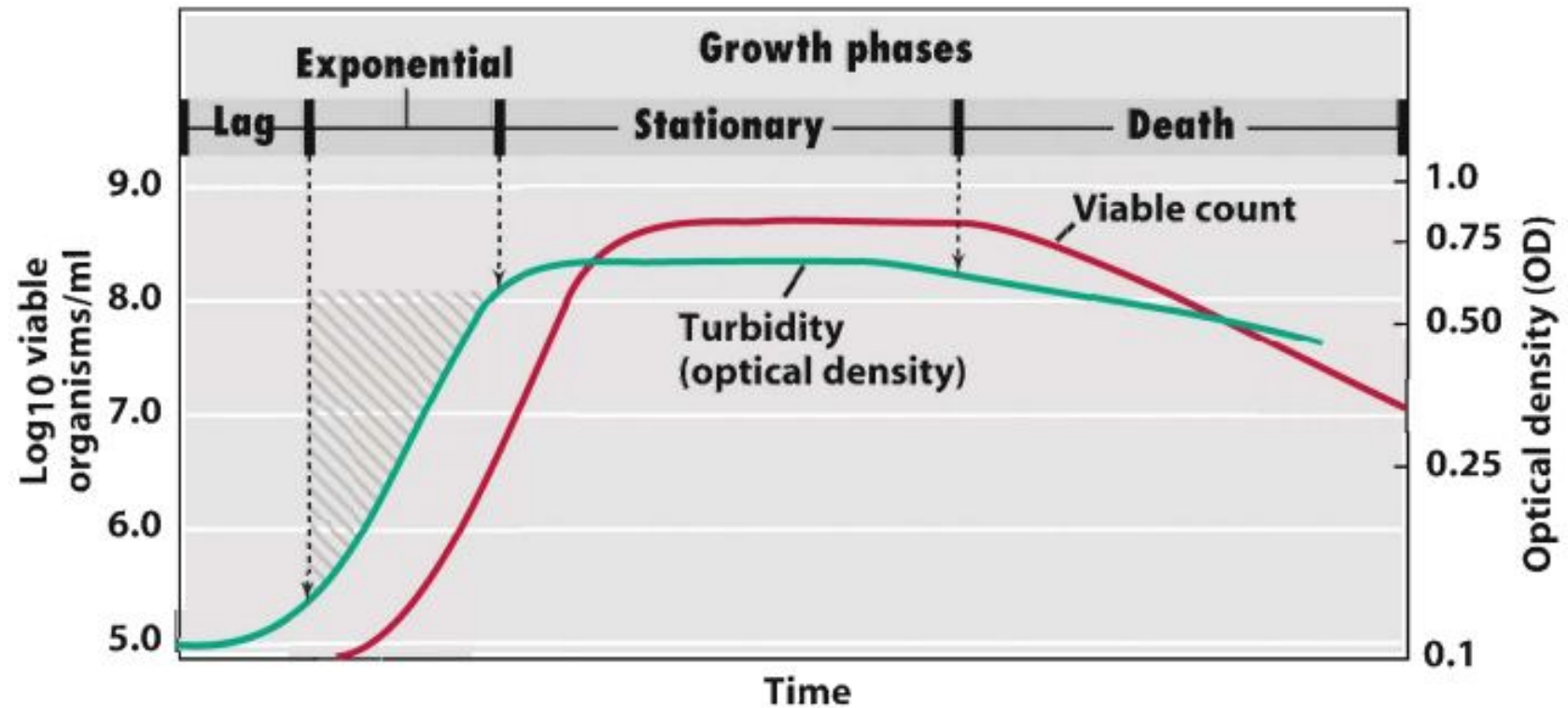


Figure 6-8 Brock Biology of Microorganisms 11/e
© 2006 Pearson Prentice Hall, Inc.

perfecta realidad con Dolby Vision hasta 4K

DESCÚBRELO >



Procesador Intel® Core™ i7



Lápiz digital: un lápiz que puede hacerlo todo.

EL MUNDO Sevilla

Jueves, 15 agosto 2019 - 20:33



Comentar

SANIDAD

40 personas afectadas por un brote de listeriosis relacionado con una marca de carne mechada

Se trata de un producto comercializado con el nombre de 'La Mechá', fabricado por la firma Magrudis



Edificio del Hospital Virgen del Rocío de Sevilla.

La Consejería de Salud y Familias, a través de la Dirección General de Salud Pública y Ordenación Farmacéutica, ha decretado este jueves una **alerta sanitaria** sobre el producto de carne mechada con el nombre comercial 'La Mechá', fabricado por la firma Magrudis, con domicilio en Sevilla capital, tras comprobar que este producto es el agente causante de los brotes de listeriosis registrados en Sevilla en las últimas semanas.

Según ha informado la Consejería en un comunicado, la alerta

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Recibir Newsletter

PUBLICIDAD



2x1 de VIPS

¡Descarga!

VIPS

Muy abierto

- total de afectados: 210
- 3 personas muertas
- 5 abortos



8-01

KRST 5B

8055

Figure 1. VITEK 2 Compact Instrument and Workstation.

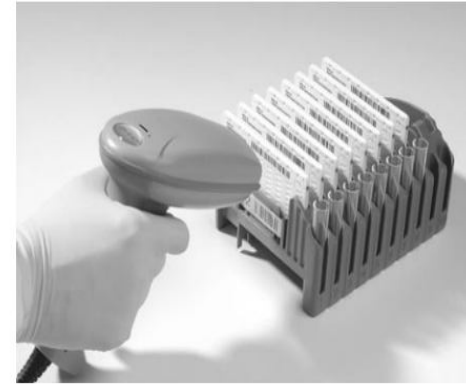


Figure 2. VITEK 2 GN Colorimetric Identification Card.

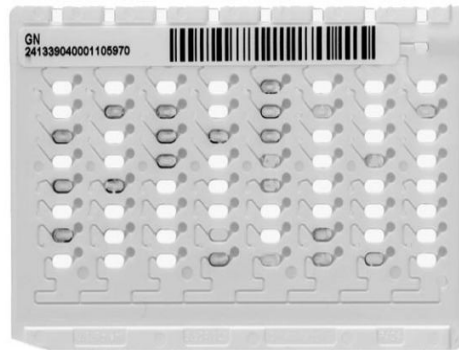


Figure 4. VITEK 2 Cassette Loaded with Cards and Suspension Tubes Being Loaded Into the Automatic Transport System.



There are currently four reagent cards available for the identification of different organism classes as follows:

1. GN - Gram-negative fermenting and non-fermenting bacilli
2. GP - Gram-positive cocci and non-spore-forming bacilli
3. YST - yeasts and yeast-like organisms
4. BCL - Gram-positive spore-forming bacilli

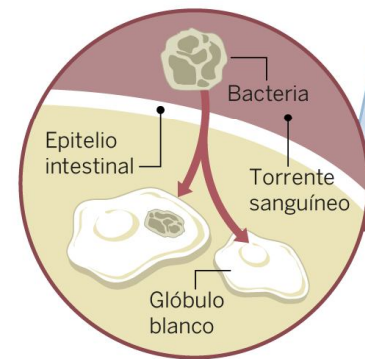
Listeria monocytogenes



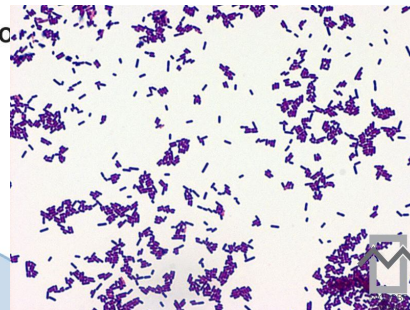
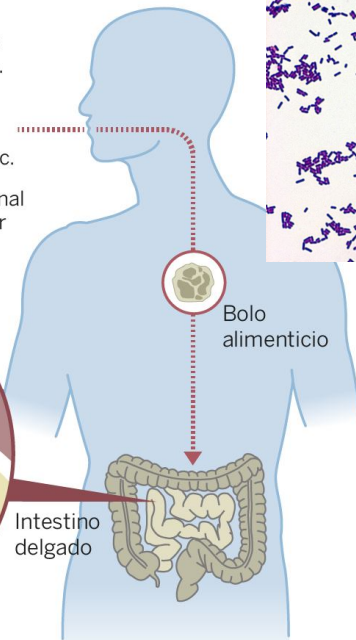
BROTE DE LISTERIOSIS

1 La listeriosis está causada por la bacteria listeria monocytogenes. La vía de contagio habitual es a través de alimentos infectados con la bacteria: carne poco hecha, leche no pasteurizada, etc.

2 La bacteria pasa al tracto intestinal y atraviesa el epitelio hasta llegar al torrente sanguíneo.

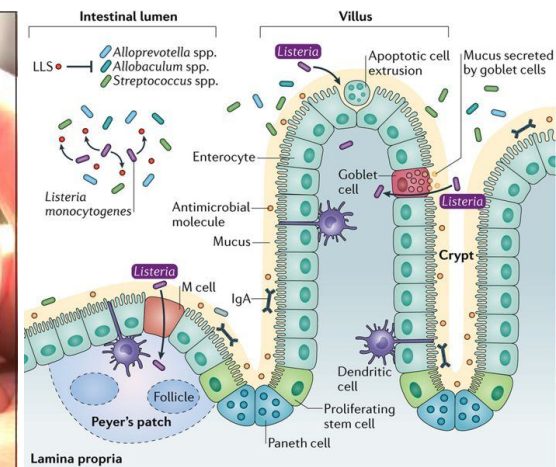
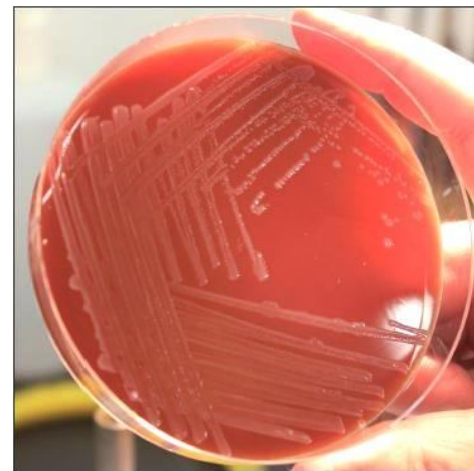


LA VÍA DE CONTAGIO









3 Una vez en la sangre, infecta a los glóbulos blancos y se multiplica. El patógeno resulta casi inocuo para la mayoría de las personas sanas, resultando más peligroso para ancianos, mujeres embarazadas o personas con el sistema inmune debilitado. En los casos más extremos los daños pueden afectar al cerebro, al corazón y a otros órganos.

Fuente: Ministerio de Sanidad y elaboración propia. EL PAÍS



Enfermedades infecciosas

ENFERMEDAD	BACTERIA	SINTOMAS	CONTAGIO
BOTULISMO	 <p><i>Clostridium botulinum</i></p>	Doble visión, visión borrosa, párpados caídos, dificultad para hablar, para tragar, sensación de sequedad en la boca, debilidad muscular que desciende a través del cuerpo: primero los hombros, luego los brazos, los muslos, las pantorrillas, etc. La parálisis de los músculos respiratorios puede causar la muerte. No se transmite de una persona a otra.	Ingestión de alimentos que poseen la toxina producida por la bacteria.
BRUCELOSIS	 <p><i>Brucella</i></p>	Fiebre, escalofríos, dolores de cabeza, dolores corporales, y debilidad. La fiebre puede subir y bajar en un período de 24 horas ("fiebre ondulante").	Inoculación a través de heridas en los ganaderos, y veterinarios. Ingestión de leche o lácteos crudos
CÓLERA	 <p><i>Vibrio cholerae</i></p>	Afecta al tracto intestinal. Diarrea, vómitos y deshidratación leves o graves.	Por consumo de alimentos o agua contaminados por la materia fecal de una persona infectada. Se da con frecuencia en países subdesarrollados carentes de abastecimiento apropiado de agua y eliminación adecuada de aguas residuales.
TETANOS	 <p><i>Clostridium tetani</i></p>	Contracción muscular dolorosa. Parálisis muscular Espasmos de laringe que pueden producir asfixia.	Heridas profundas en contacto con tierra infectada.
TOSFERINA	 <p><i>Bordetella pertussis</i></p>	Accesos de tos seca y con gran esfuerzo. Asfixia. Fatiga.	Directo por gotitas de tos.
TUBERCULOSIS	 <p><i>Mycobacterium tuberculosis</i></p>	Cavernas pulmonares. Espustos sanguíneos. Fiebre. Fatiga. Pérdida de peso. Pueden invadir otros órganos como riñones, huesos o genitales.	Aire. Ropa. Utensilios de comida

Overview of Bacterial infections

Bacterial meningitis

- *Streptococcus pneumoniae*
- *Neisseria meningitidis*
- *Haemophilus influenzae*
- *Streptococcus agalactiae*
- *Listeria monocytogenes*

Otitis media

- *Streptococcus pneumoniae*

Pneumonia

Community-acquired:

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Staphylococcus aureus*

Atypical:

- *Mycoplasma pneumoniae*
- *Chlamydia pneumoniae*
- *Legionella pneumophila*

Tuberculosis

- *Mycobacterium tuberculosis*

Skin infections

- *Staphylococcus aureus*
- *Streptococcus pyogenes*
- *Pseudomonas aeruginosa*

Sexually transmitted diseases

- *Chlamydia trachomatis*
- *Neisseria gonorrhoeae*
- *Treponema pallidum*
- *Ureaplasma urealyticum*
- *Haemophilus ducreyi*

Eye infections

- *Staphylococcus aureus*
- *Neisseria gonorrhoeae*
- *Chlamydia trachomatis*

Sinusitis

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*

Upper respiratory tract infection

- *Streptococcus pyogenes*
- *Haemophilus influenzae*

Gastritis

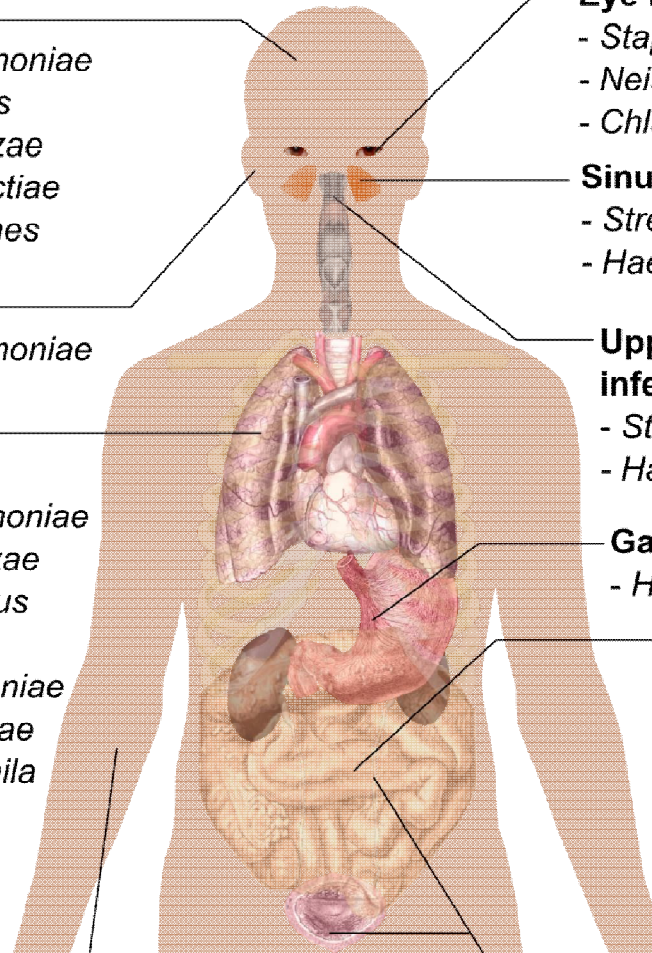
- *Helicobacter pylori*

Food poisoning

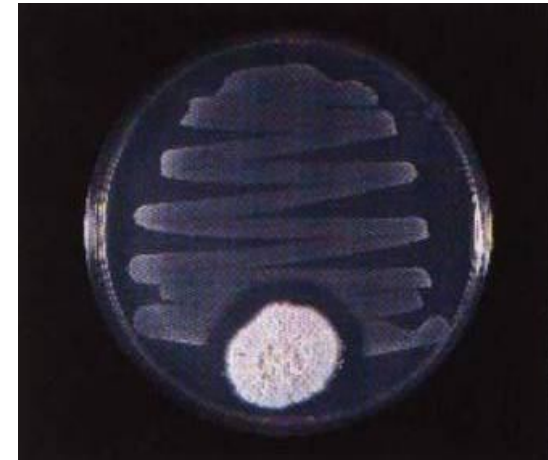
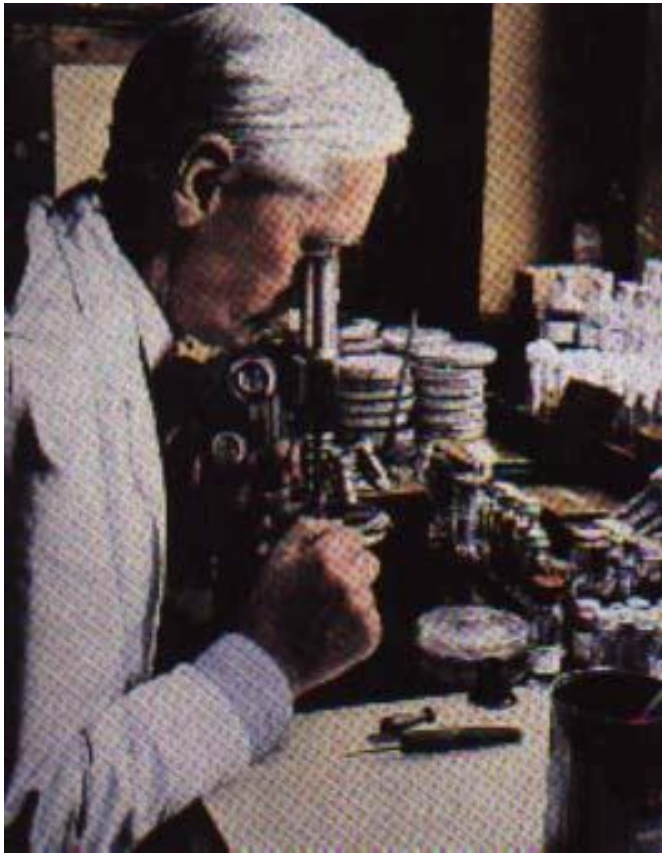
- *Campylobacter jejuni*
- *Salmonella*
- *Shigella*
- *Clostridium*
- *Staphylococcus aureus*
- *Escherichia coli*

Urinary tract infections

- *Escherichia coli*
- Other Enterobacteriaceae
- *Staphylococcus saprophyticus*
- *Pseudomonas aeruginosa*



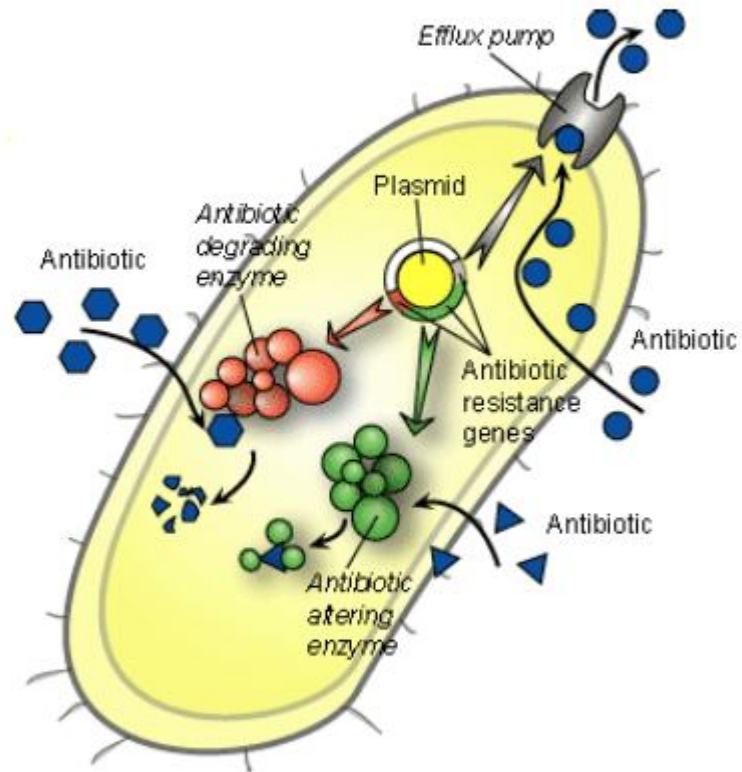
Alexander Fleming (1881-1955)



Sir Alexander Fleming (1929) discovered the antibiotic penicillin. He had the insight to recognize the significance of the inhibition of bacterial growth in the vicinity of a fungal contaminant.



As a result...resistance to antimicrobials



EUROPEAN ANTIBIOTIC AWARENESS DAY



A EUROPEAN HEALTH INITIATIVE

English (en)



- Plan a campaign
- For prescribers
- Get informed
- Get involved
- Campaigns in Europe
- News
- About

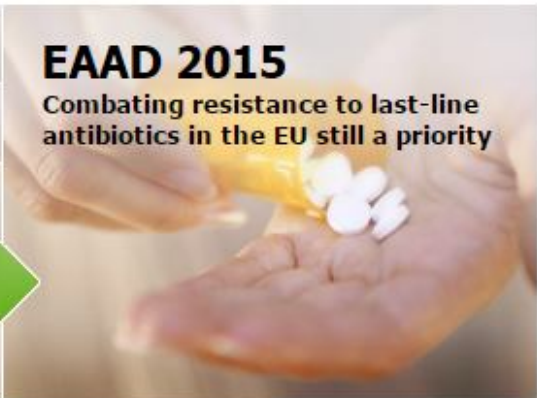
Do not self-medicate with antibiotics

New infographic

Patient stories

EAAD 2015

What is antibiotic resistance?



TWEET #EAAD

#EAAD

 **Julie McIntyre** @artisans_jw
@EAAD_EU What is the date for the #EAAD in 2016, please?
Thanks

18h

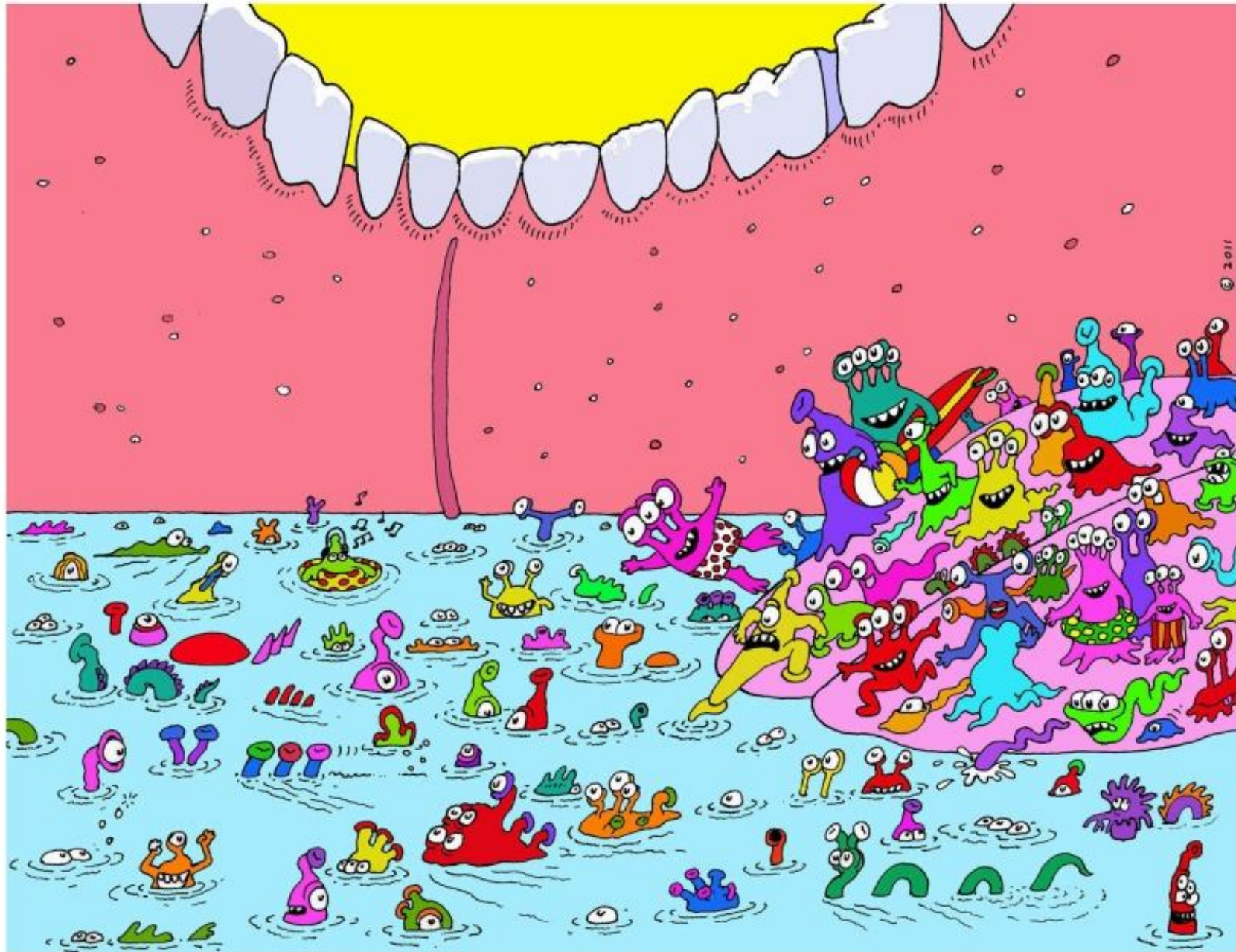
1/6 of Europeans are not aware that the misuse of antibiotics makes them less effective

ANTIBIOTICS

00:32

HD

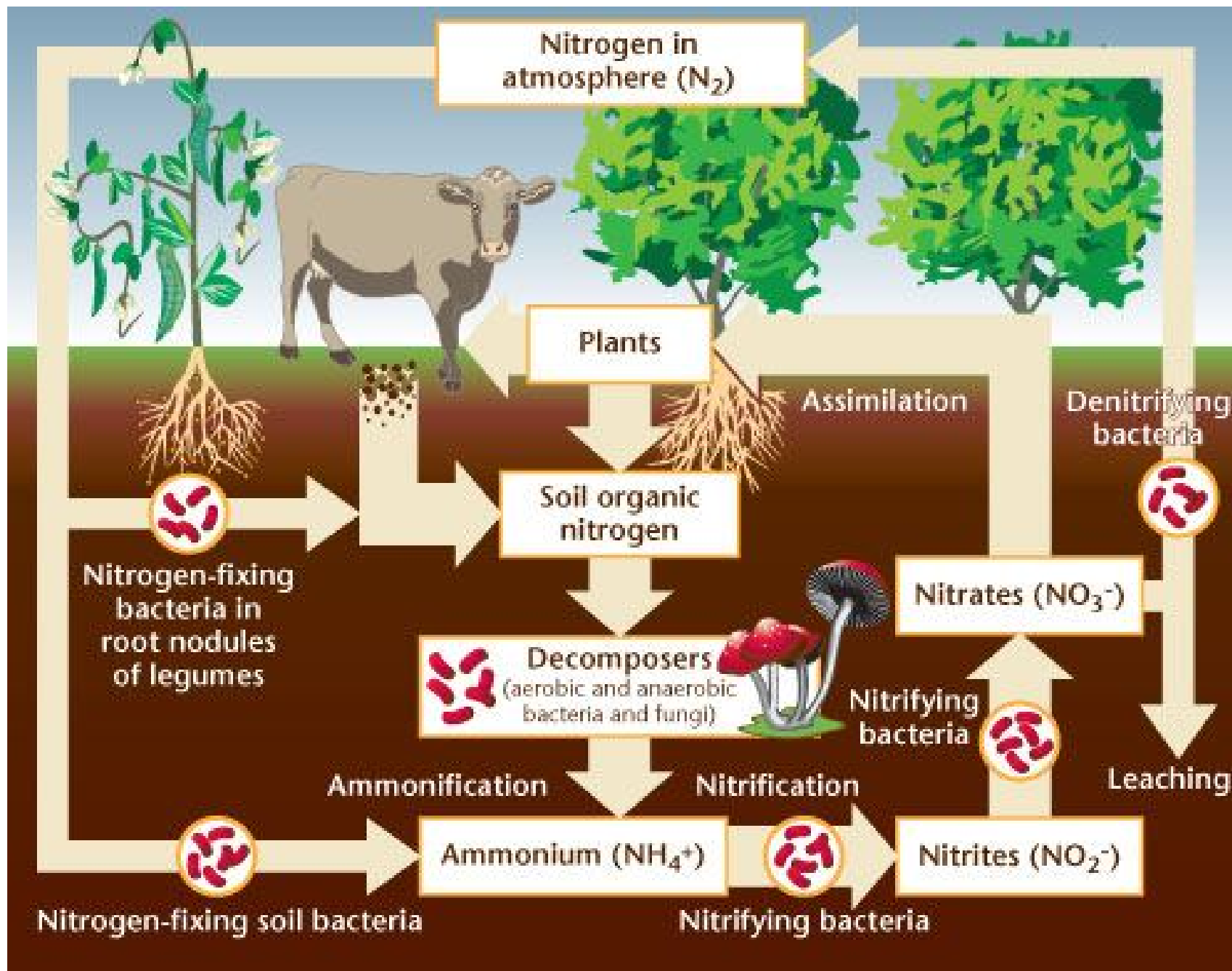
What is antibiotic resistance and prudent antibiotic use? How to use antibiotics responsibly?
See patient stories, infographics, videos



Ubiquity

- They live everywhere....
- Even in extreme environments
 - Black smokers
 - Hot springs
 - Acidic environments
 - Ice surface
 - Dry desert
 - "Where else?...."







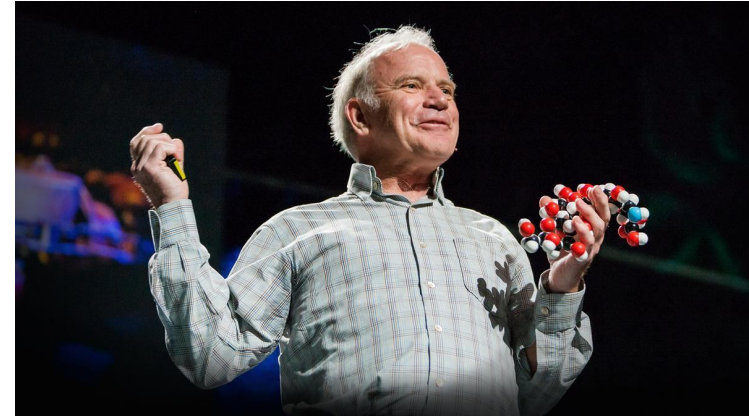
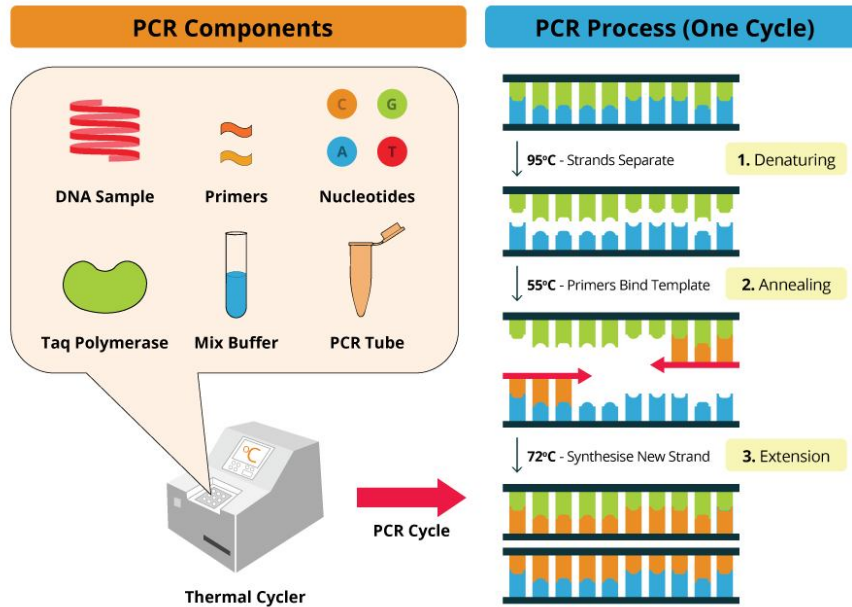
DECOMPOSERS

They consume (eat) dead plants & animals and decomposes them - reduces them to simpler forms of matter.

PRIMARY DECOMPOSERS
Fungi & Bacteria



PCR: Kary Mullis



Kary B. Mullis, 74, Dies; Found a Way to Analyze DNA and Won Nobel

His discovery created a new world of possibilities in diagnosing disease, unearthing the past and assisting in criminal cases, including O.J. Simpson's murder trial.

Kary Mullis: Unconventional Nobel laureate who unlocked DNA research

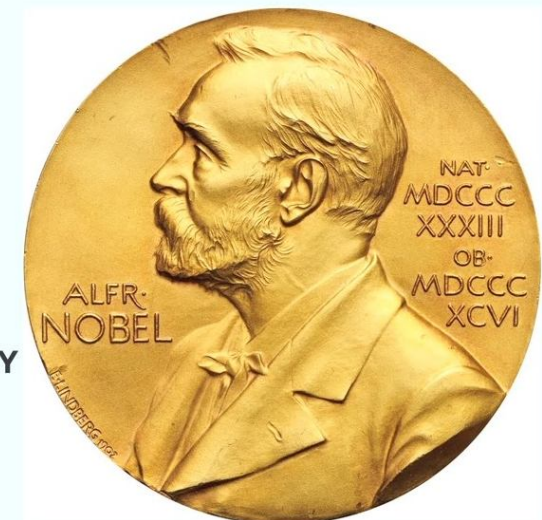
His work proved to be a milestone in biochemistry, but his views on climate change and Aids made him an outlier in the scientific establishment

Martin Weil | Wednesday 21 August 2019 23:00 |

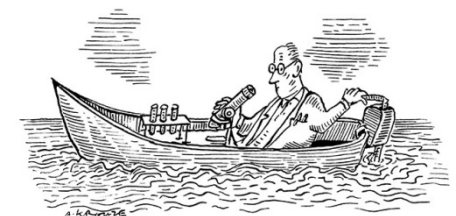
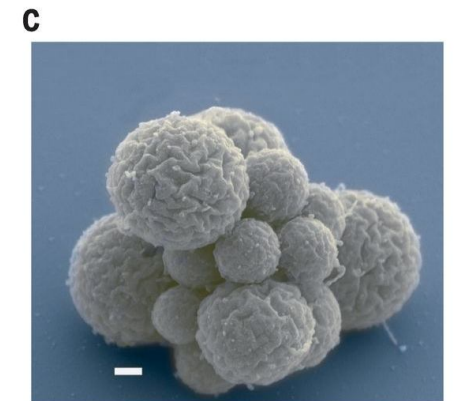
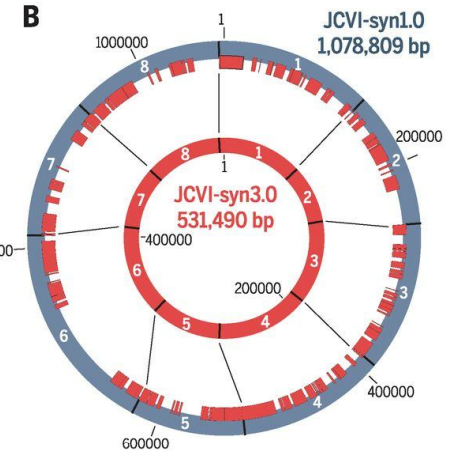
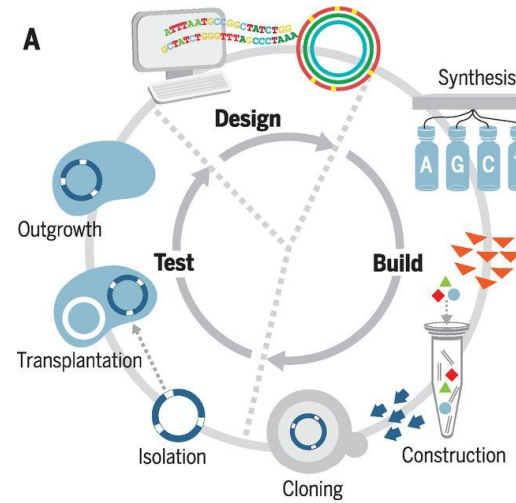
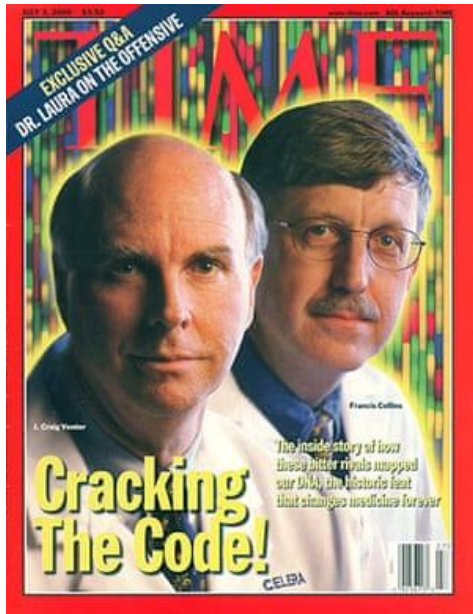


1993 NOBEL PRIZE IN CHEMISTRY
AWARDED TO
KARY MULLIS

\$450,000 - 550,000

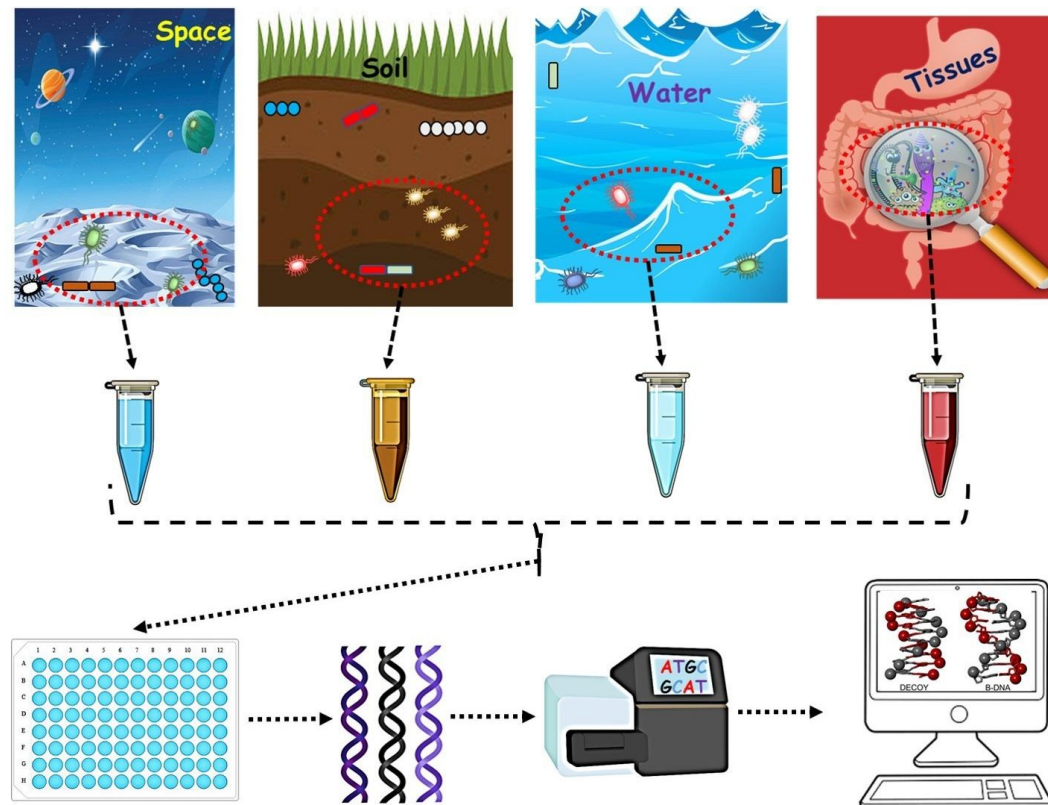


Synthetic bacteria: Craig Venter

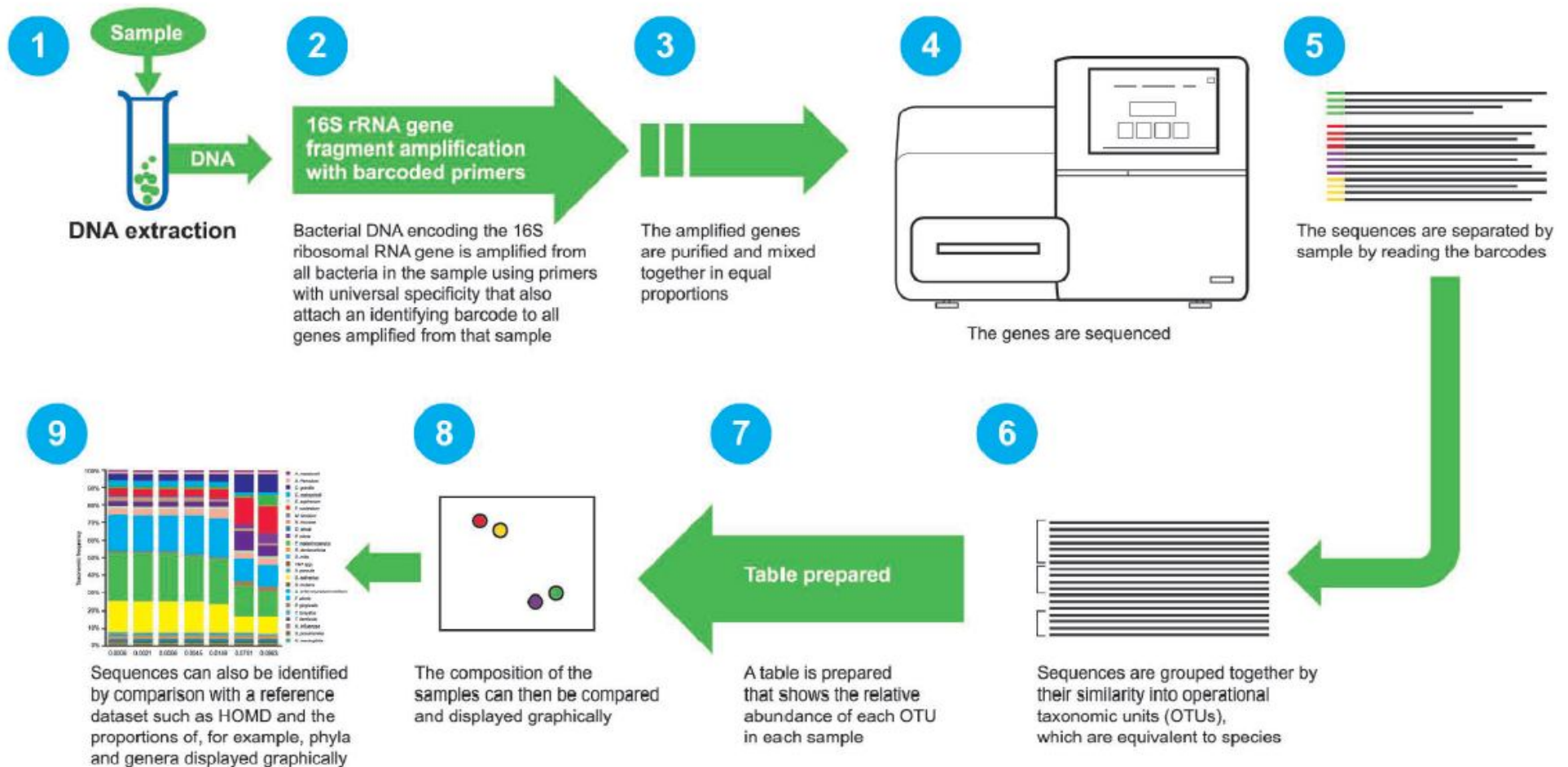


Metagenomics

- *The application of modern genomics techniques to the study of communities of microbial organisms directly in their natural environments, bypassing the need for isolation and lab cultivation of individual species.*

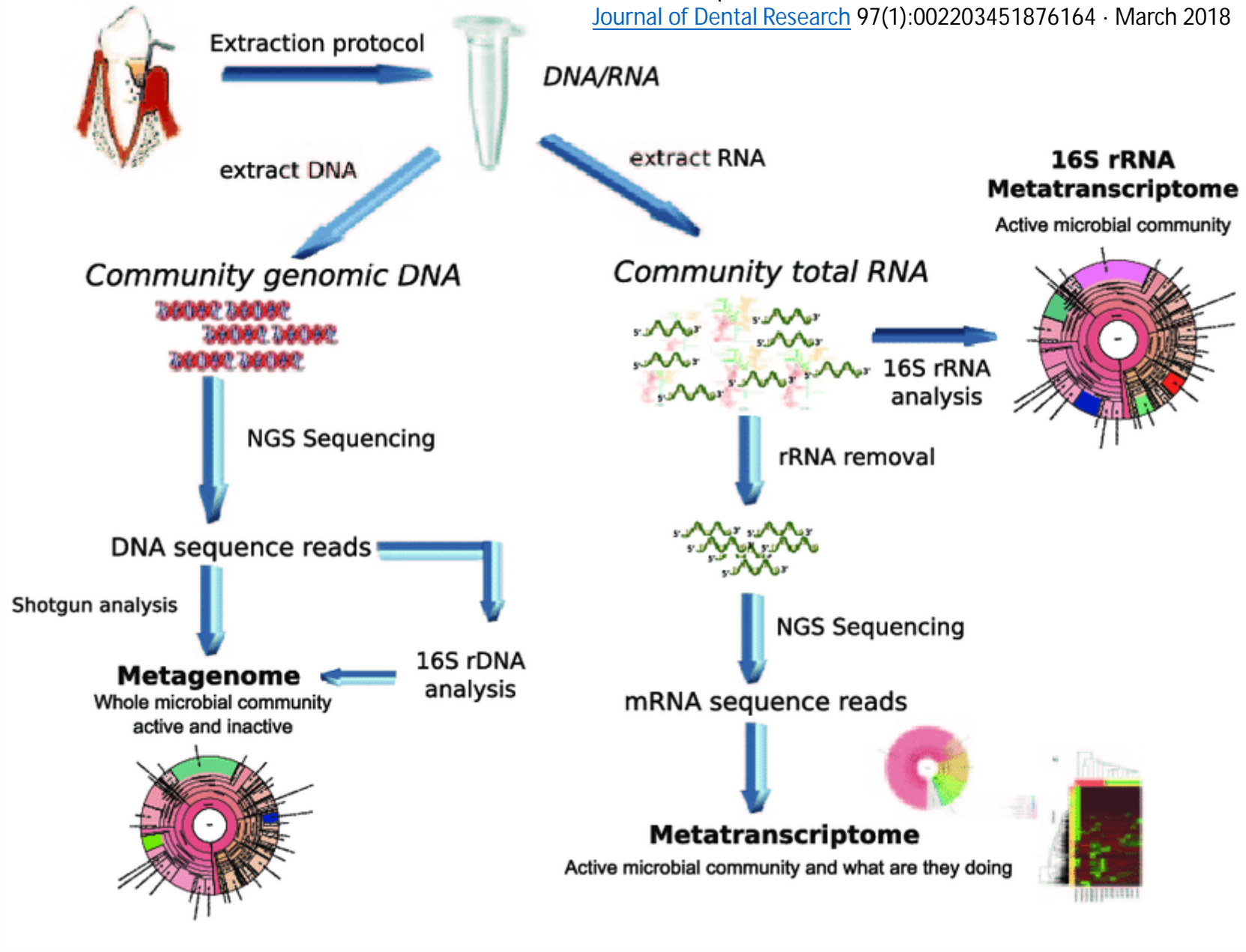


Community analysis



Sample collection

Metatranscriptome of the Oral Microbiome in Health and Disease
[Journal of Dental Research](#) 97(1):002203451876164 · March 2018



RECERCA

Al metro de Barcelona hi ha menys bacteris que als ambulatoris i als aeroports

Un estudi del CSIC ha constatat que la majoria de microorganismes que habiten al metro de Barcelona són innocus per a les persones

EFE Barcelona 19/01/2017 13:20

Twitter
Facebook
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1
Enviar
Imprimir



TEMPS D'ESPERA DIFERENTS A Madrid (esquerra) el temps d'espera d'un tren a l'andana és molt més llarg que a Barcelona (dreta). / OLMO CALVO / FRANCESC MELCIÓN

Al metro de Barcelona hi viuen **10.000 bacteris** per metre cúbic d'aire, la majoria **innocus** per a les persones i molts **menys que a qualsevol ambulatori o aeroport espanyol**, segons un estudi del **CSIC**.

El Centre d'Estudis Avançats de Blanes (CEAB-CSIC), a la Selva, i l'Institut de Diagnòstic Ambiental i Estudis de l'Aigua (IDAEA-CSIC), els dos del CSIC, han elaborat el **primer catàleg genètic** de la **comunitat microbiana del metro**, que serà útil per saber i controlar la **qualitat de l'aire** que respiren els usuaris del transport suburbà.

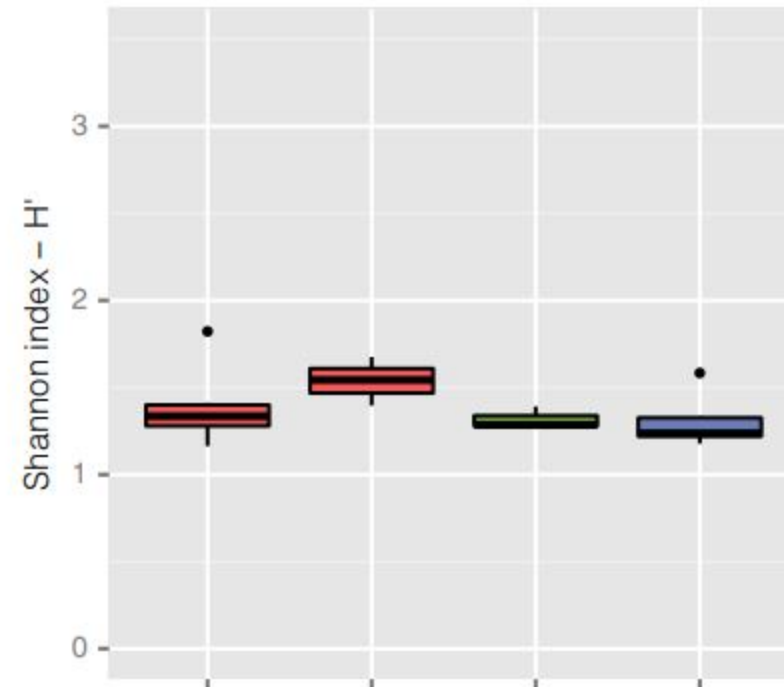


FIGURE 4 Boxplots of bacterial diversity (Shannon index, upper panel) and bacterial richness (as number of OTUs at 0.03 cutoff, lower panel) for different analyzed compartments in the Barcelona's subway system

ORIGINAL ARTICLE

Bioaerosols in the Barcelona subway system

X. Triadó-Margarit¹ | M. Veillette² | C. Duchaine² | M. Talbot² | F. Amato³ |
M. C. Minguillón³ | V. Martins³ | E. de Miguel⁴ | E. O. Casamayor¹ | T. Moreno³

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Indoor Air. 2017;27:564–575.

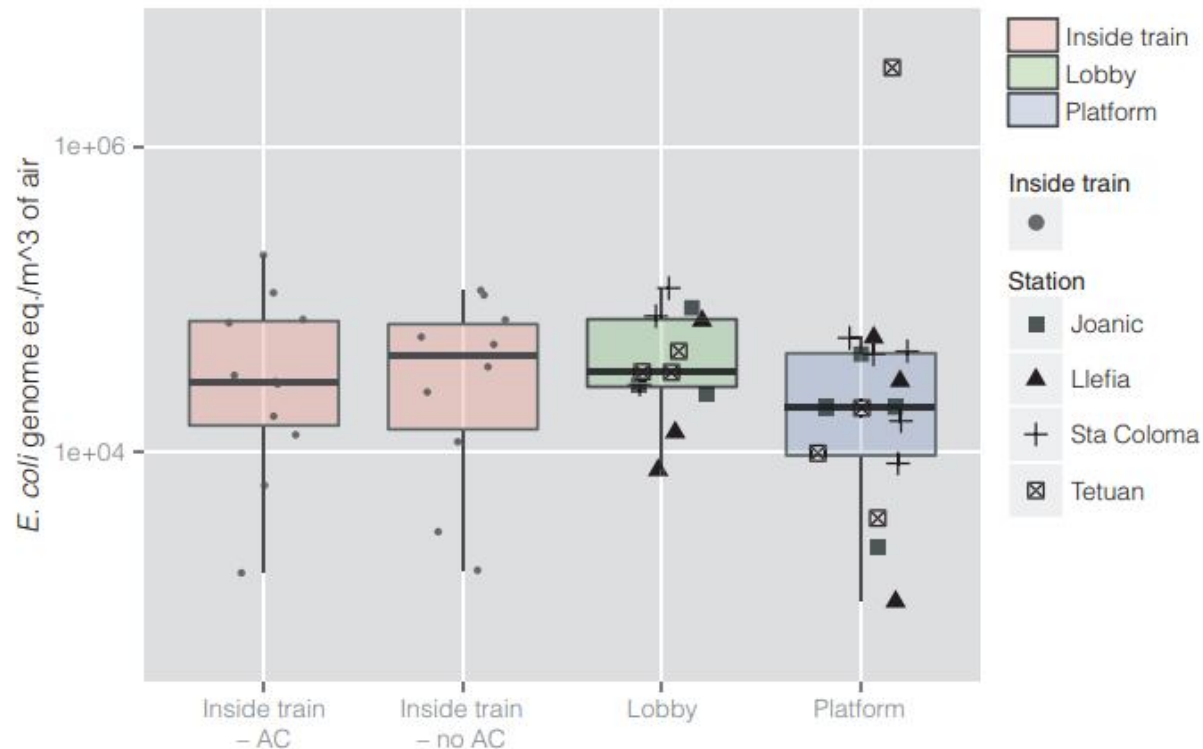


FIGURE 2 Concentrations of airborne Bacterial 16S rRNA gene copies determined by qPCR analyses for different compartments of the Barcelona subway system (n = 54)

Human Microbiome

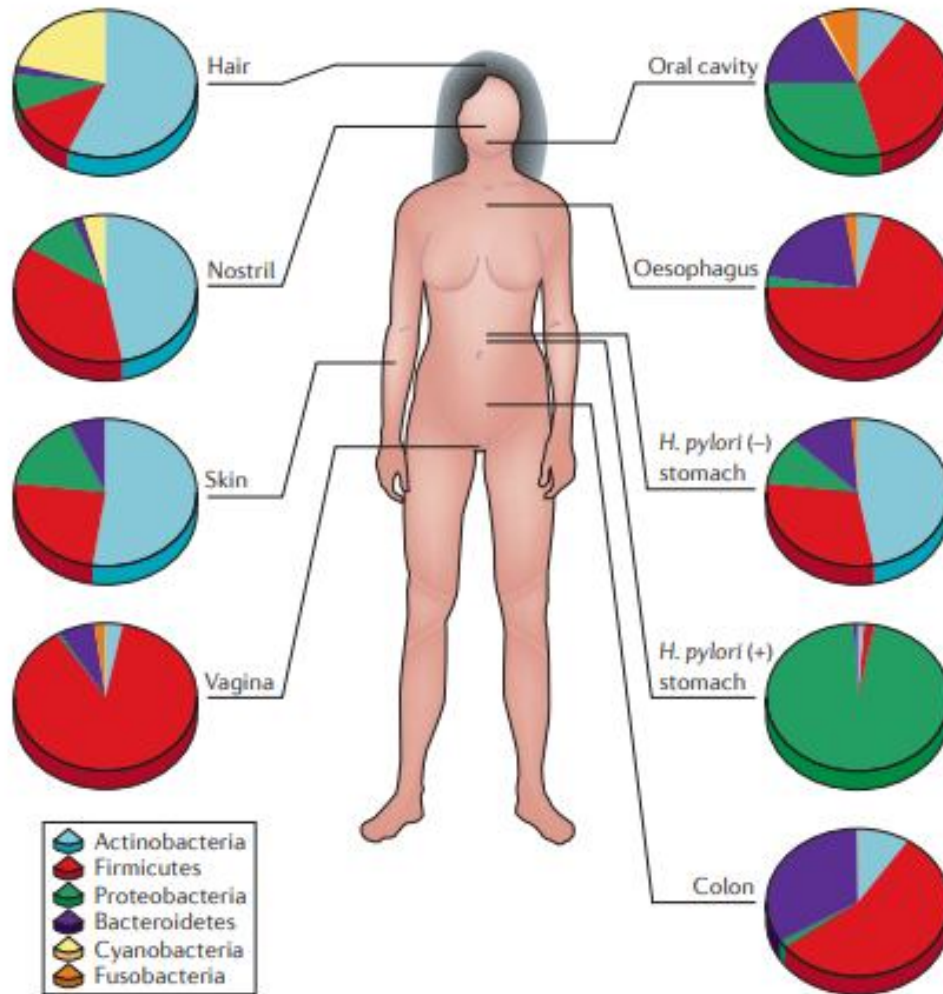


Table 1 | Examples of associations of human conditions with particular microbiota characteristics

Disease	Relevant finding	Refs
Psoriasis	Increased ratio of Firmicutes to Actinobacteria	88
Reflux oesophagitis	Oesophageal microbiota dominated by gram-negative anaerobes; gastric microbiota with low or absent <i>Helicobacter pylori</i>	75,133
Obesity	Reduced ratio of Bacteroidetes to Firmicutes	17,31
Childhood-onset asthma	Absent gastric <i>H. pylori</i> (especially the cytotoxin-associated gene A (<i>cagA</i>) genotype)	96,134
Inflammatory bowel disease (colitis)	Larger populations of Enterobacteriaceae	113
Functional bowel diseases	Larger populations of <i>Veillonella</i> and <i>Lactobacillus</i>	135
Colorectal carcinoma	Larger populations of <i>Fusobacterium</i> spp.	101,102
Cardiovascular disease	Gut-microbiota-dependent metabolism of phosphatidylcholine	136

Microbiome

IN NUMBERS



Interfacing Food & Medicine

The microbiome is more medically accessible and manipulable than the human genome

100 Trillion

symbiotic microbes live in and on every person and make up the human microbiota

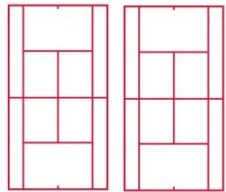
The human body has more microbes than there are stars in the milky way

95%

of our microbiota is located in the GI tract

150:1

The genes in your microbiome outnumber the genes in our genome by about 150 to one



The surface area of the **GI tract** is the same size as 2 tennis courts

You have

1.3X

more microbes than human cells

>10,000

Number of different microbial species that researchers have identified living in and on the human body

2kg

The gut microbiota can weigh up to 2Kg

90%

It is thought that

of disease can be linked in some way back to the gut and health of the microbiome

5:1

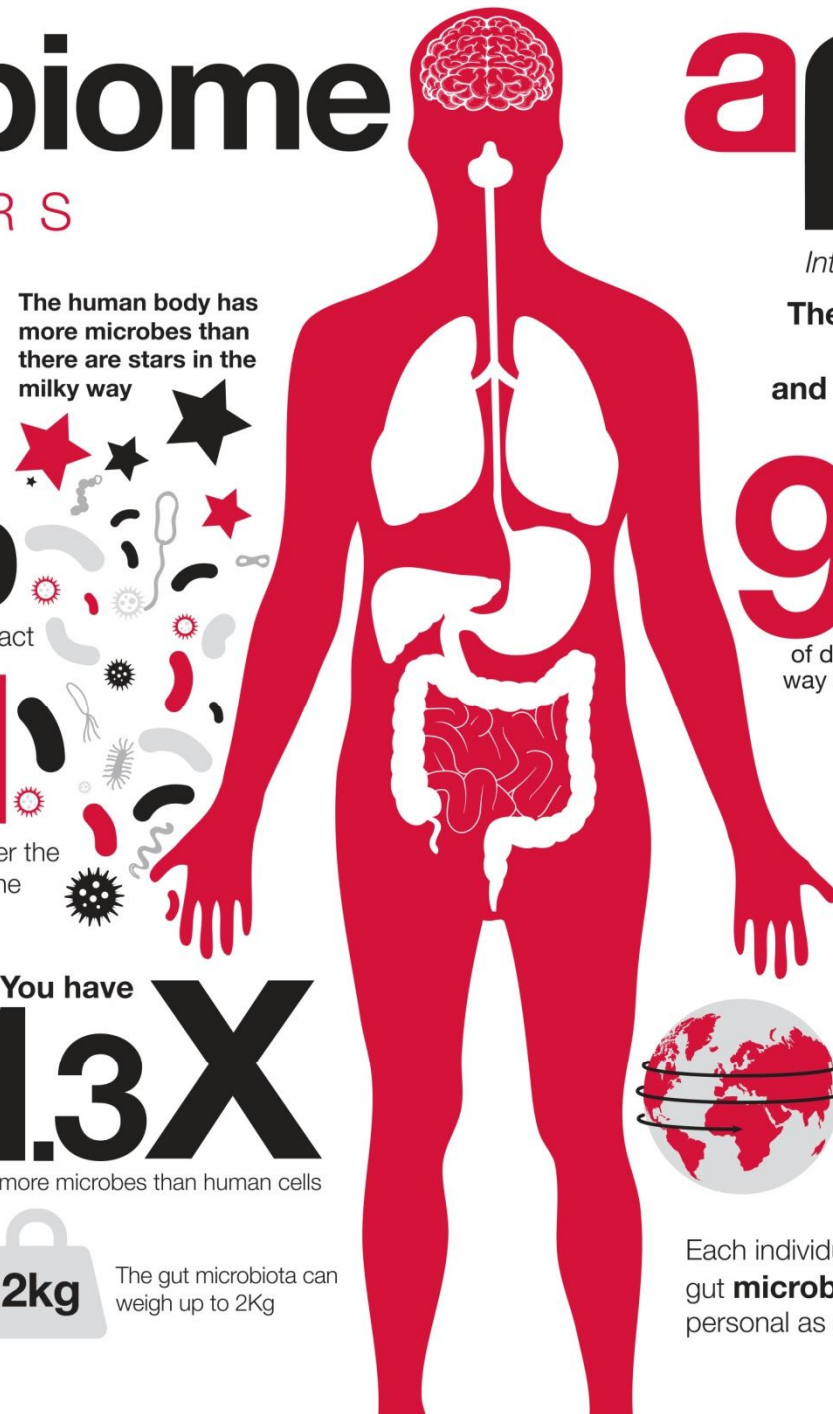
Viruses:Bacteria in the gut microbiota

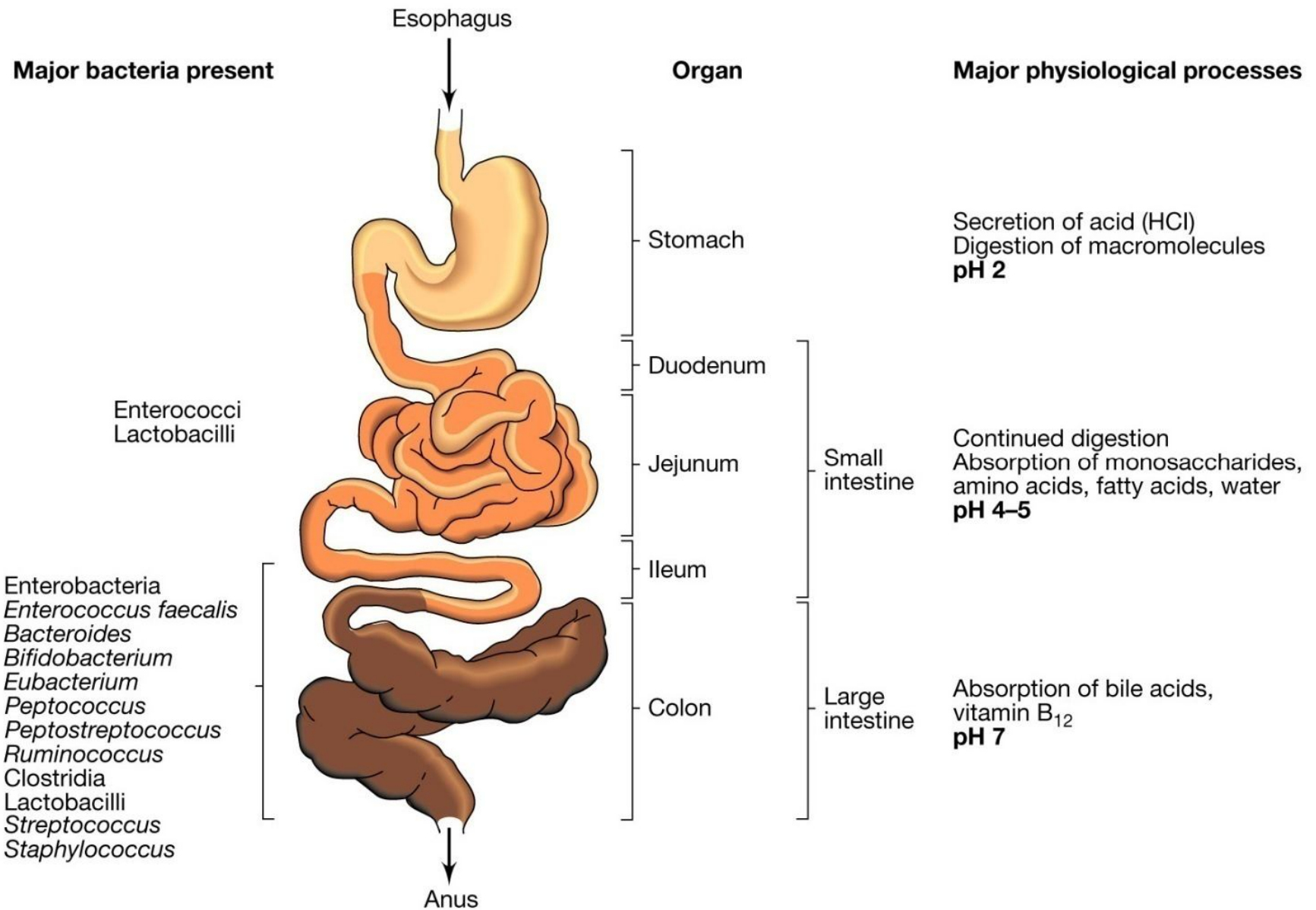


2.5

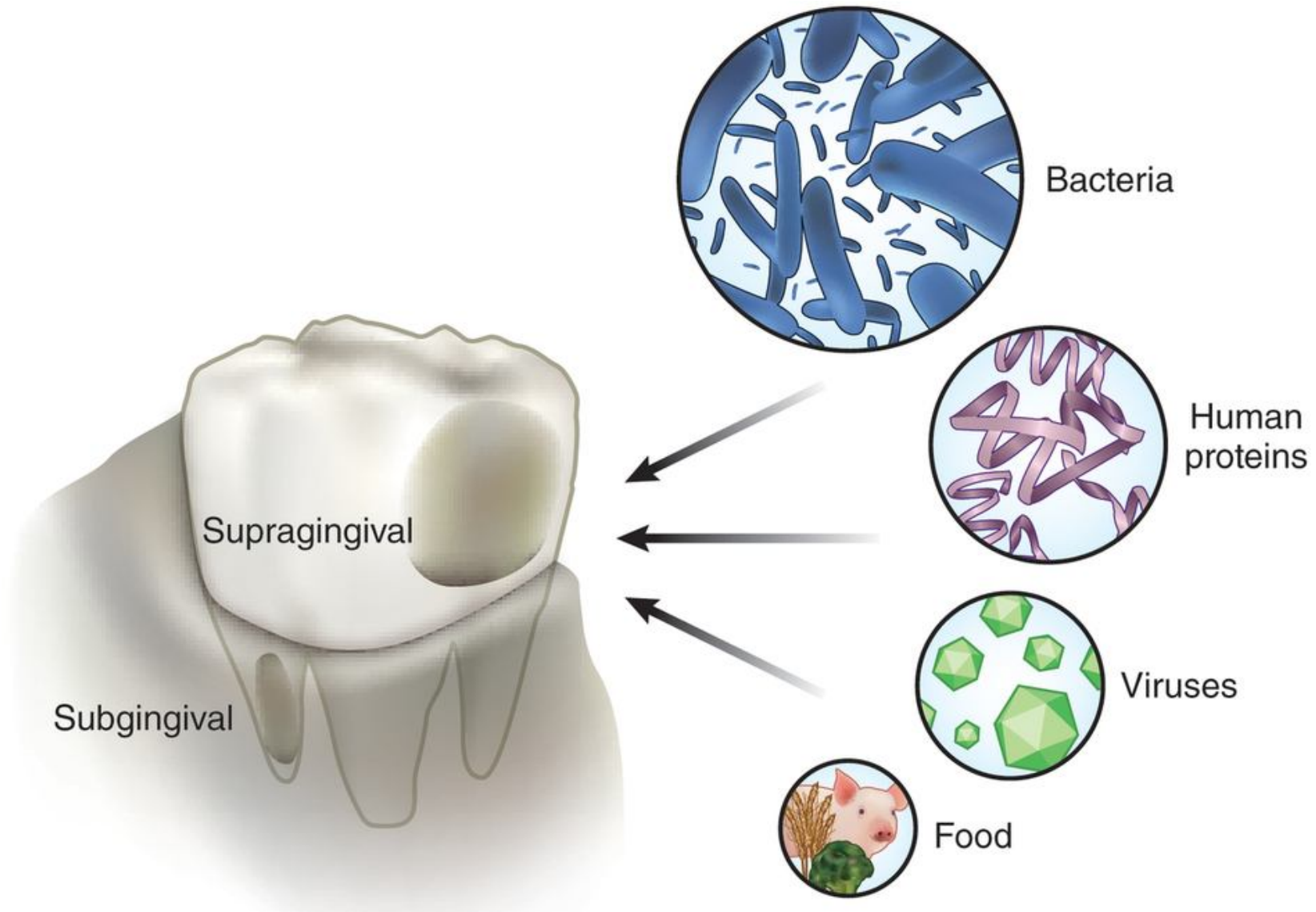
The number of times your body's microbes would circle the earth if positioned end to end

Each individual has a unique gut **microbiota**, as personal as a fingerprint





Diverse metabolisms in the mouth



Mouth sampling



Defining the Normal Bacterial Flora of the Oral Cavity

Jørn A. Aas,^{1,2*} Bruce J. Paster,^{1,3} Lauren N. Stokes,¹ Ingar Olsen,²
and Floyd E. Dewhirst^{1,3}

*Department of Molecular Genetics, The Forsyth Institute,¹ and Faculty of Dentistry,² University of Oslo, Oslo, Norway,
and Department of Oral and Developmental Biology, Harvard School of Dental Medicine, Boston, Massachusetts³*

RESEARCH ARTICLE

Open Access

Pyrosequencing analysis of the human microbiota of healthy Chinese undergraduates

Zongxin Ling^{1†}, Xia Liu^{2†}, Yueqiu Luo¹, Li Yuan¹, Karen E Nelson³, Yuezhu Wang⁴, Charlie Xiang^{1,3*} and Lanjuan Li^{1*}

RESEARCH ARTICLE

Open Access

Comparative analysis of the human saliva microbiome from different climate zones: Alaska, Germany, and Africa

Jing Li^{1,2*}, Dominique Quinque^{1,7}, Hans-Peter Horz³, Mingkun Li¹, Margarita Rzhetskaya⁴, Jennifer A Raff^{4,8}, M Geoffrey Hayes^{4,5,6} and Mark Stoneking¹

ORIGINAL ARTICLE

Species-level core oral bacteriome identified by 16S rRNA pyrosequencing in a healthy young Arab population

Nezar Noor Al-hebshi^{1*}, Ahmed Abdulhaq², Ahmed Albarrag³, Vinod Kumar Basode² and Tsute Chen⁴

¹Department of Preventive Dentistry, College of Dentistry, Jazan University, Jazan, Saudi Arabia; ²Unit of Medical Microbiology, Department Medical Laboratory Technology, College of Applied Medical Sciences, Jazan University, Jazan, Saudi Arabia; ³Department of Pathology, College of Medicine, King Saud University, Riyadh, Saudi Arabia; ⁴Department of Microbiology, Forsyth Institute, Cambridge, MA, USA

RESEARCH ARTICLE

Open Access

Preliminary characterization of the oral microbiota of Chinese adults with and without gingivitis

Shi Huang^{1†}, Fang Yang^{4,5†}, Xiaowei Zeng¹, Jie Chen¹, Rui Li^{2*}, Ting Wen², Chun Li², Wei Wei², Jiquan Liu², Lan Chen², Catherine Davis³ and Jian Xu^{1*}

RESEARCH ARTICLE

Open Access

Use of 16S ribosomal RNA gene analyses to characterize the bacterial signature associated with poor oral health in West Virginia

Joan C Olson^{1*}, Christopher F Cuff¹, Slawomir Lukomski¹, Ewa Lukomska^{1,2}, Yeremi Canizales³, Bei Wu⁴, Richard J Crout⁵, John G Thomas⁶, Daniel W McNeil⁷, Robert J Weyant⁸, Mary L Marazita^{9,10}, Bruce J Paster^{1,11,12}, Thomas Elliott¹

Diversity of Bacterial Populations on the Tongue Dorsa of Patients with Halitosis and Healthy Patients

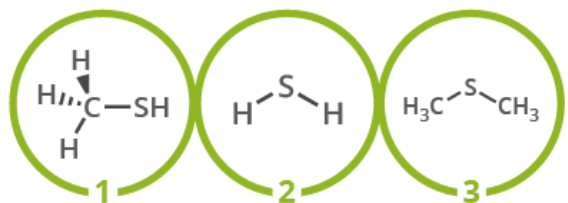
C. E. Kazor,¹ P. M. Mitchell,² A. M. Lee,² L. N. Stokes,² W. J. Loesche,¹ F. E. Dewhirst,^{2,3} and B. J. Paster^{2,3*}

Department of Microbiology and Immunology, School of Medicine, University of Michigan, Ann Arbor, Michigan,¹ and Department of Molecular Genetics, The Forsyth Institute,² and Department of Oral and Developmental Biology, Harvard School of Dental Medicine,³ Boston, Massachusetts

THE CHEMISTRY OF BODY ODOURS

Body odour is the result of bacterial activity producing odorous compounds. Here, we look at some of the main compounds in particular odours.

HALITOSIS



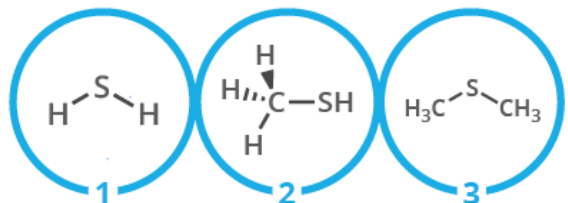
NAME

1. METHANETHIOL
2. HYDROGEN SULFIDE
3. DIMETHYL SULFIDE

SMELLS LIKE

sulfur, garlic
sulfur, rotting eggs
cabbage, sulfur, sweet

FLATULENCE



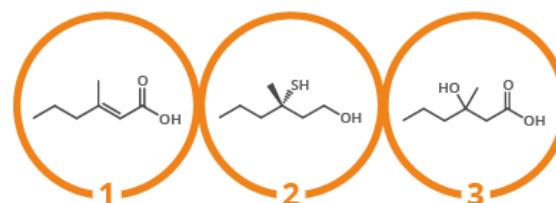
NAME

1. HYDROGEN SULFIDE
2. METHANETHIOL
3. DIMETHYL SULFIDE

SMELLS LIKE

sulfur, rotting eggs
sulfur, garlic
cabbage, sulfur, sweet

UNDERARM ODOUR



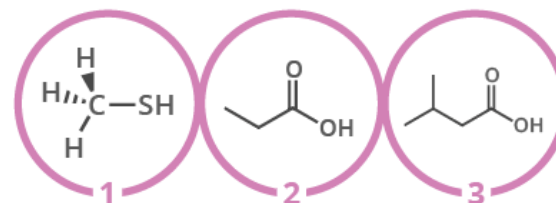
NAME

1. (E)-3-METHYL-2-HEXENOIC ACID
2. (S)-3-METHYL-3-SULFANYLHEXAN-1-OL
3. 3-HYDROXY-3-METHYLHEXANOIC ACID

SMELLS LIKE

goat
onion
cumin

FOOT ODOUR



NAME

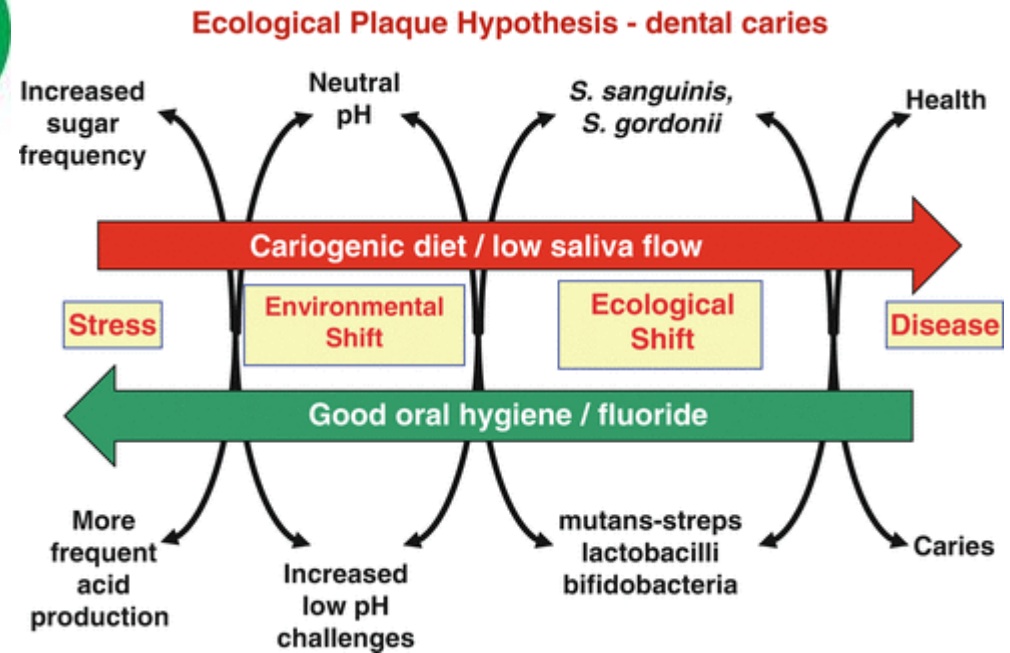
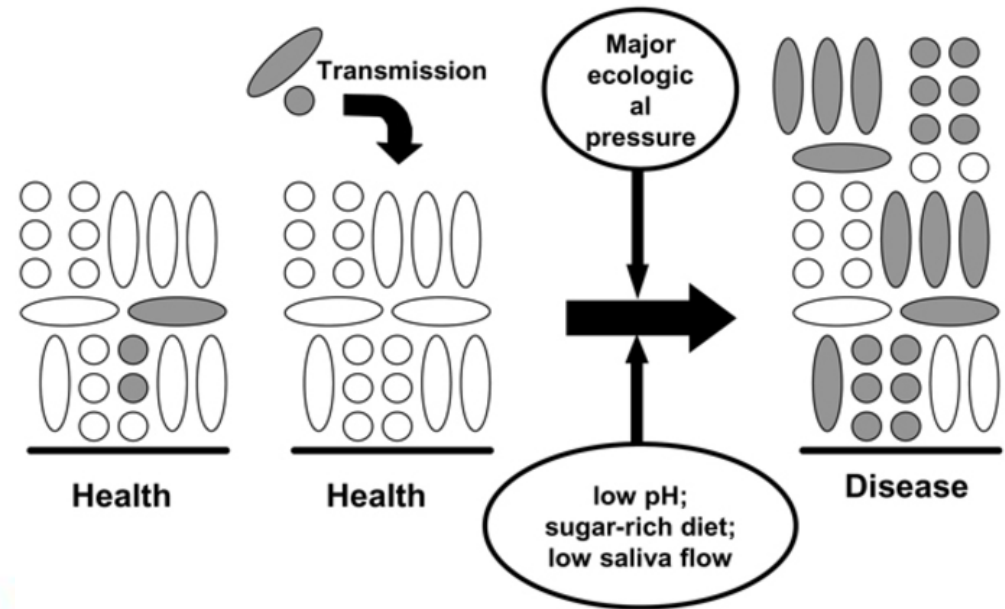
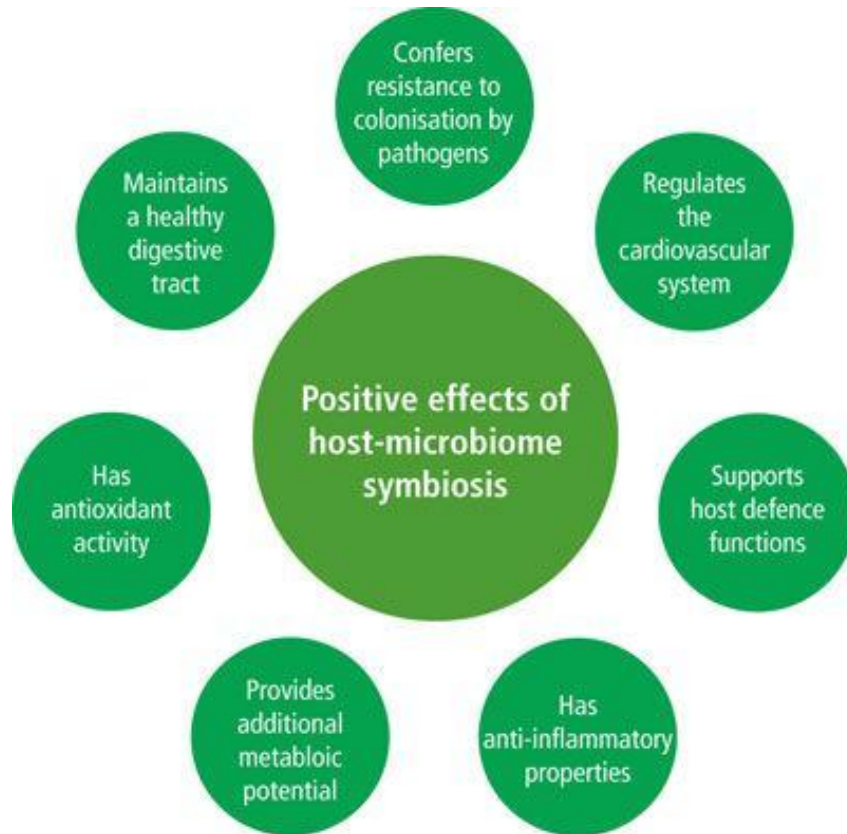
1. METHANETHIOL
2. PROPANOIC ACID
3. ISOVALERIC ACID

SMELLS LIKE

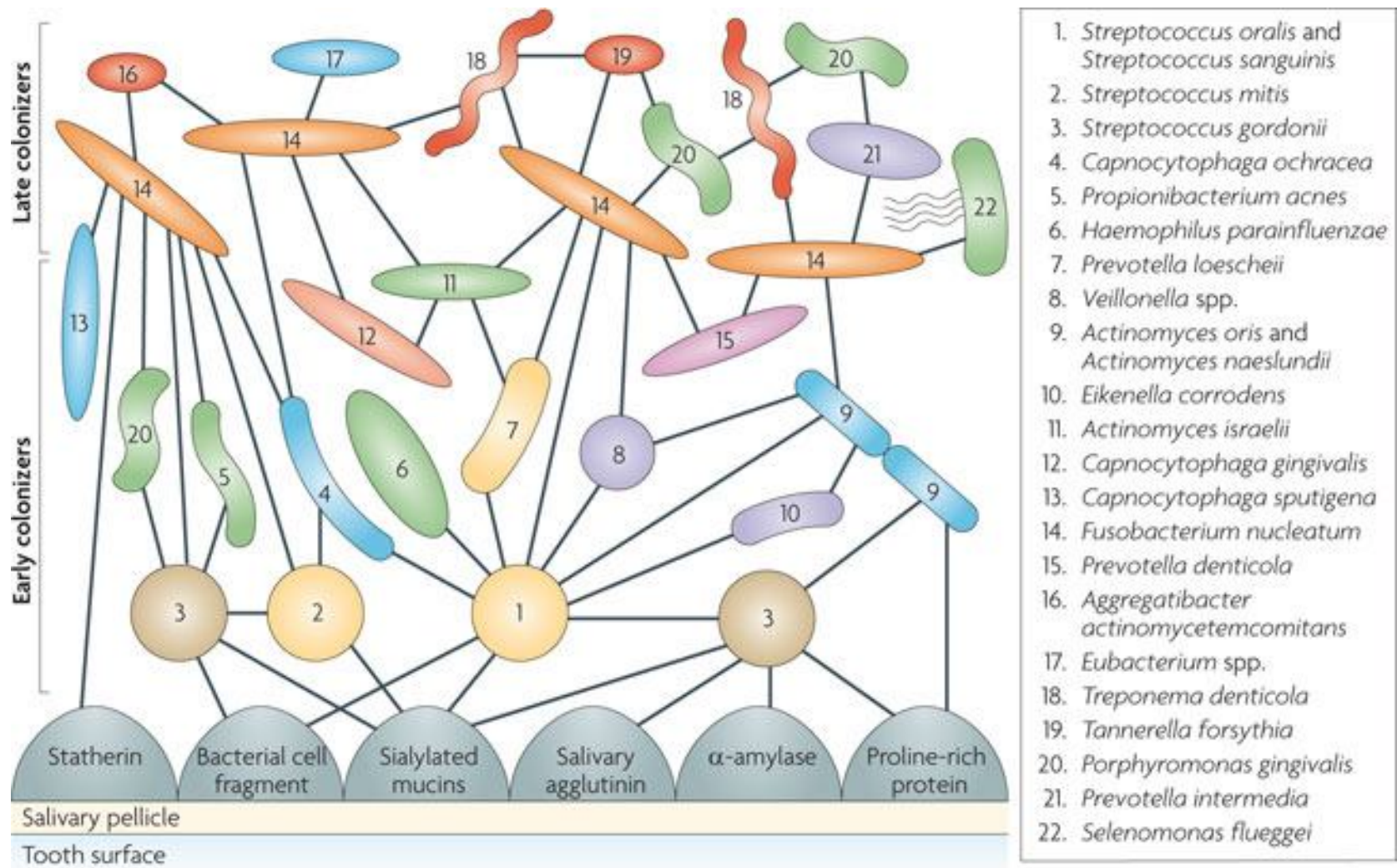
sulfur, garlic
pungent, rancid, sour
cheesy, fermented, rancid



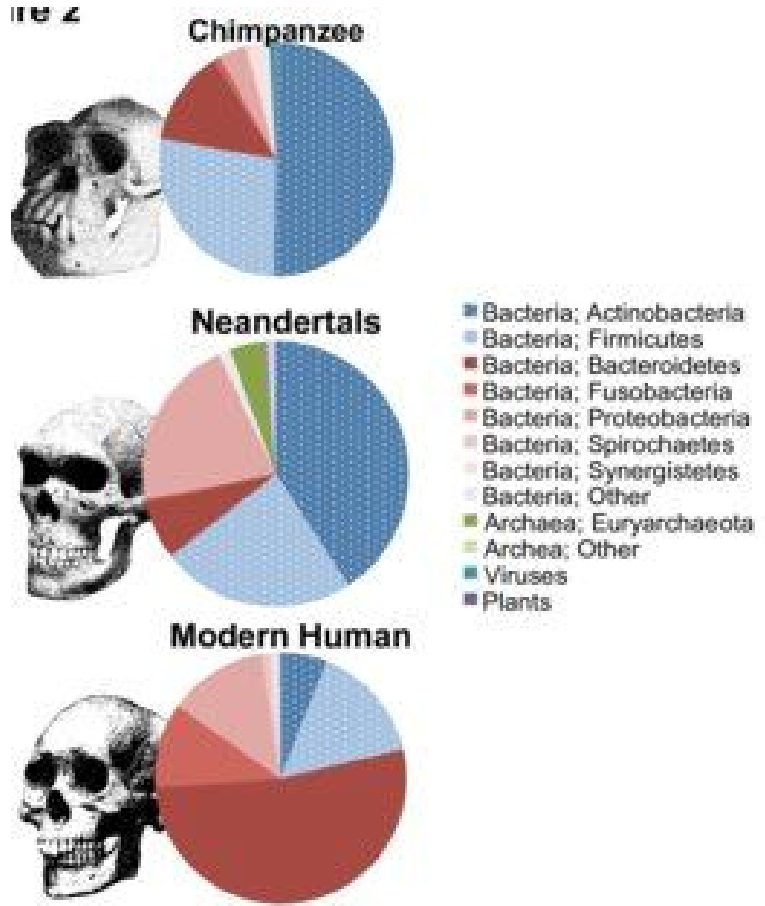
P.D. Marsh

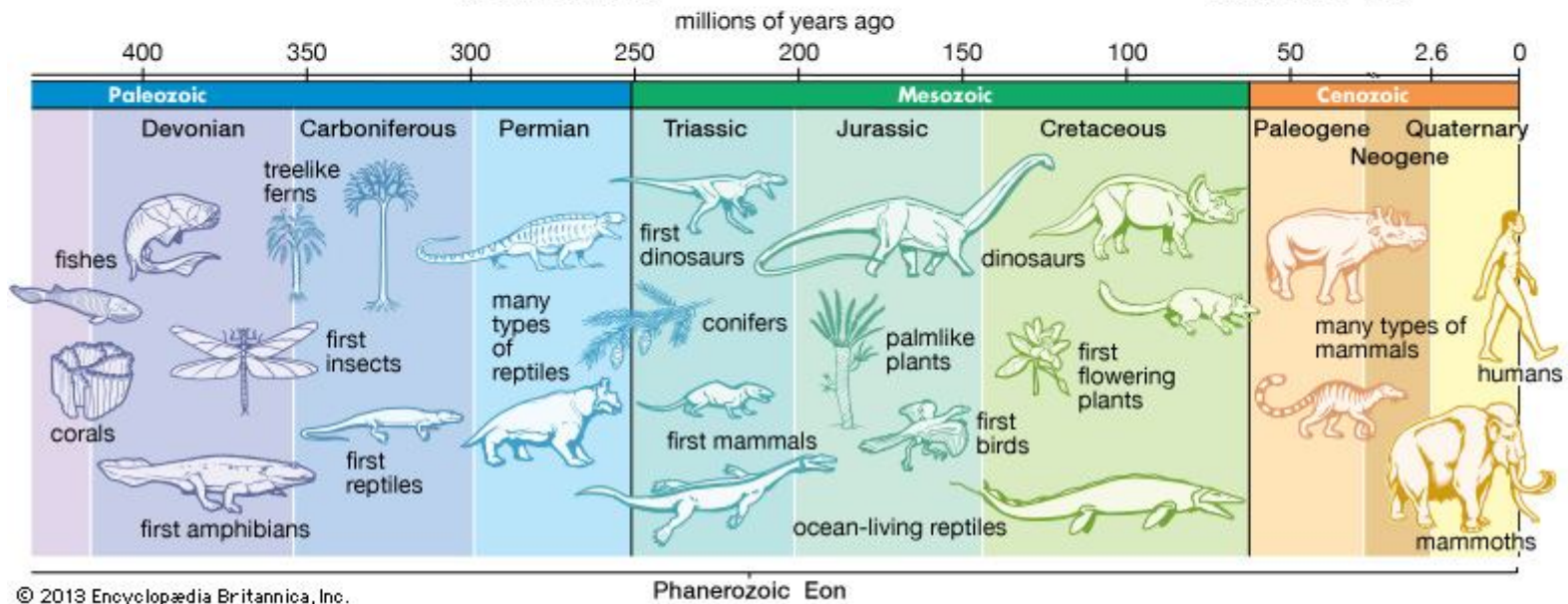
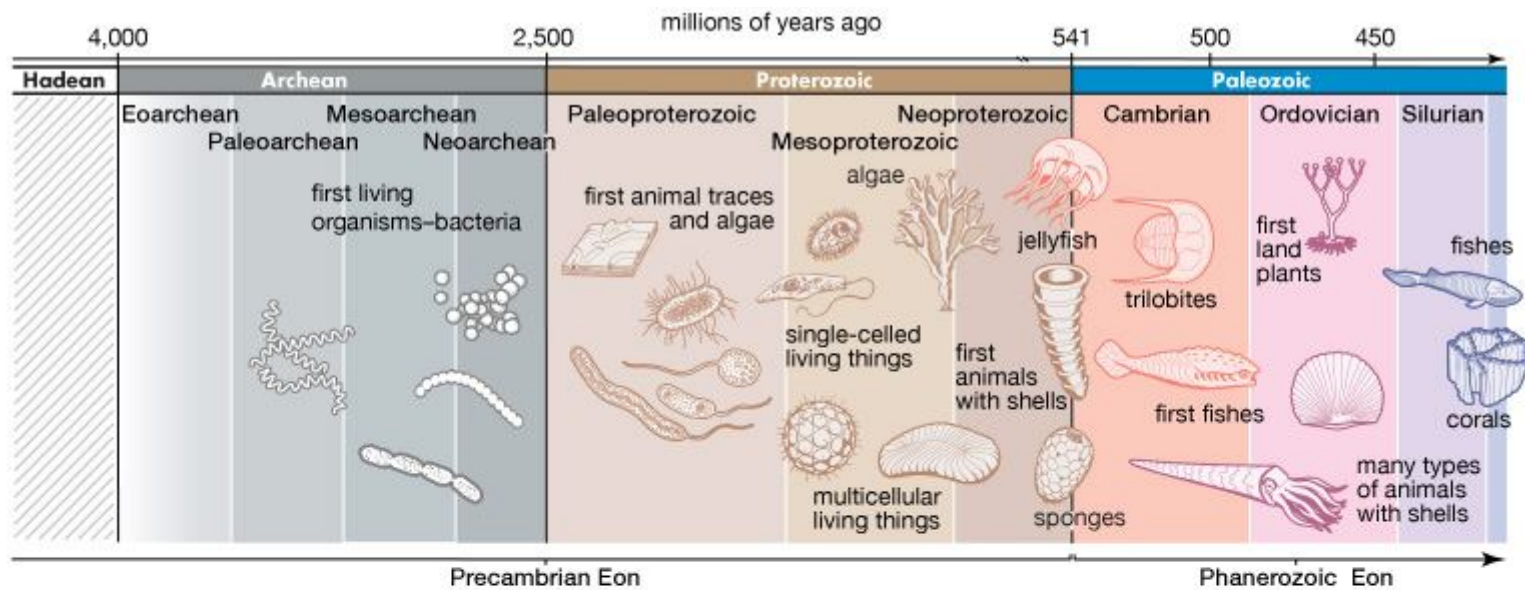


Gene transfer in biofilms



Quant fa que tenim bacteris a la boca?







The mouth as microbial habitat



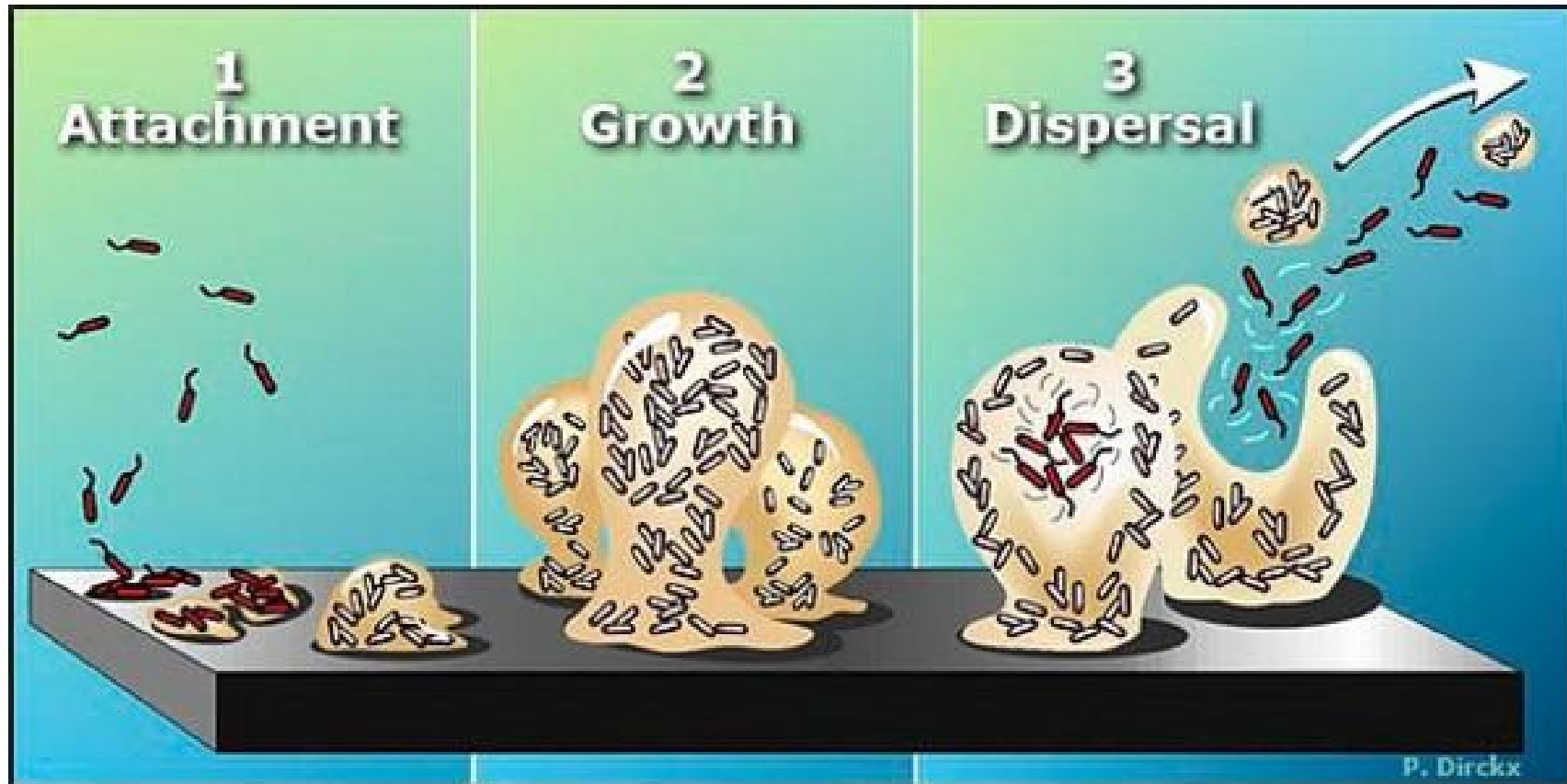
- Cheeks, lips, palate**
- Desquamation
 - Saliva is major influence
 - Microbiota has low diversity
 - Facultative anaerobes
 - *Streptococcus* spp. predominate



- Teeth**
- Non-shredding surface
 - Stagnant sites: food impaction possible
 - Diverse microbiota; site variation
 - Many obligate anaerobes
 - Influenced by saliva
 - *Streptococcus*, *Actinomyces*, *Neisseria*, unculturable organisms

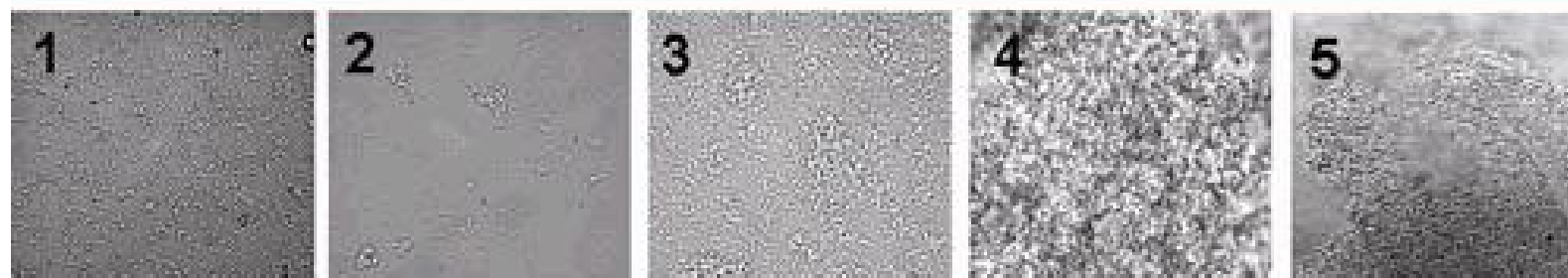
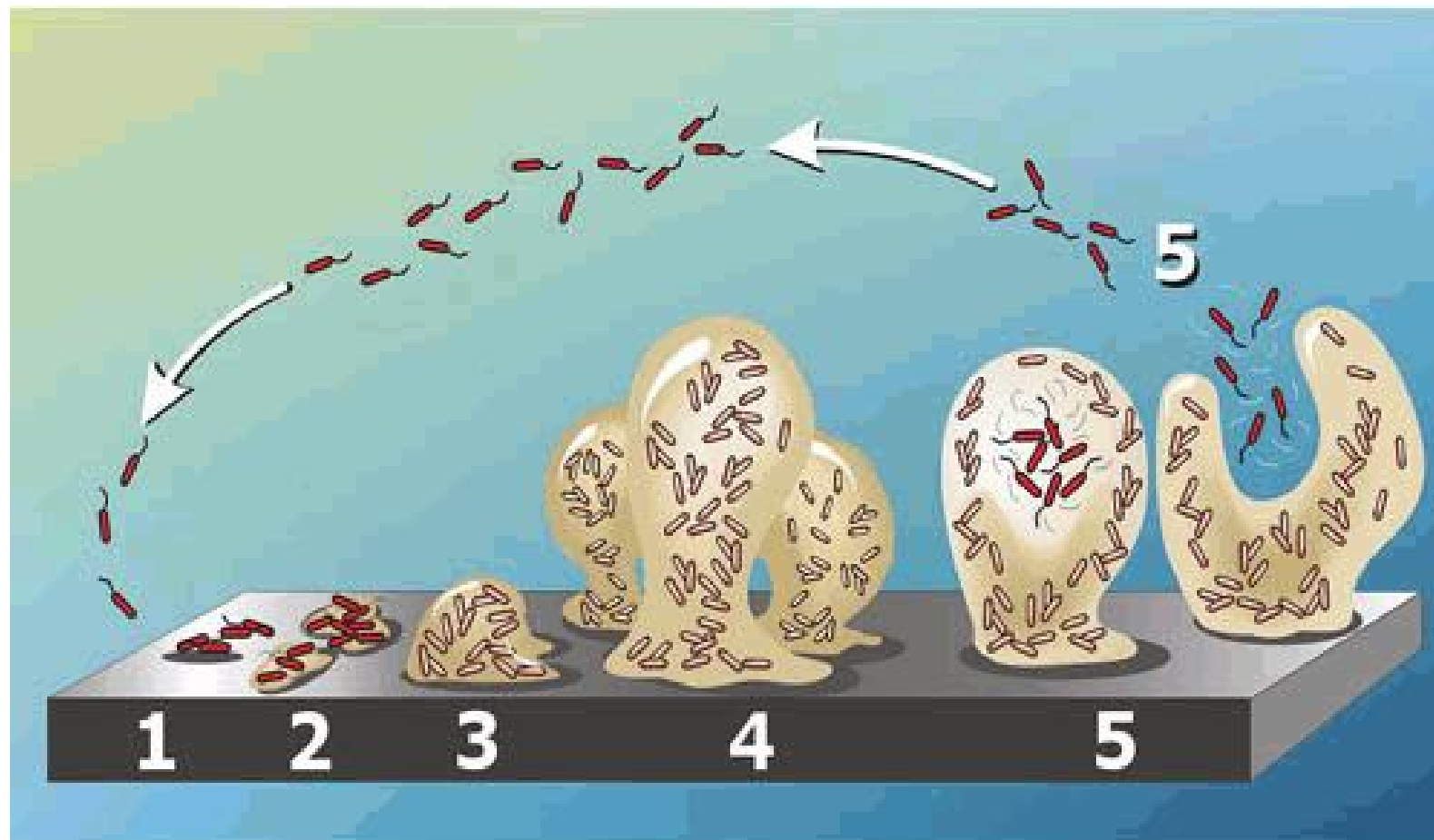
- Tongue**
- Highly papillated surface
 - Some anaerobic sites
 - Desquamation
 - Diverse microbiota
 - Facultative and obligate anaerobes
 - *Streptococcus*, *Actinomyces*, some Gram negative anaerobes





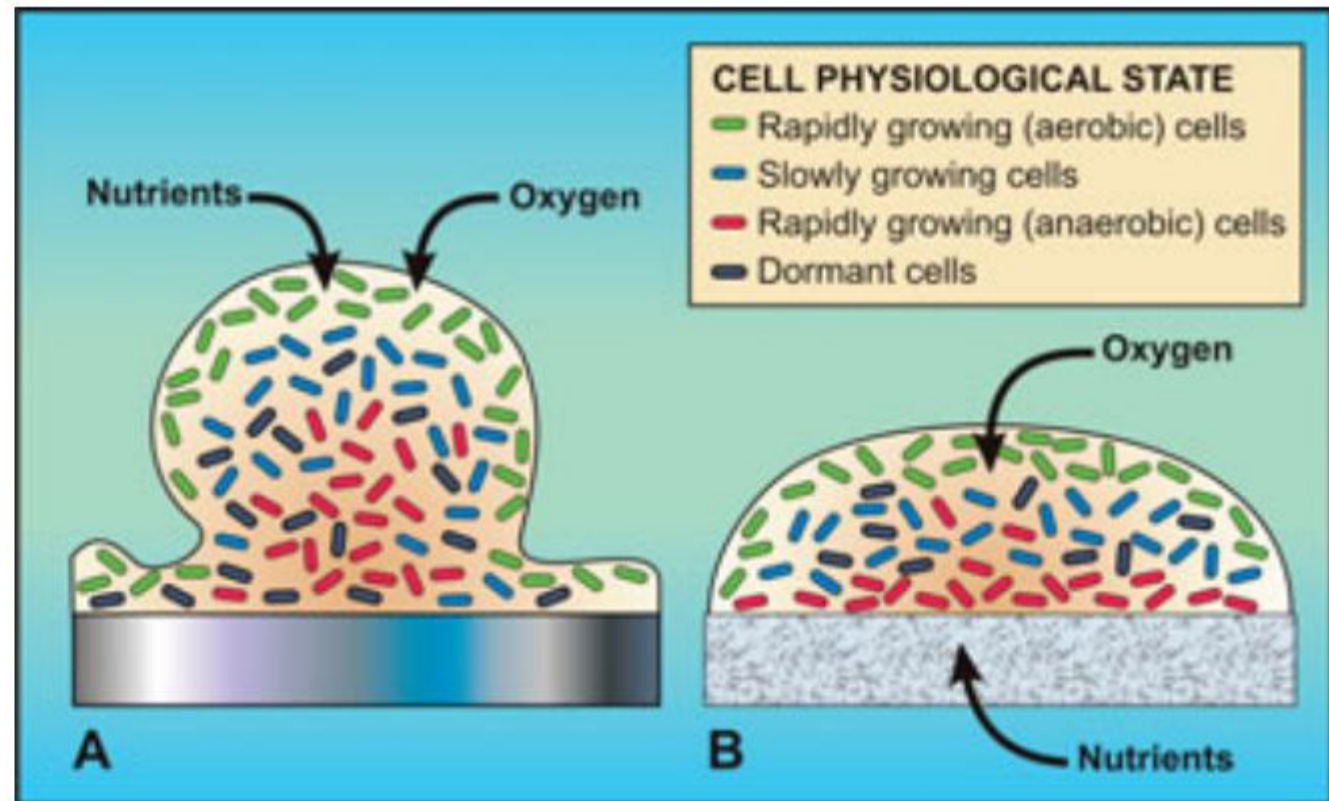
AN INTRODUCTION TO THE BIOFILM LIFE CYCLE: 1) Free-floating, or planktonic, bacteria encounter a submerged surface and within minutes can become attached. They begin to produce slimy extracellular polymeric substances (EPS) and to colonize the surface. 2) EPS production allows the emerging biofilm community to develop a complex, three-dimensional structure that is influenced by a variety of environmental factors. Biofilm communities can develop within hours. 3) Biofilms can propagate through detachment of small or large clumps of cells, or by a type of "seeding dispersal" that releases individual cells. Either type of detachment allows bacteria to attach to a surface or to a biofilm downstream of the original community.

Biofilm formation

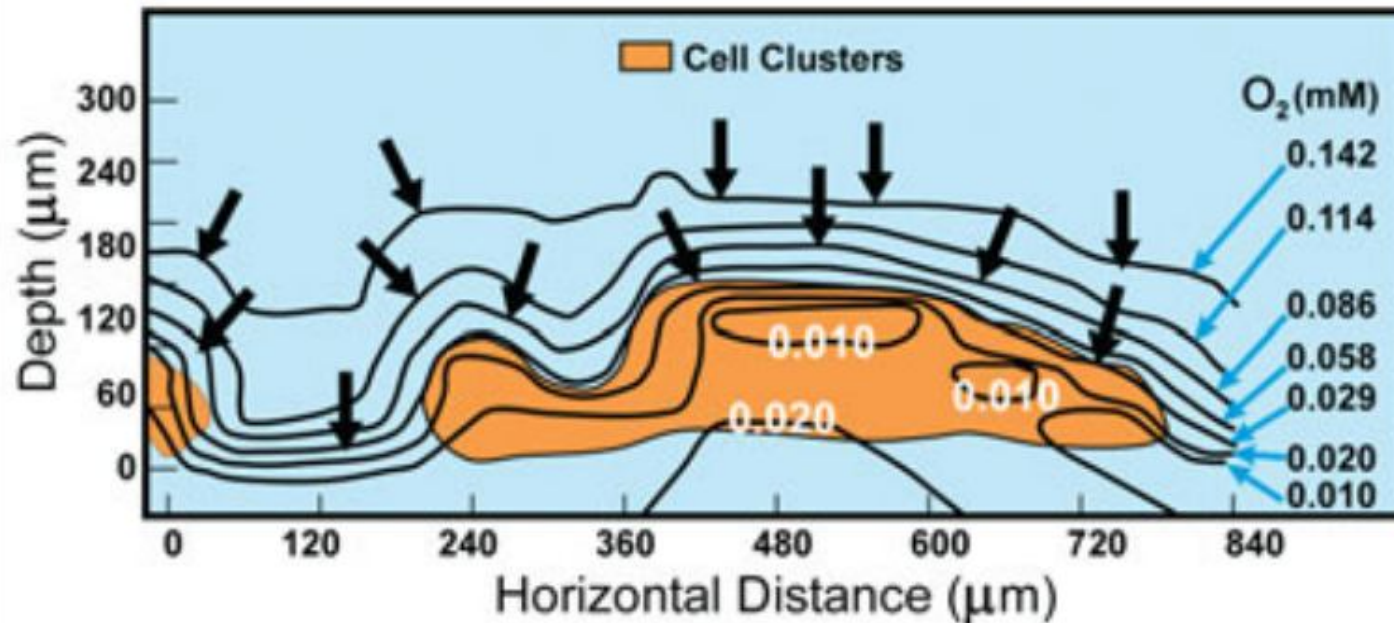


PHENOTYPIC HETEROGENEITY & DIFFERENTIATION

Cells of a given species can occupy a wide variety of phenotypic states in the same biofilm, from rapidly growing to dormant to expressing a unique activity. Mechanisms of diversification include nutrient gradients, mutation and natural selection, and genetic regulatory switches and signaling pathways.



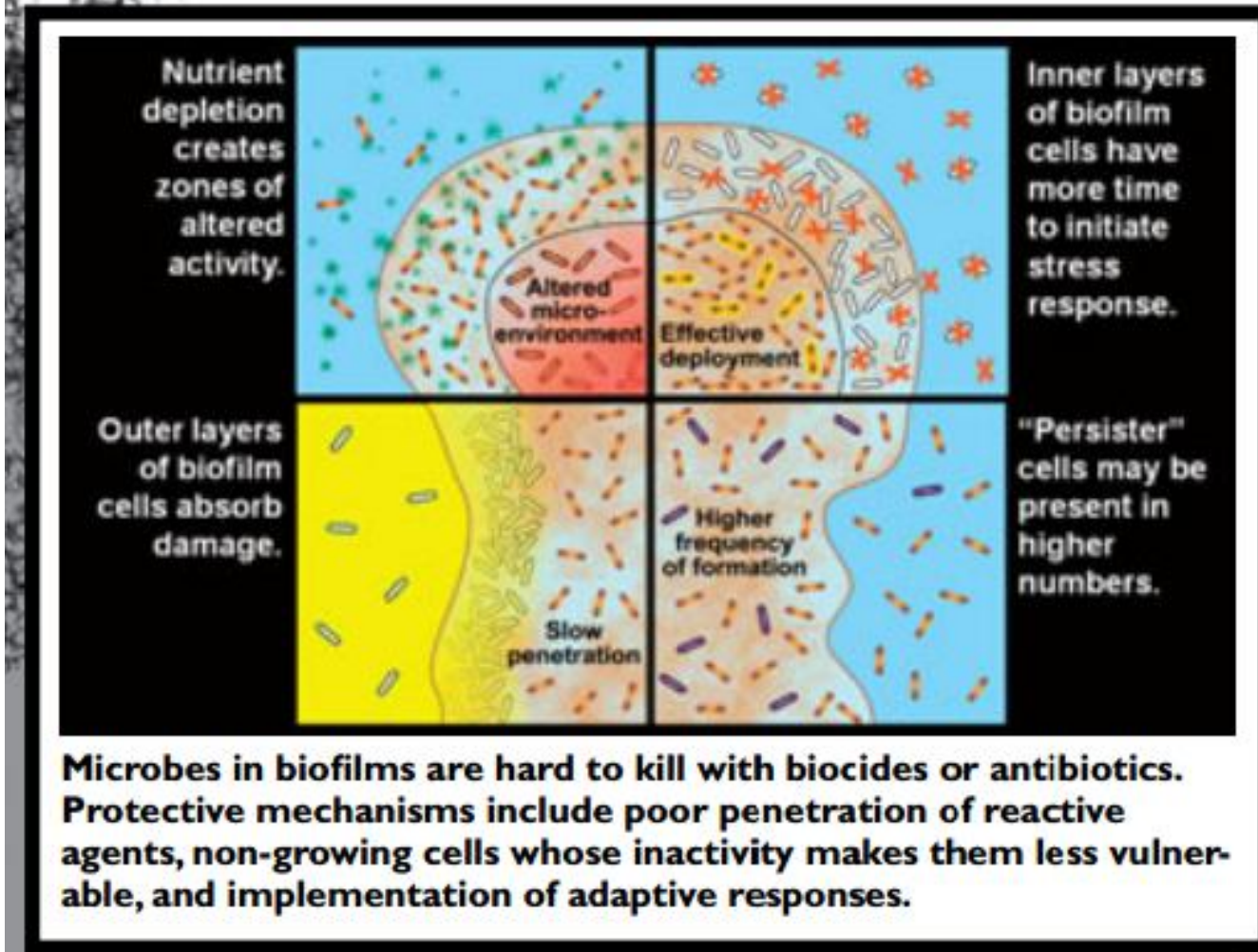
OXYGEN GRADIENTS



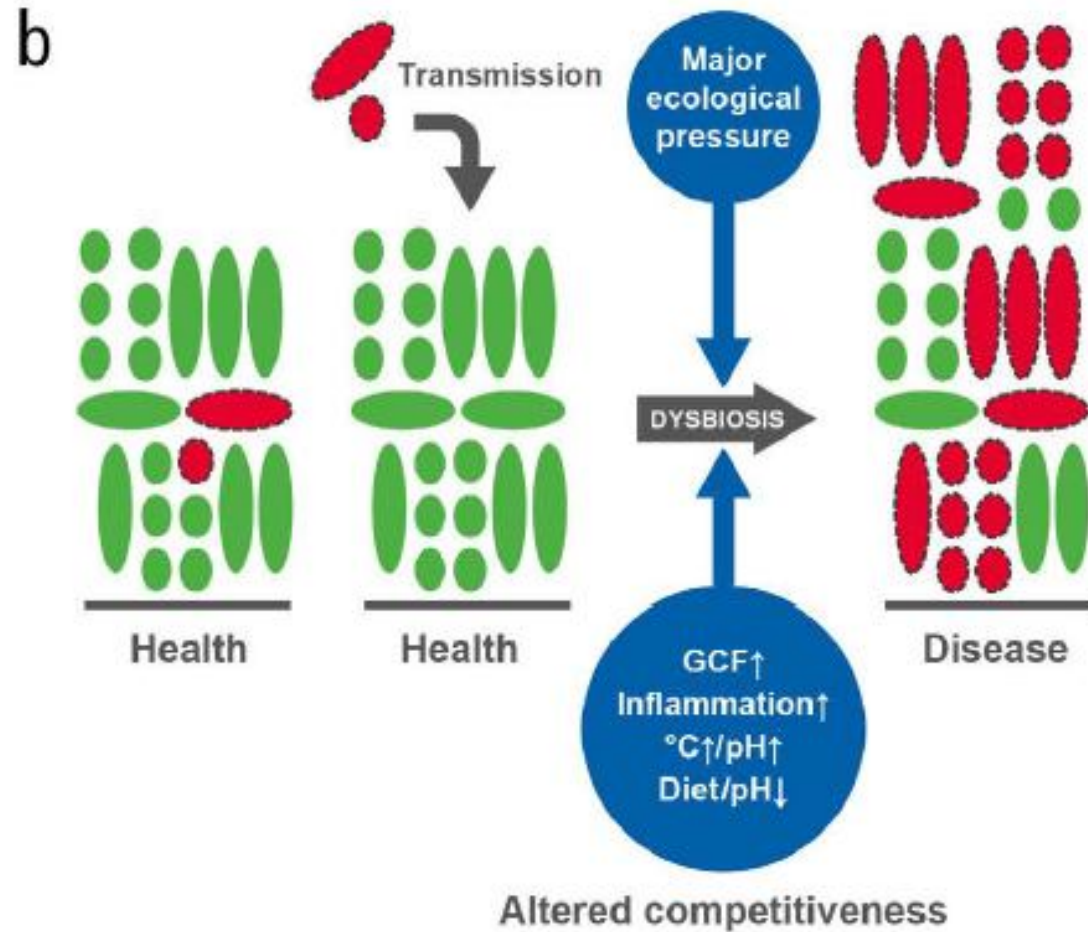
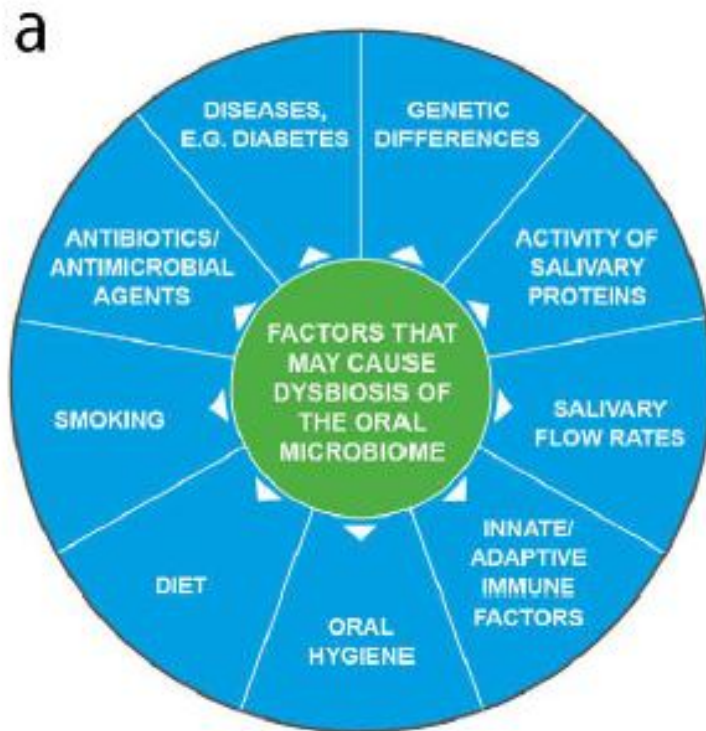
Mature biofilms are criss-crossed by gradients in the concentrations of metabolic substrates and products. Oxygen is the foremost example. Local depletion of oxygen allows anaerobic bacteria to thrive in the depths of a biofilm bathed in aerated water.

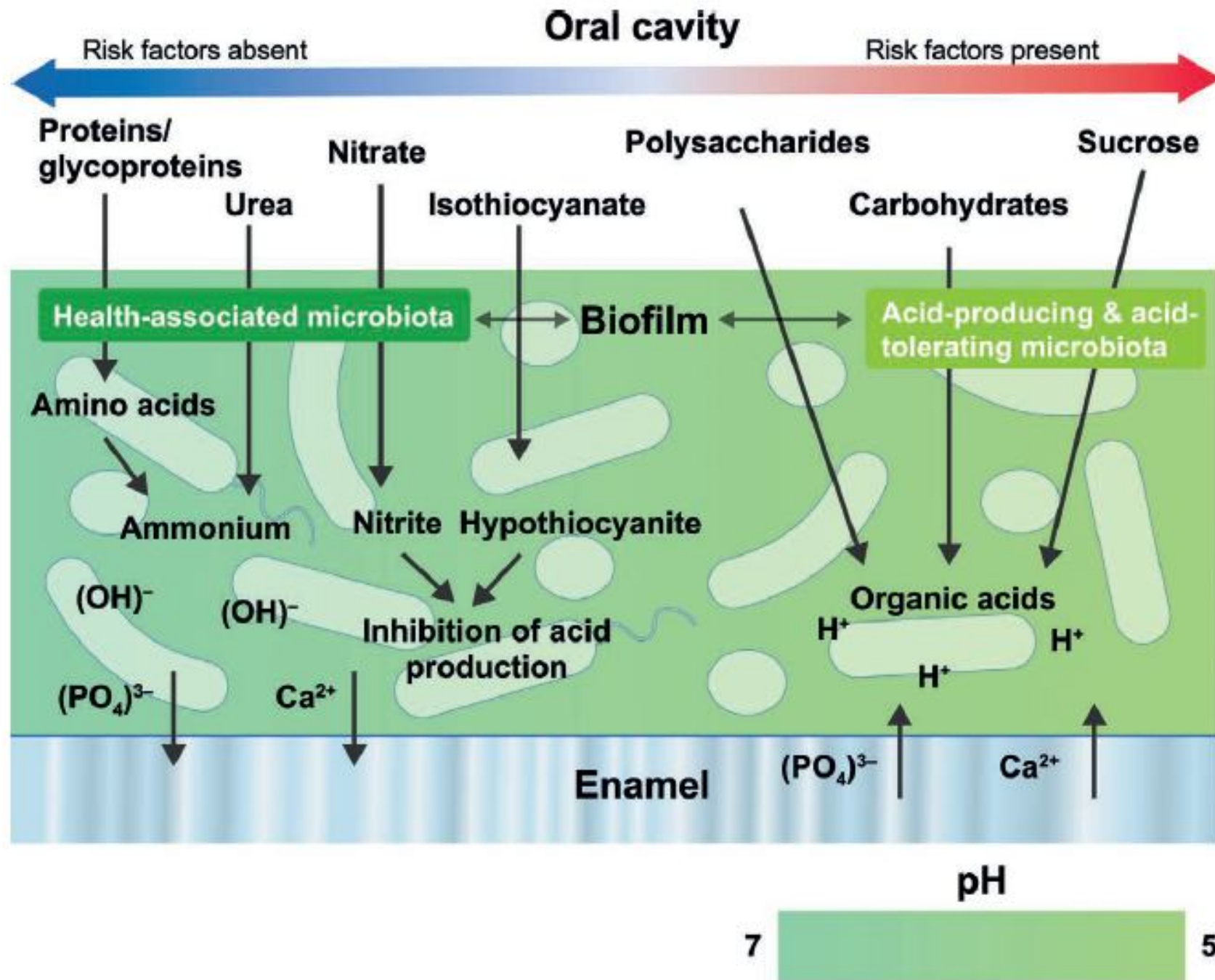
Plot of microsensors-detected gradients of dissolved oxygen in a biofilm: D de Beer, P Stoodley, Z Lewandowski, MSU-CBE

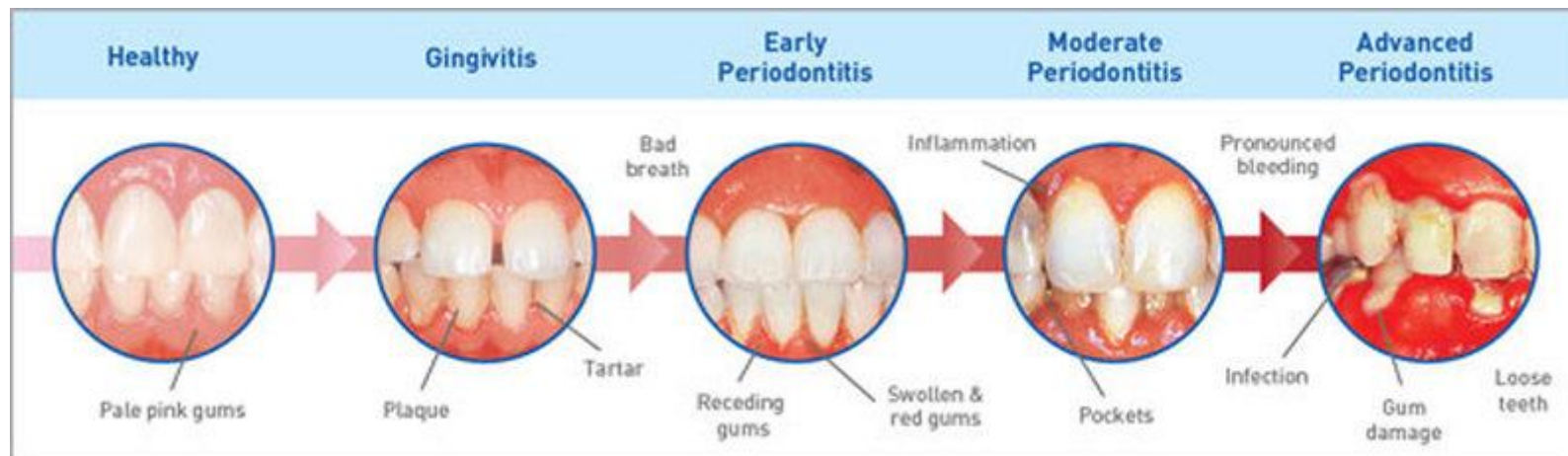
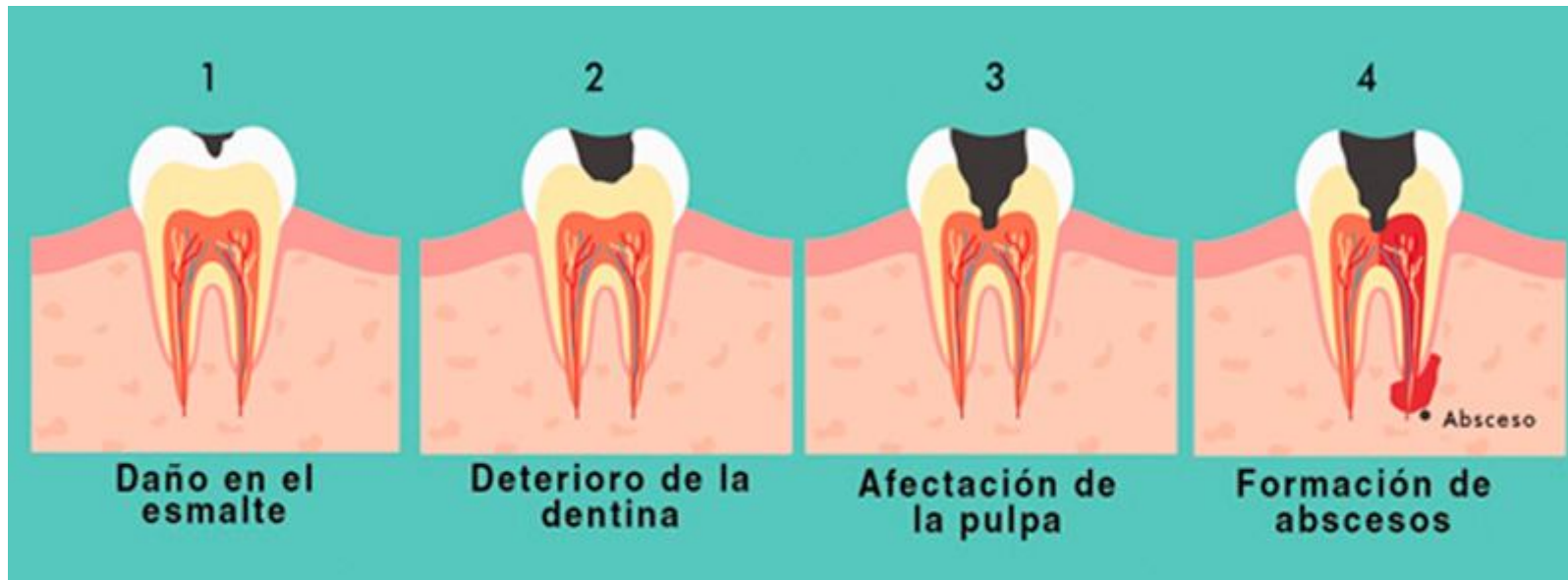
ANTIMICROBIAL TOLERANCE

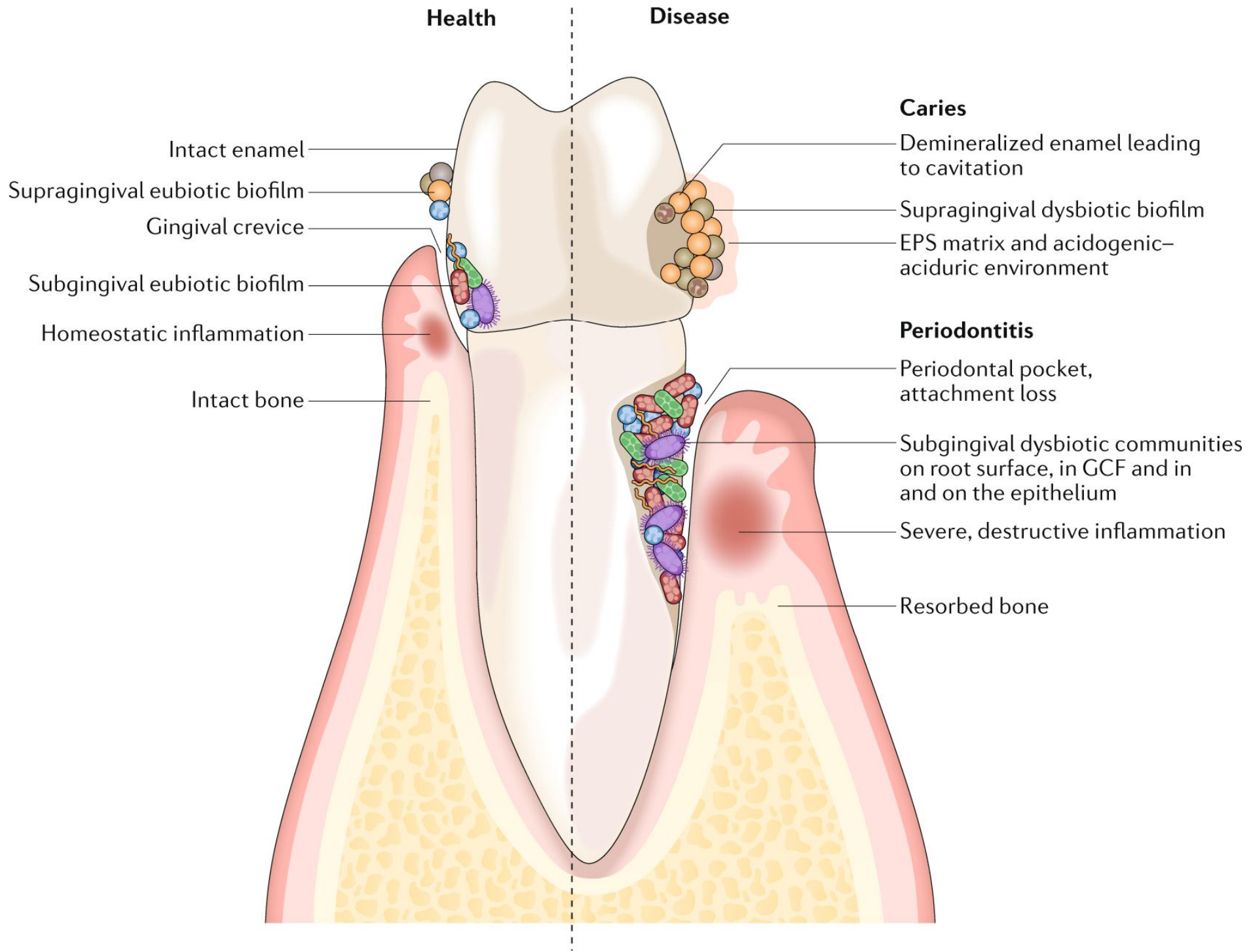


Causes of Dysbiosis

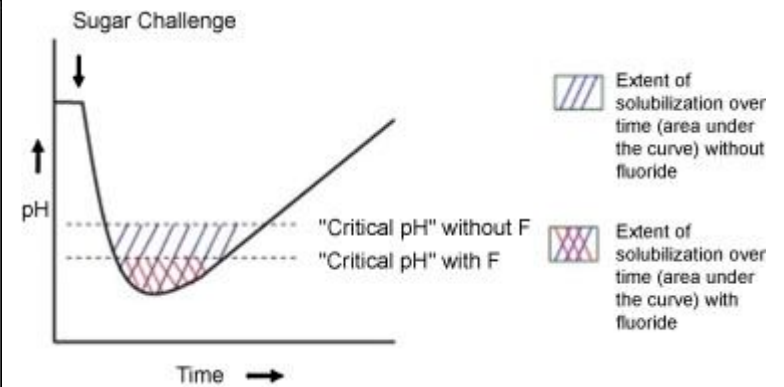
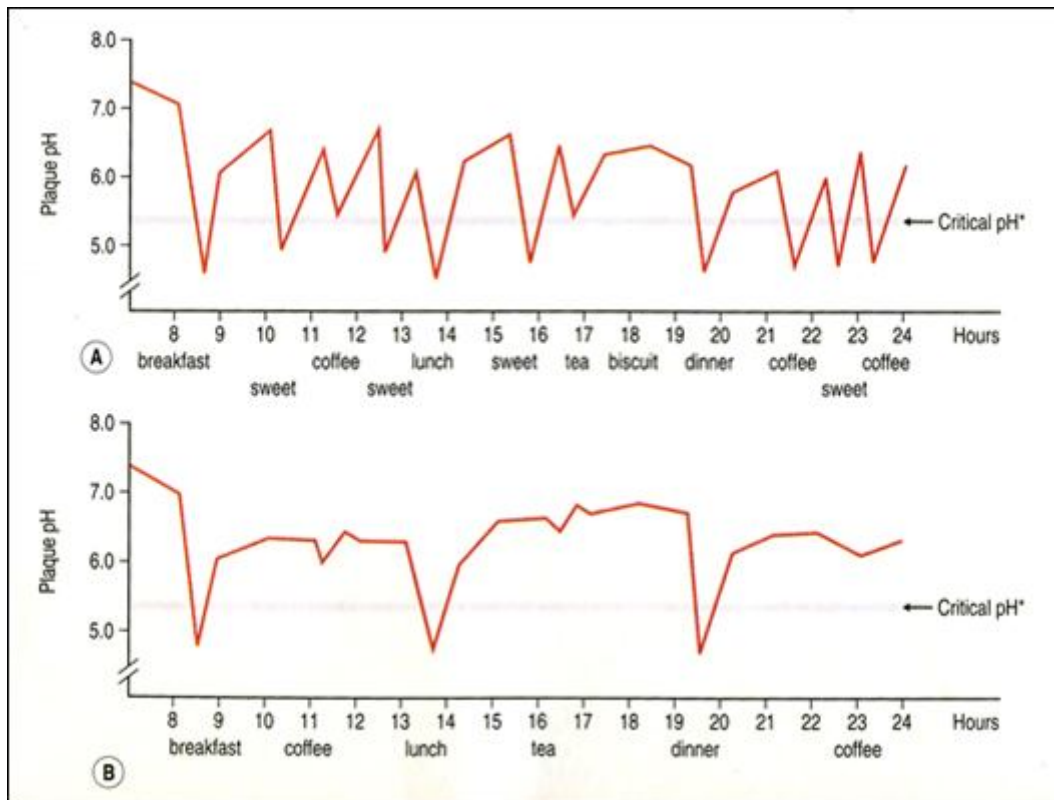
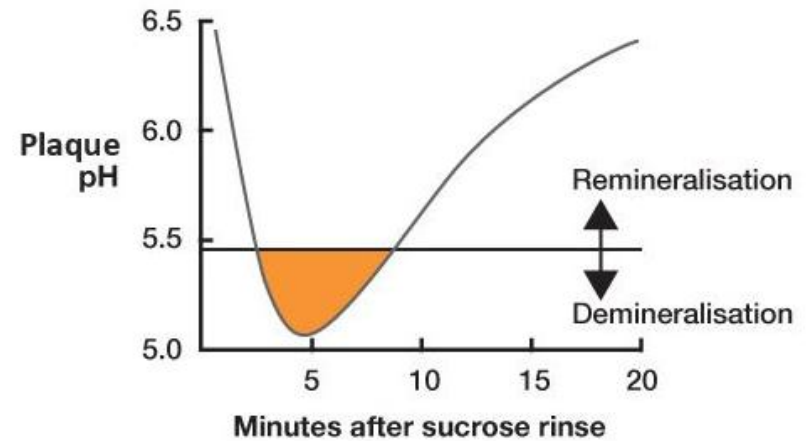
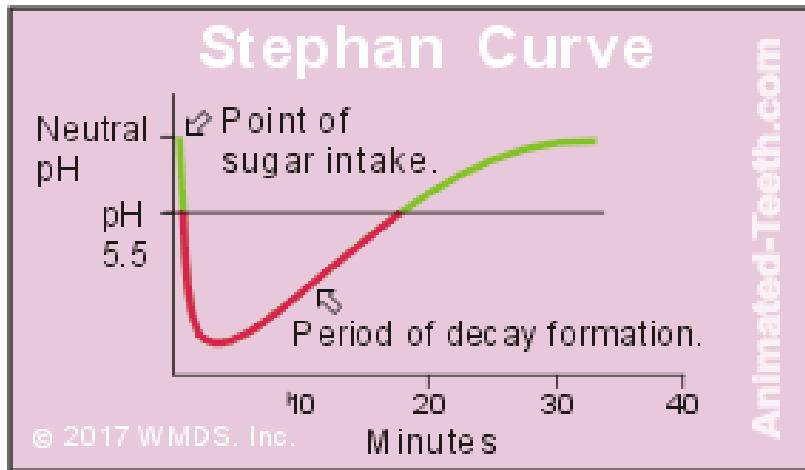




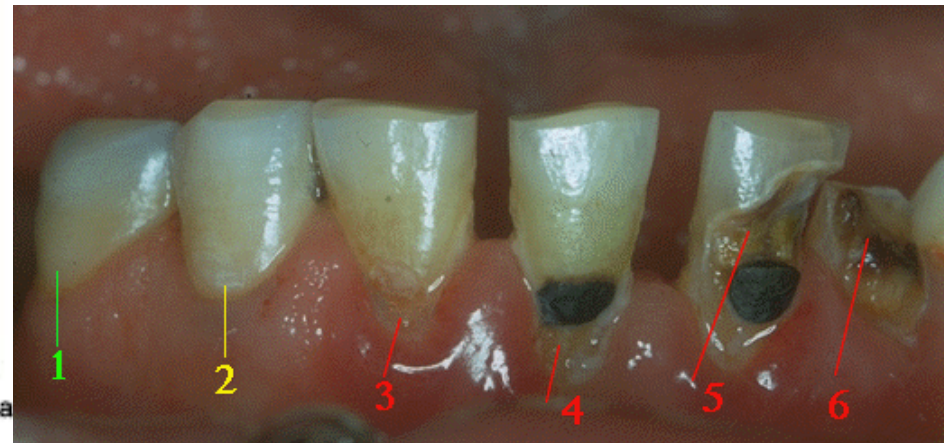
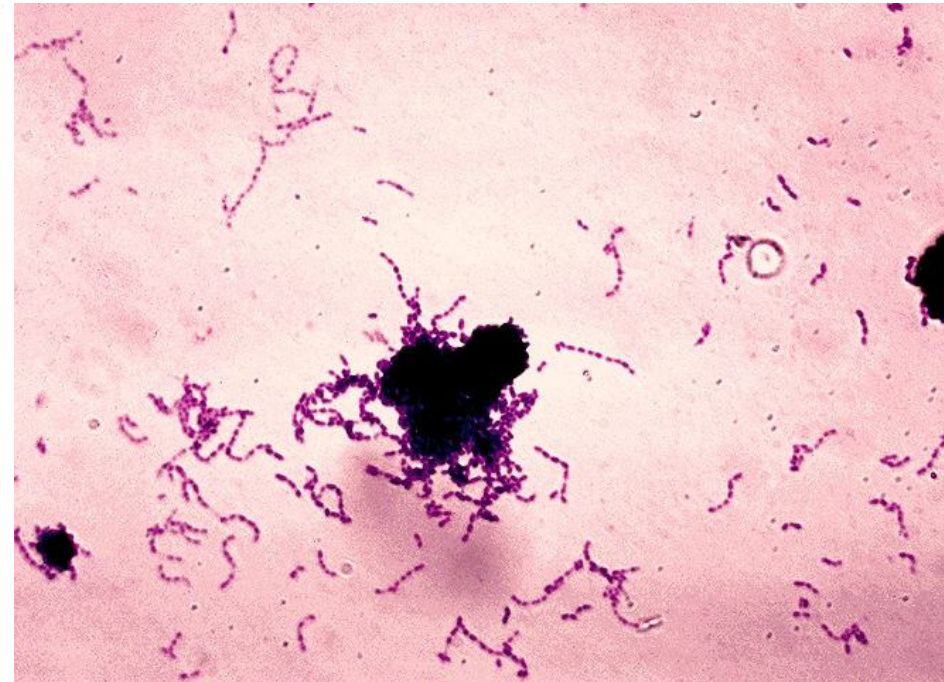
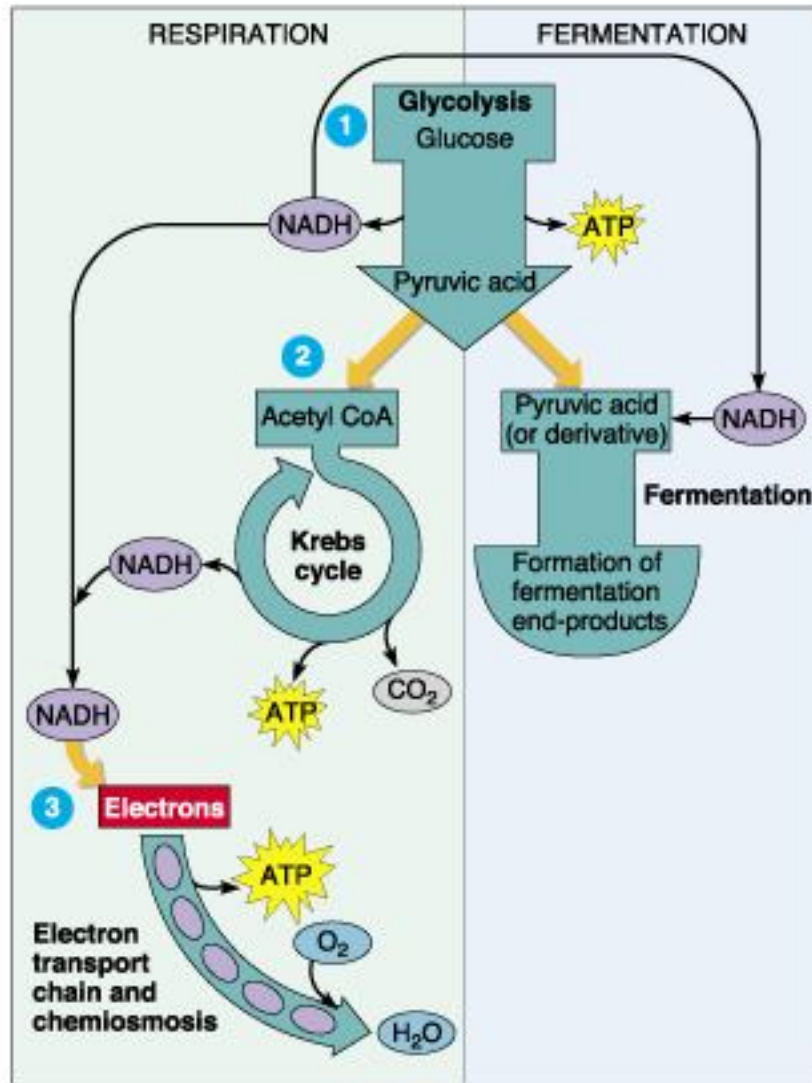


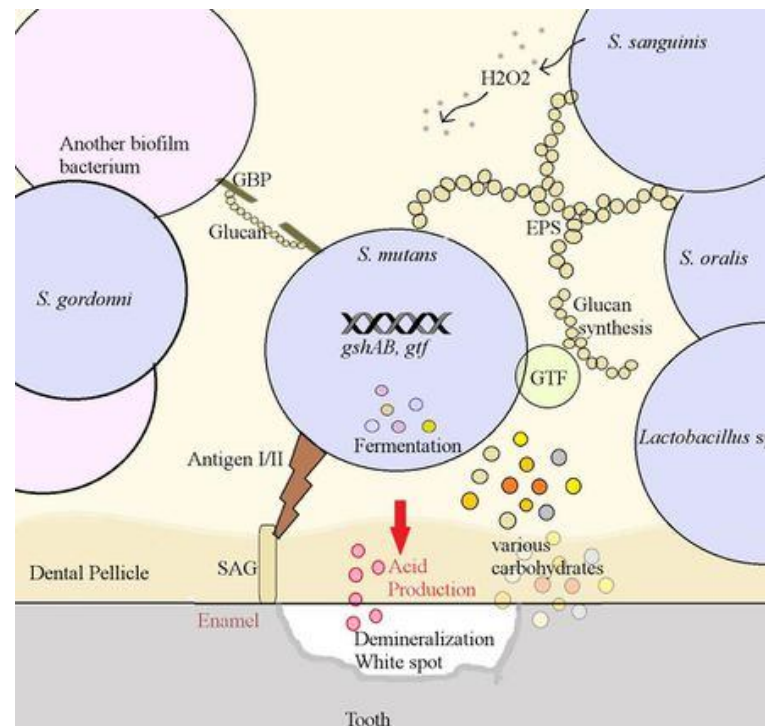
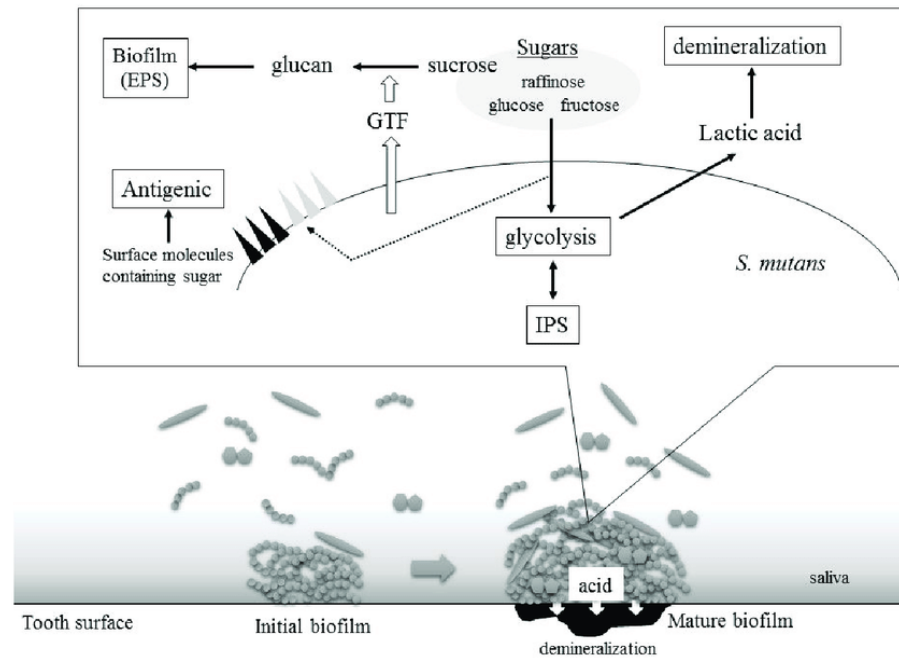
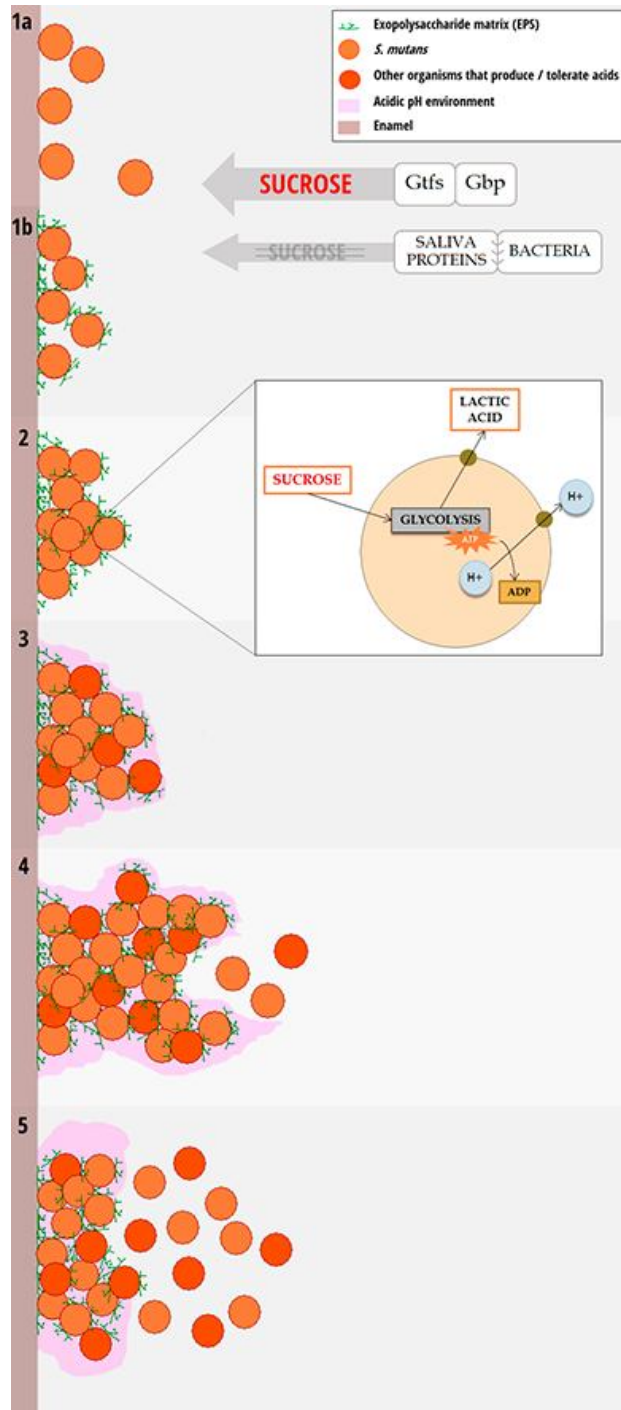


pH

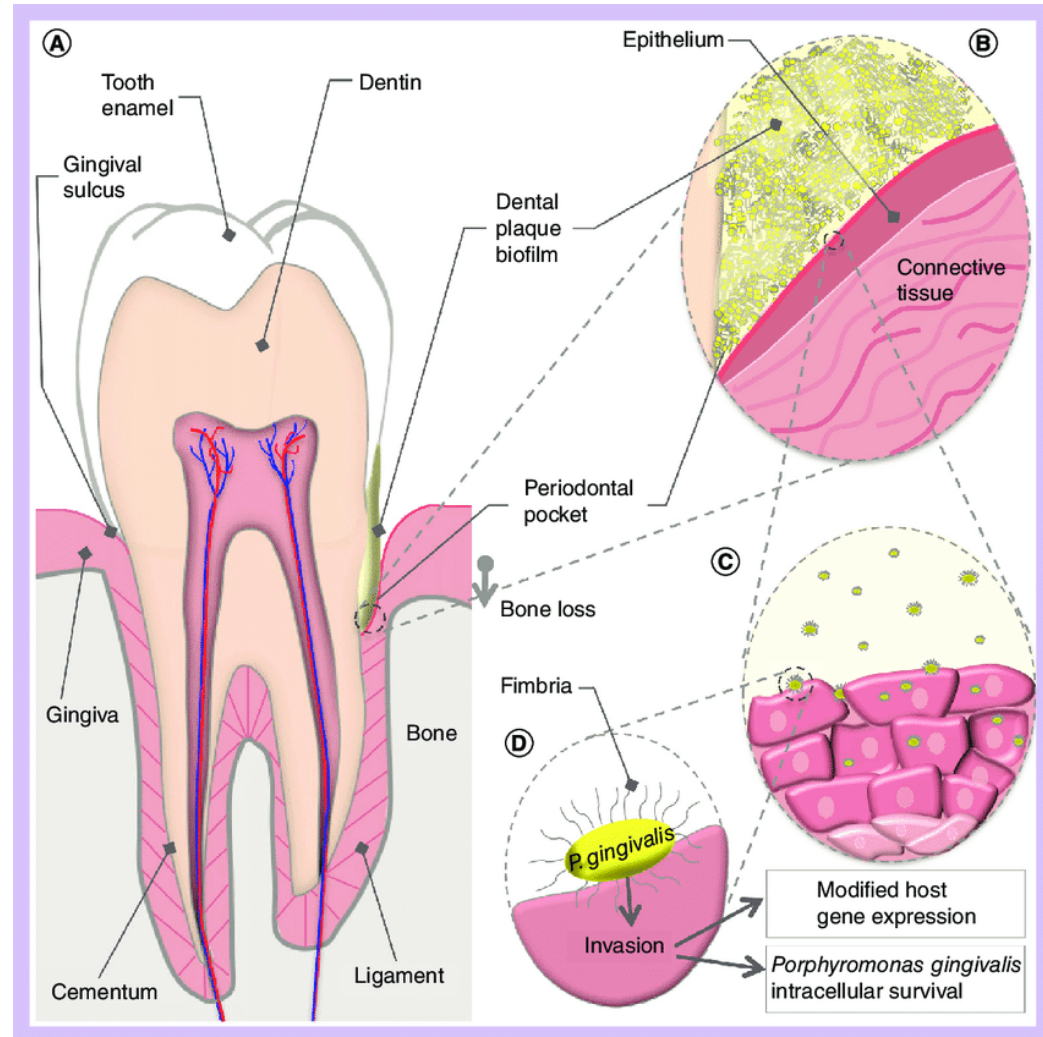
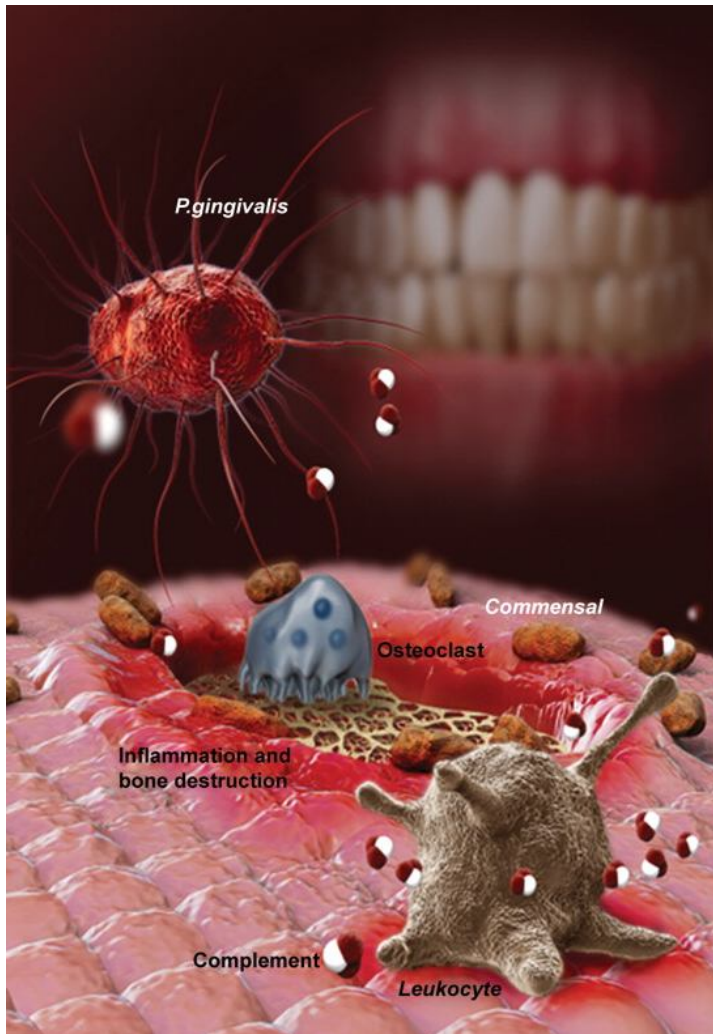


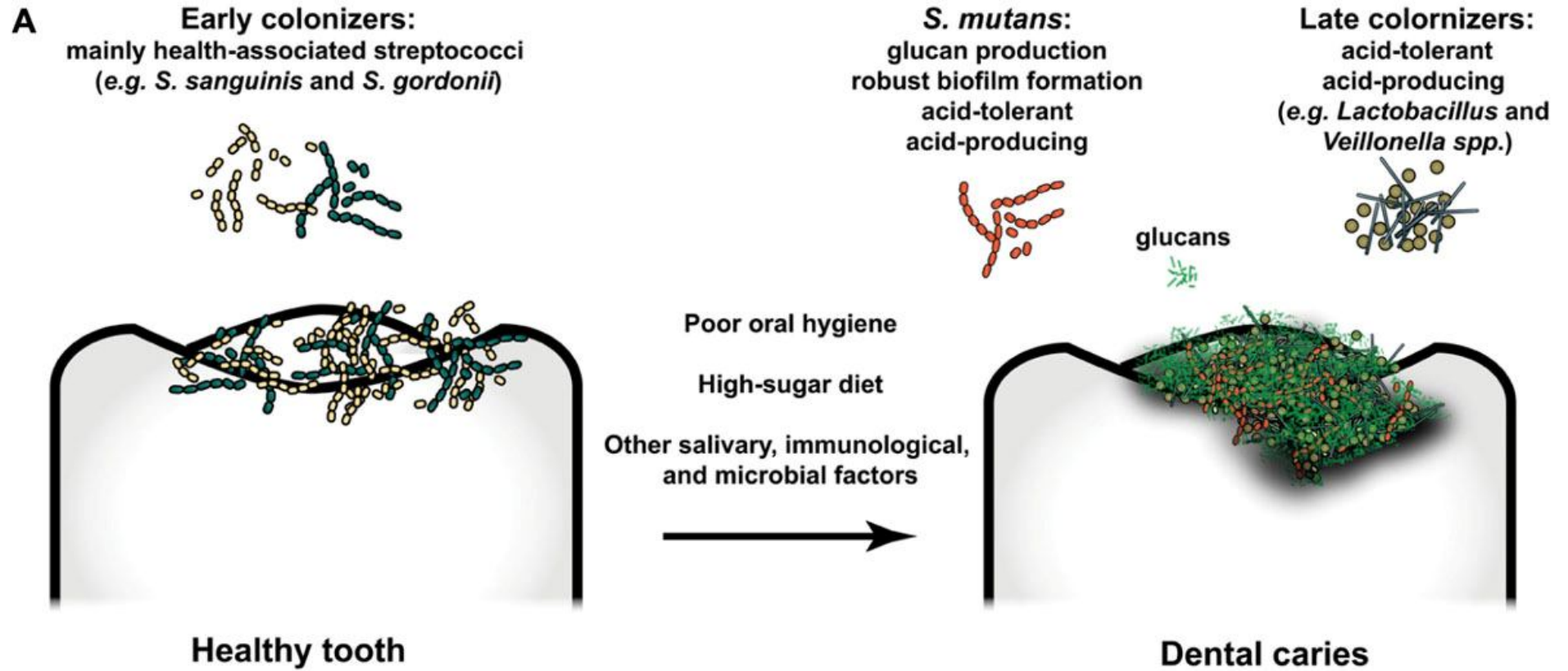
Streptococcus mutans



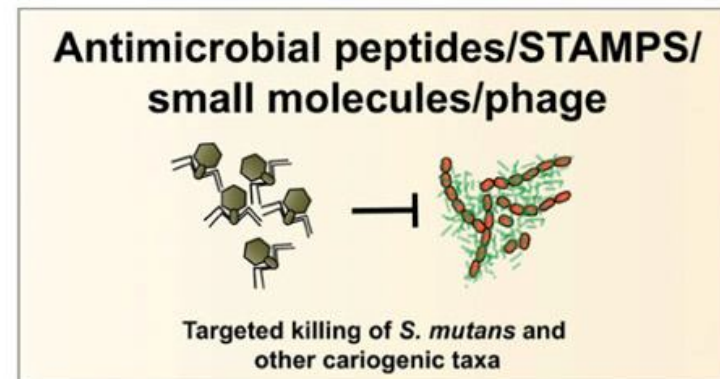
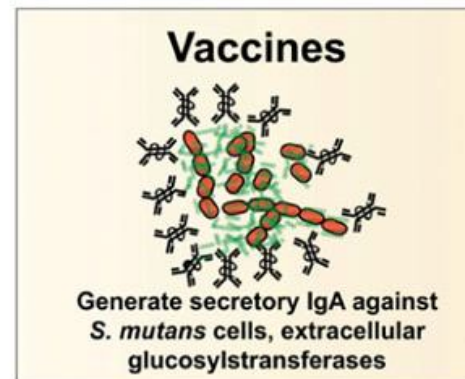
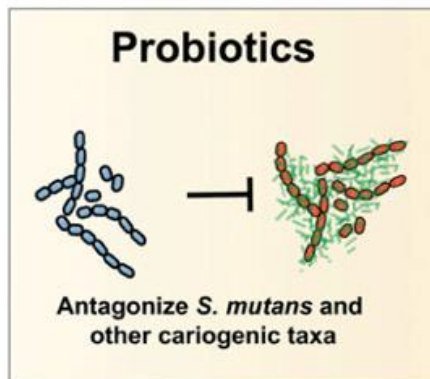
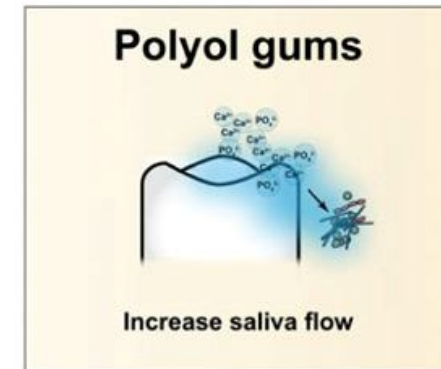
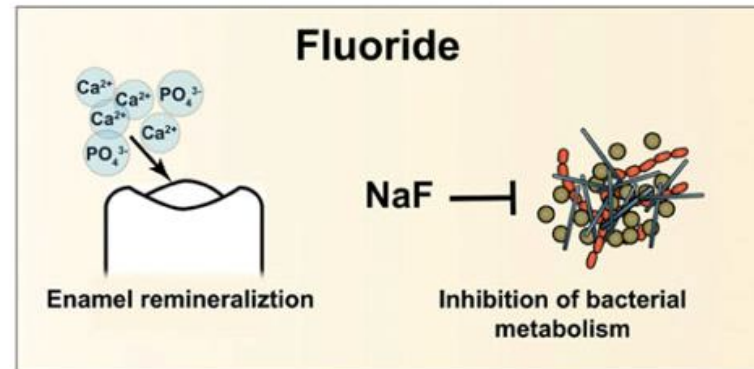
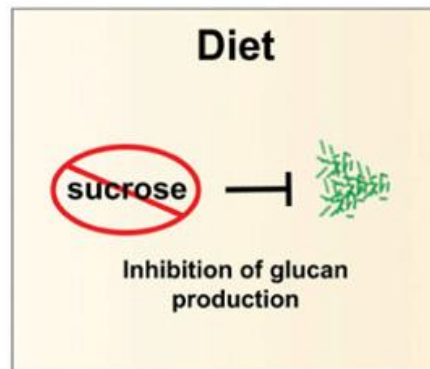


Porphyromonas gingivalis

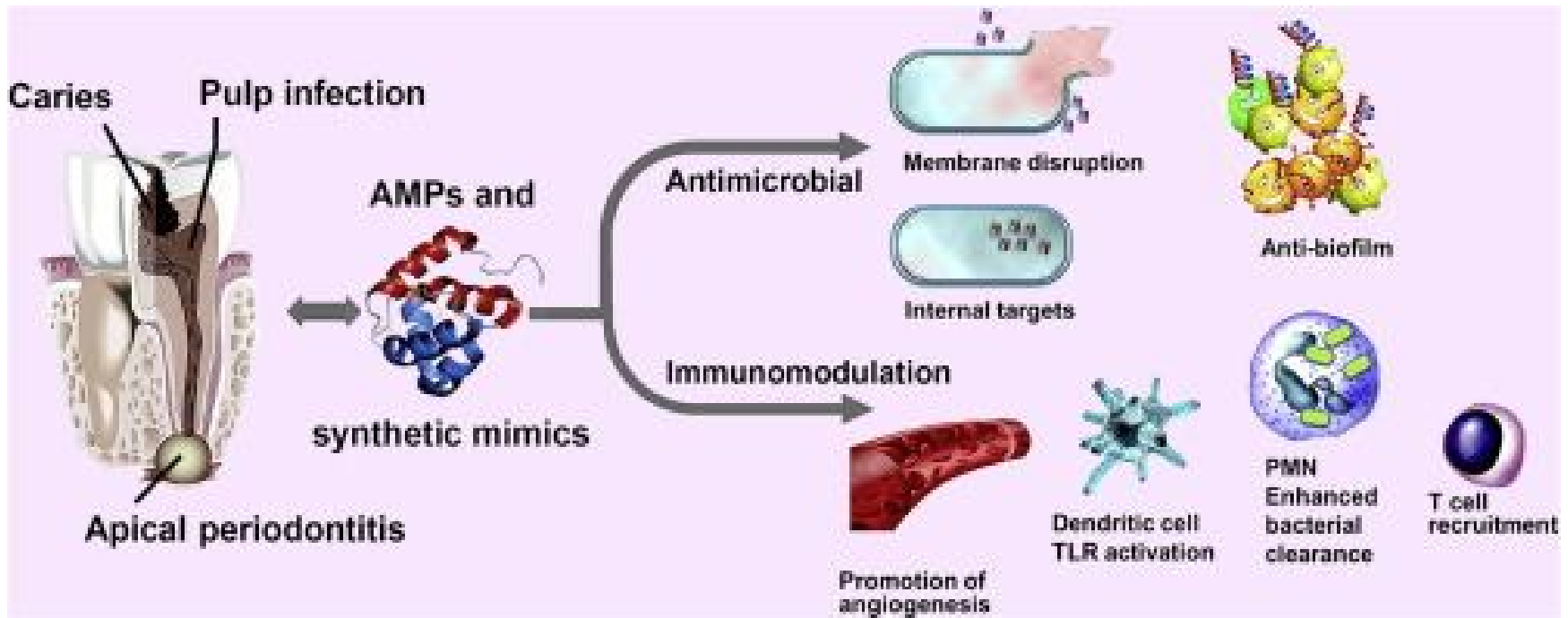




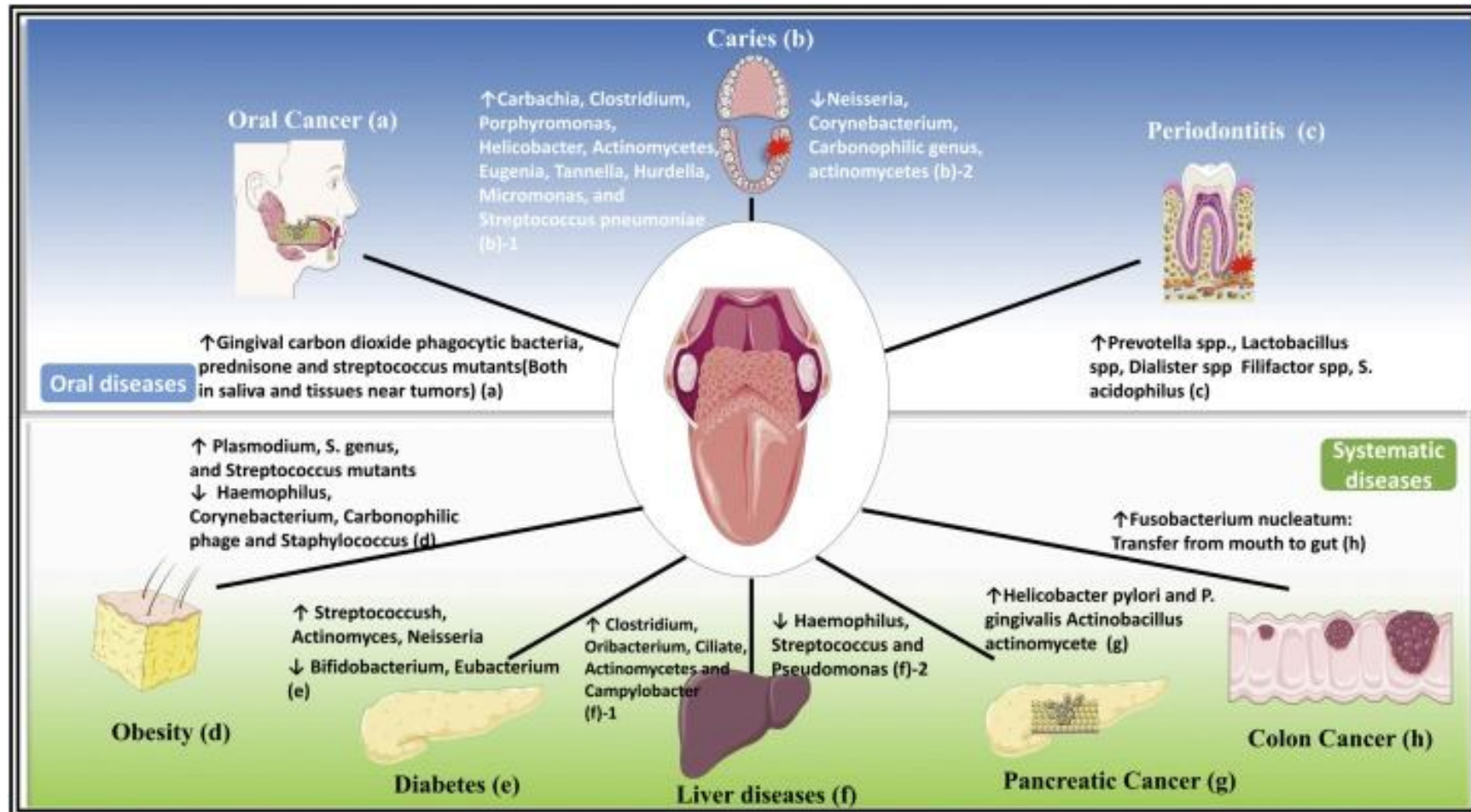
Ens protegim?



STAMP

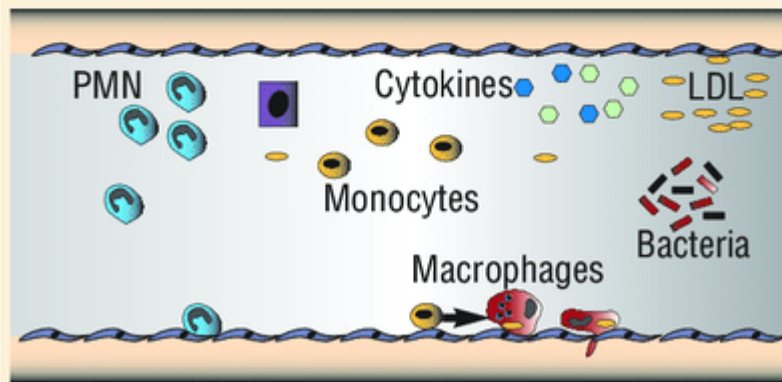
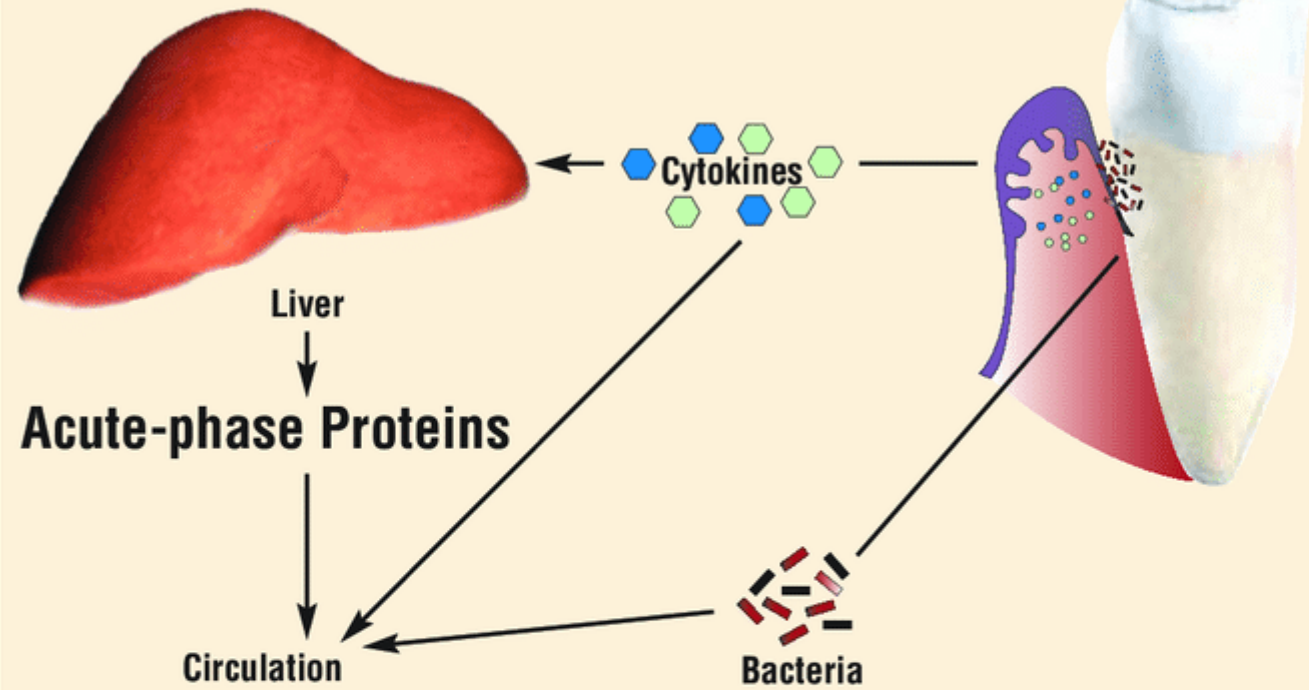


Bacteris de la boca, "on the move"

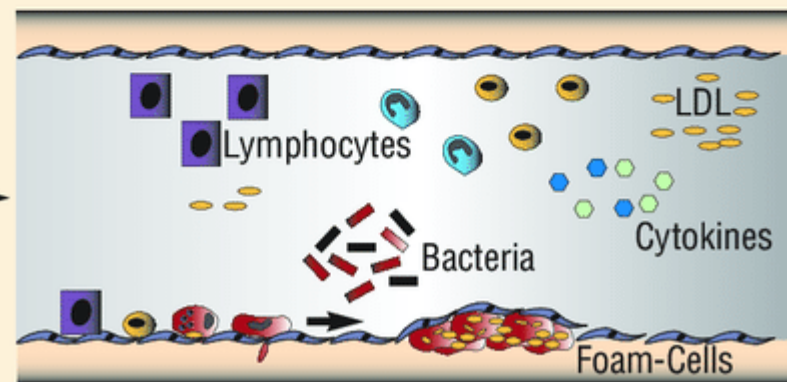


Periodontal Disease

- Biofilm formation
- Inflammation
- Attachment loss



Early Events

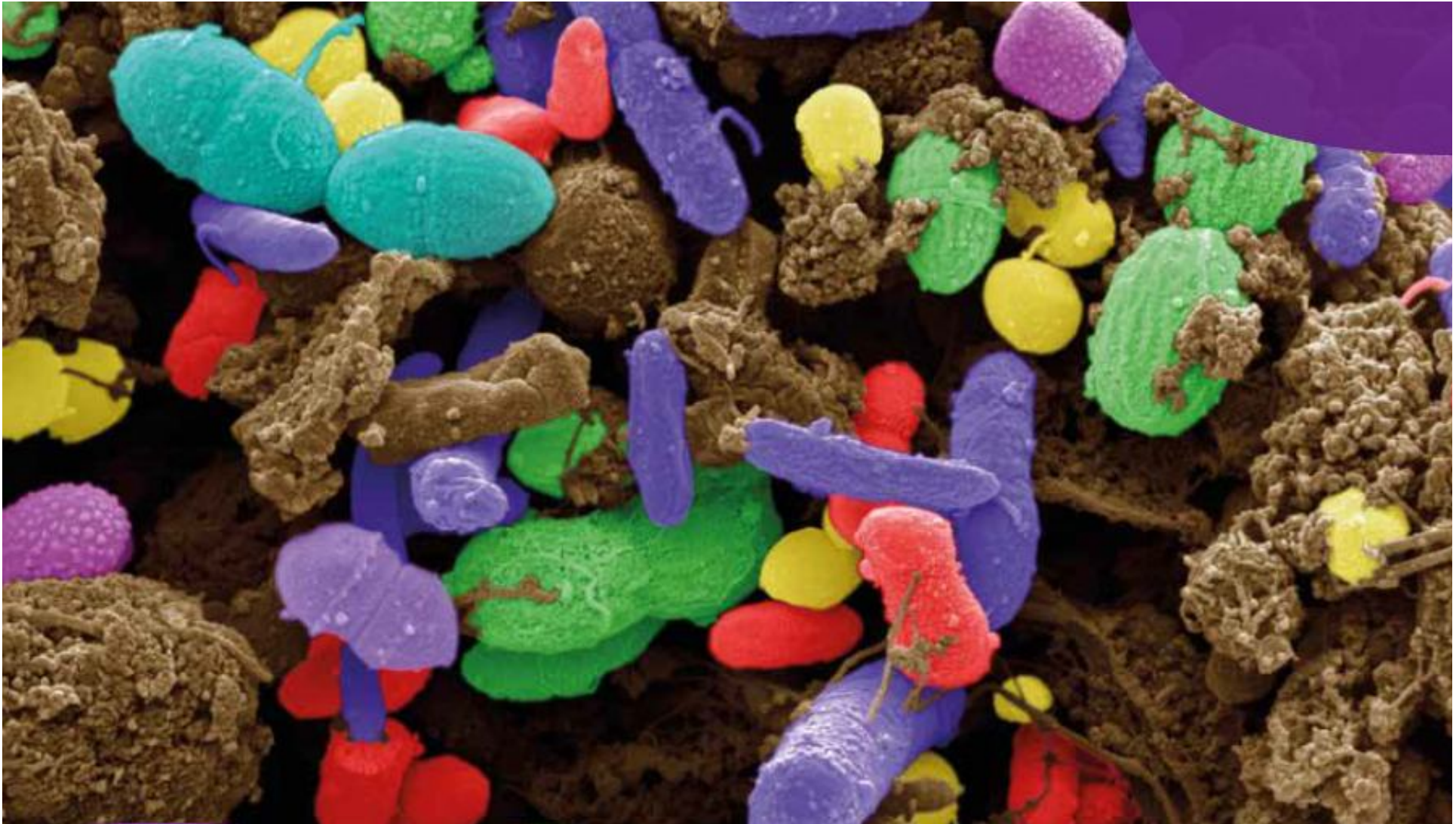


Atherosclerotic Lesion

Diversitat = Eficàcia



**També estan presents a les
xarxes socials...**





Microbiology 2.0

Microbiology contents on line





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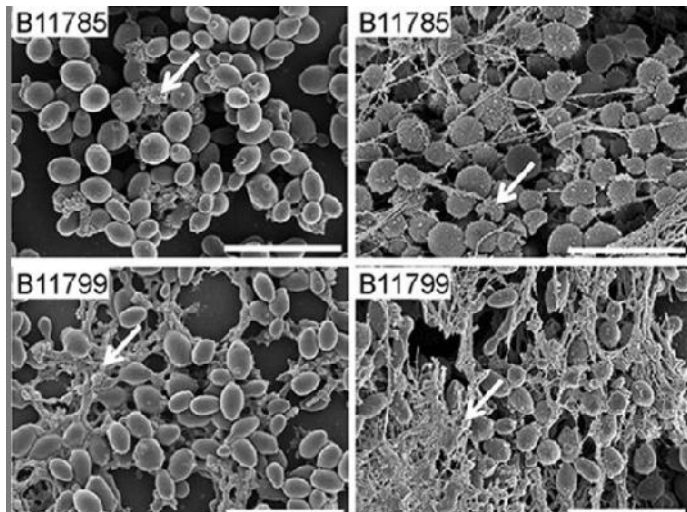
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 9513_li @hyson_pereira so beautiful, look
 at this shit
 hyson_pereira @95_sasuke you are
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1,686 others

JULY 13, 2016

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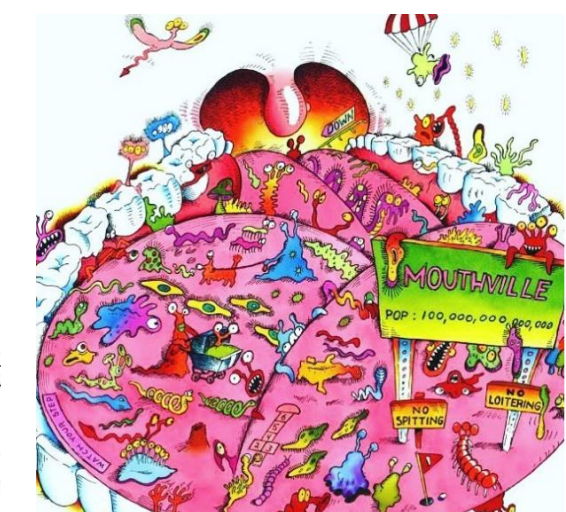


asmicrobiology • Following

asmicrobiology Microbiology Monday: Do you see a difference between the cultures on the right and those on the left? These are Candida auris biofilms from in vitro (L) or in vivo (R) conditions. A study published in mSphere reported much more extracellular matrix material produced by in vivo biofilms, where the matrix can sequester up to 70% of antifungal compounds. This study emphasizes the importance of studying in vivo infection models. What else differs between in vitro

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dr.amandas • Follow
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dr.amandas Toothful Tuesday: Did you know there are more bacteria in the human mouth than there are people on the Earth!! *

#toothfultuesday #didyouknow #mouthville #earth #oralhealth #thegoodthebadandtheugly #bacteria #oralbacteria #gumdissease #decay #cavities #womenindentistry #kelownadentist #dmd #dentistry #dentist #okanagan #kelowna #BC #canada

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A world to discover es una serie de videos de corta duración dedicados al mundo que habitualmente pasa desapercibido a nuestros ojos. Un mundo en el que habita una enorme cantidad de seres vivos a los que, debido a su pequeño tamaño, no podemos ver a simple vista. Gracias a las técnicas de macrofotografía y de fotomicrografía (la fotografía y el video a través del microscopio) podemos penetrar en él y sorprendernos. En los diferentes capítulos que componen la serie podremos adentrarnos visualmente en ese extraordinario mundo y descubrir algunas de sus
[Más informació](#)

Tiny World



Oral Microbiology

<https://www.youtube.com/watch?v=plB4rPuIWEE>

GRÀCIES

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St Pere de Ribes
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