CARRERA DE ESPECIALIZACIÓN EN ESTERILIZACIÓN

ASIGNATURA: MICROBIOLOGÍA APLICADA

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Clase 1
2018
Rosario

MICROBIOLOGÍA

Deriva de 3 palabras griegas: *mikros* (pequeño), *bios* (vida) y *logos* (ciencia) que conjuntamente significan el estudio de la vida microscópica

"La ciencia encargada del estudio de los microorganismos tan pequeños cuya visualización requiere del microscopio“ abarca:

partículas no celulares como los virus, viroides y priones, hasta organismos celulares tan diferentes como las bacterias, los protozoos y parte de las algas y de los hongos.

ÁMBITO DE LA MICROBIOLOGÍA

- Todo el ecosistema depende de las bacterias. Éstas influyen en la sociedad humana de muchas formas.
- Repercusión sobre: medicina, agronomía, bromatología, ecología, genética, bioquímica…
- Ocupaciones de un microbiólogo:

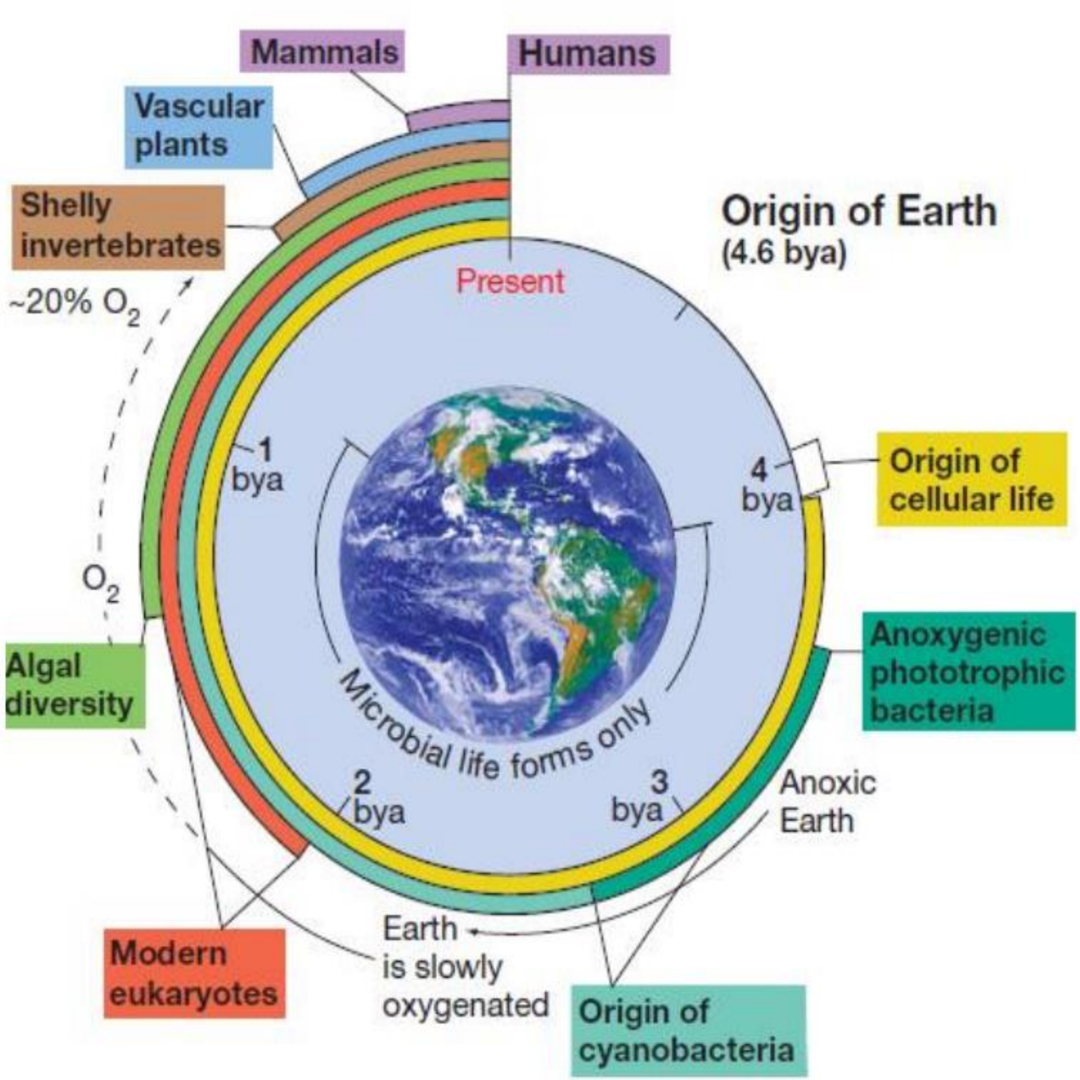
➢ **Microbiología médica**: identificación del agente causal de una enfermedad infecciosa y planificar medidas para eliminarlo. Descubrir nuevos patógenos, y los mecanismos por los cuales actúan.

➢ **Microbiólogo de Salud Pública:** controlar la extensión de enfermedades infecciosas.

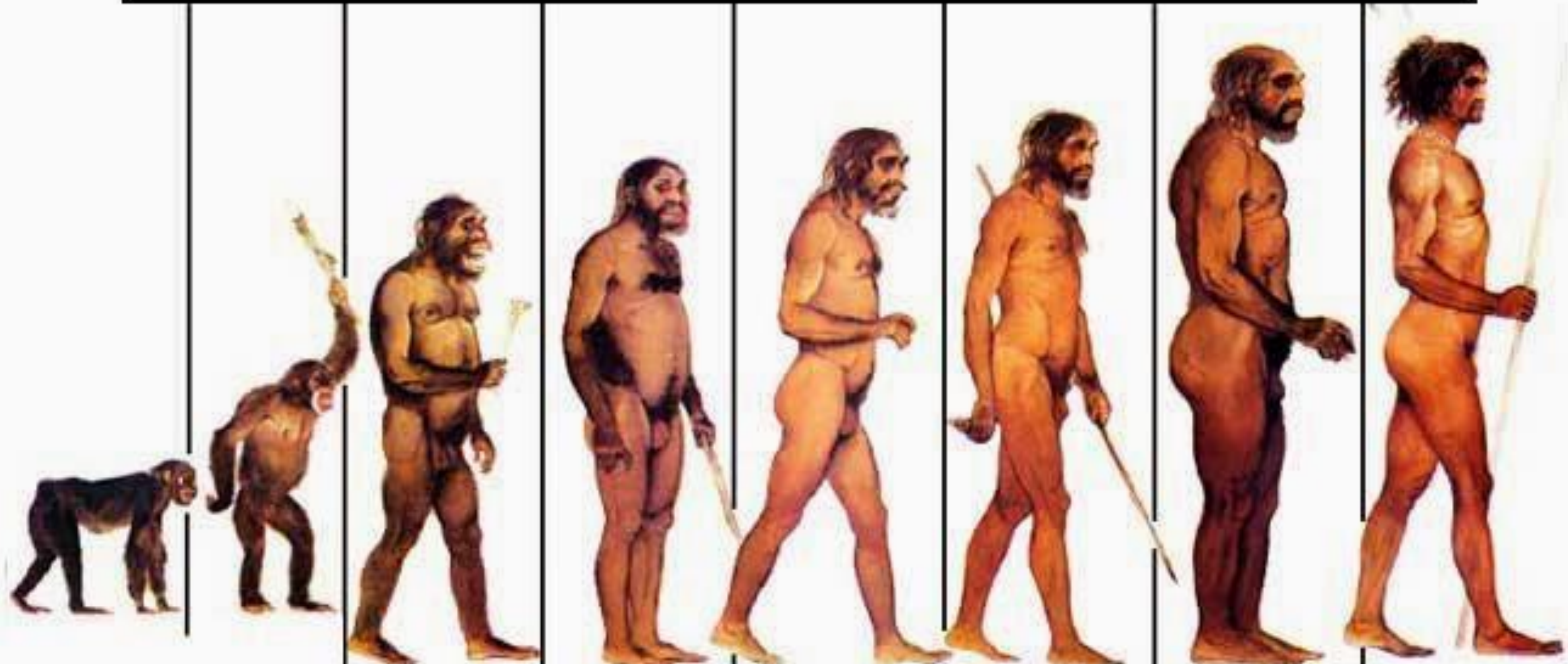
➢ **Inmunólogo:** estudiar cómo el sistema inmune actúa frente a agentes patógenos.

- **Microbiólogo agrícola**: estudia efectos de los microorganismos sobre la agricultura. Trabajan en combatir enfermedades de las plantas que atacan a los cultivos alimentarios. Trabajan en métodos que aumentan fertilidad del suelo. Biopesticidas.
- **Ecólogo microbiano:** estudian relaciones entre microorganismos y sus hábitats. Tratamiento biológico de basuras.
- **Microbiólogo de alimentos:** evitar putrefacción de los alimentos y transmisión de enfermedades alimentarias, elaboración de productos por medio de microorganismos (pan), mejorar procesos industriales (conservantes biológicos).
- **Microbiólogo industrial:** elaboración de antibióticos, vacunas, vitaminas, aminoácidos, liberación minerales valiosos…
- **Microbiólogos de investigación básica:** fisiología, bioquímica, genética, biología molecular**…**
- **MUCHAS OTRAS INCUMBENCIAS…**

Vida en la Tierra a traves del tiempo



LA EVOLUCIÓN DEL HOMBRE



Ancestro Común

Hace 5 ó 6 millones de año

Australopithecus

Existió hace 4 mill. de años.

De tamaño similar al de un gorila

Logra una marcha bípeda (de dos pies)

Homo habilis

Los primeros humanos.

Exiistió hace 2.5 mill. de años.

Tiene un cerebro 30% mas grande que el del Australopithecus.

Homo erectus

1.5 mill. de años.

Mejora su marcha bípeda e incrementa su capacidad craneana

Homo neanderthalensis

El hombre del Neanderthal. Tiene una edad de 400 mil años.

Humanos arcaicos y capaces de comunicarse.

Homo sapiens

250 mil años.

Humanos premodernos con cráneo casi esférico.

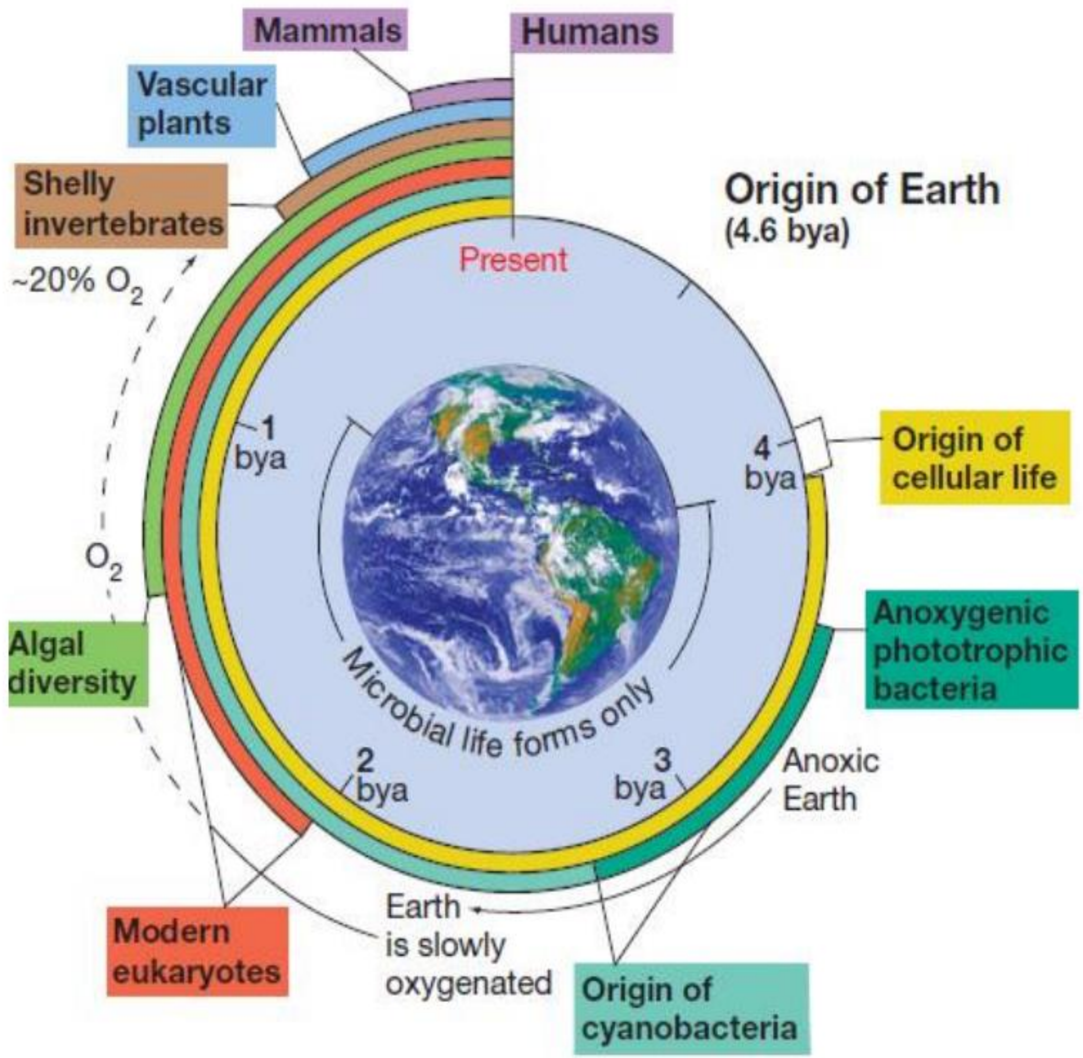
Homo sapiens sapiens

100 mil años.

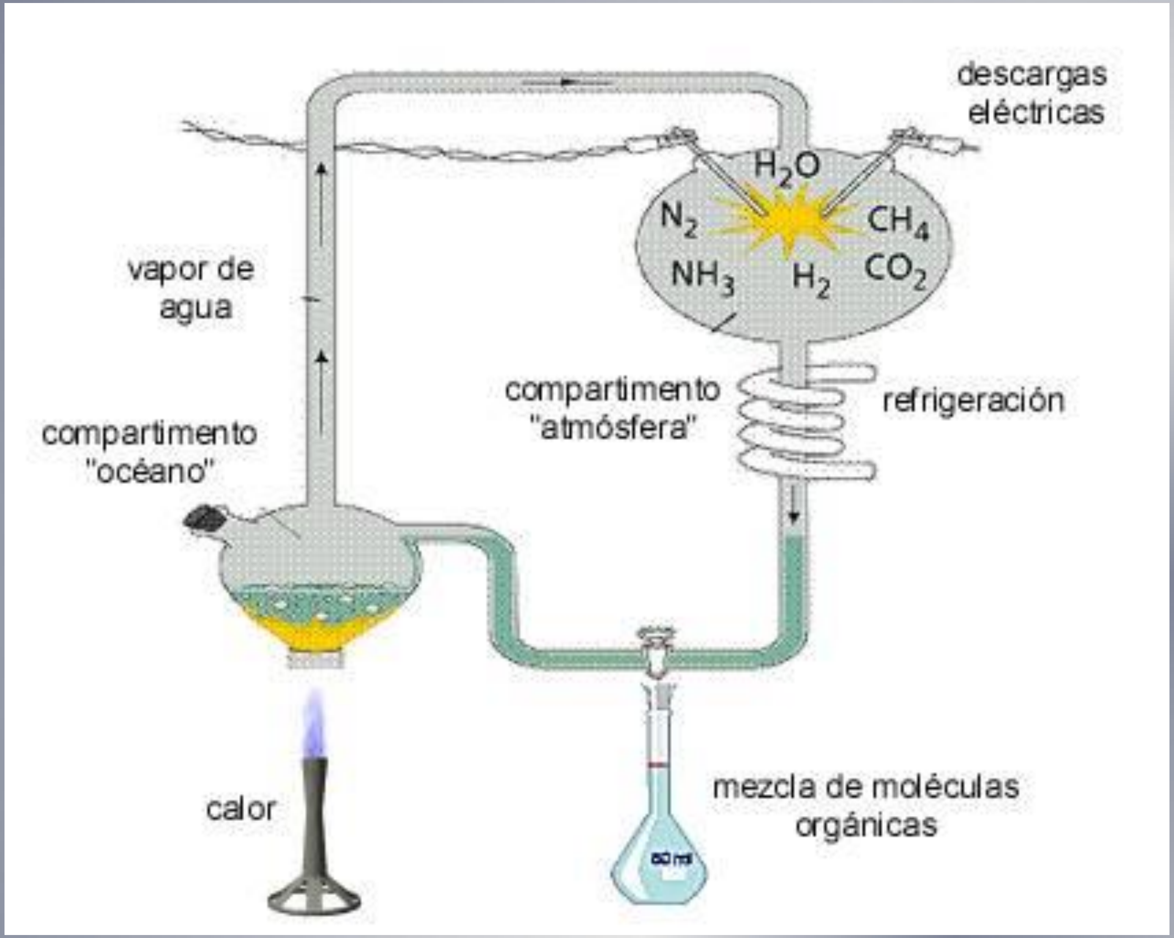
Humanos anatómicamente modernos.

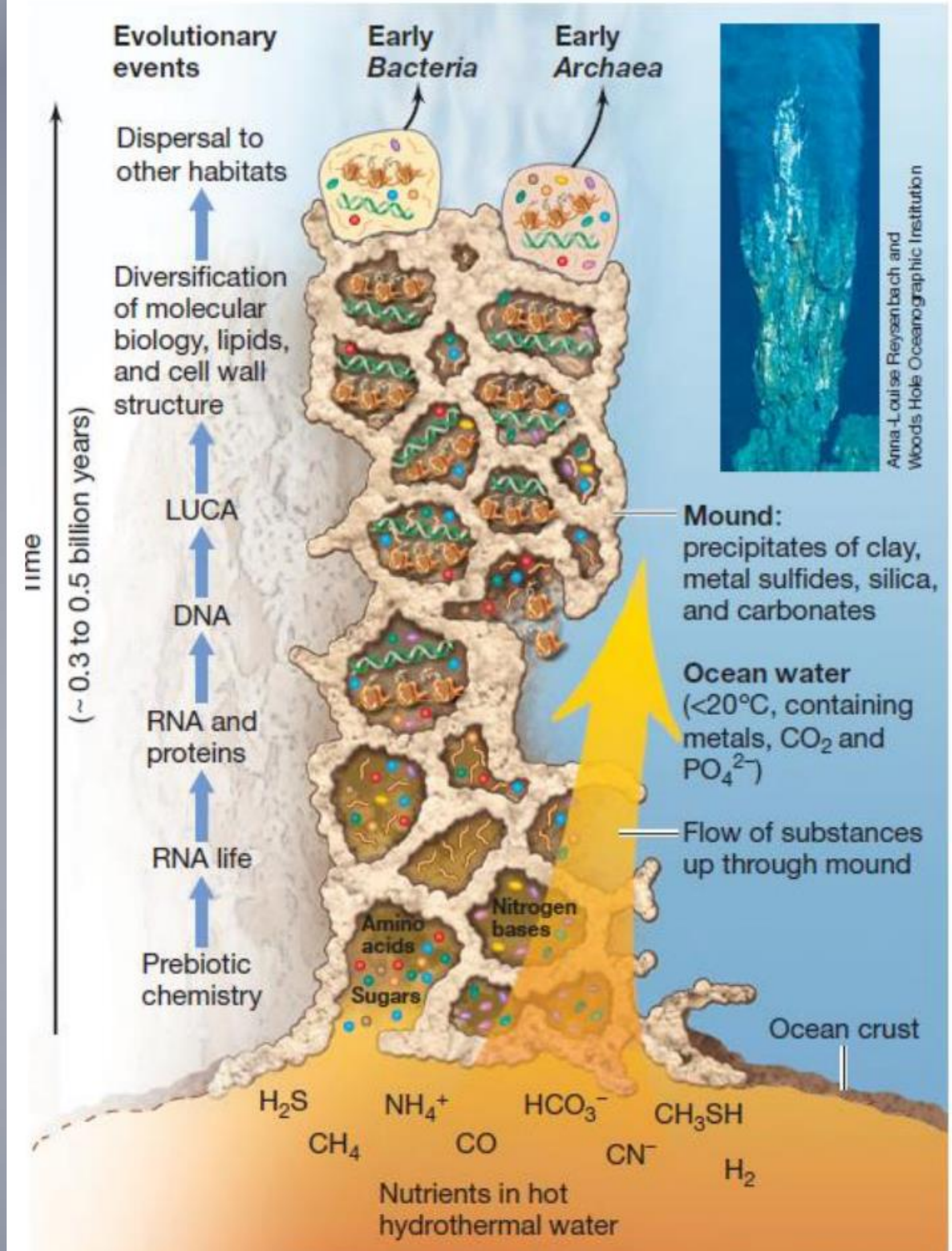
TEORÍA DE OPARÍN Y HALDANE

Vida en la Tierra a traves del tiempo



TEORÍA DE OPARÍN Y HALDANE

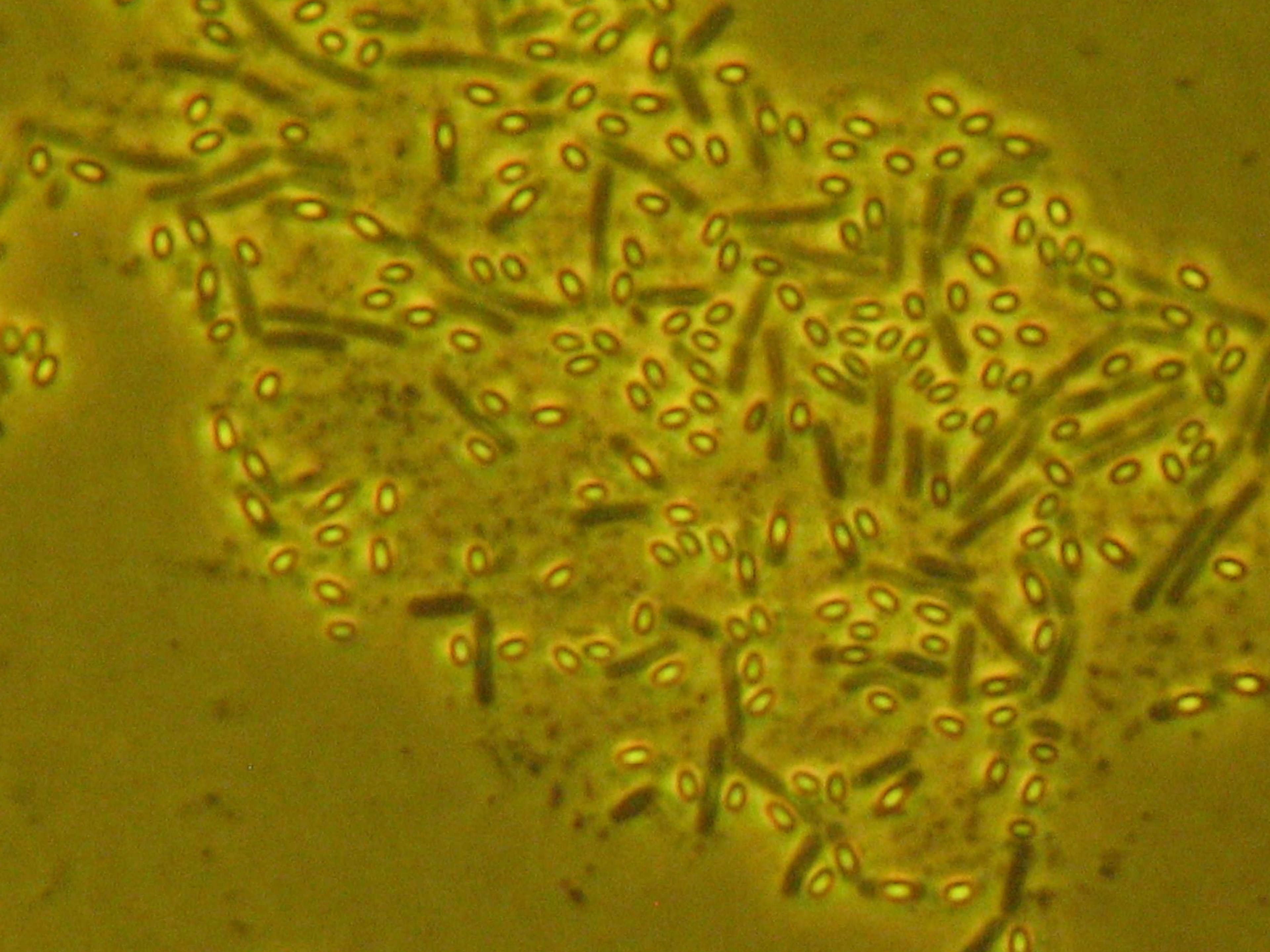


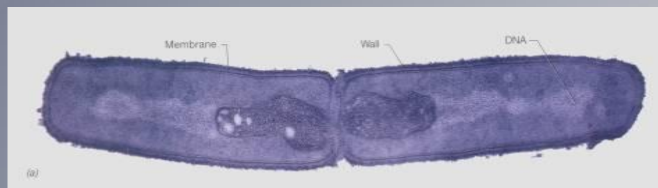

Evolutionary events
Early Bacteria
Early Archaea
Time (~ 0.3 to 0.5 billion years)
Dispersal to other habitats
Diversification of molecular biology, lipids, and cell wall structure
LUCA
DNA
RNA and proteins
RNA life
Prebiotic chemistry
Amino acids
Nitrogen bases
Sugars
Anna-Louise Reysenbach and Woods Hole Oceanographic Institution
Mound: precipitates of clay, metal sulfides, silica, and carbonates
Ocean water (<20°C, containing metals, CO_2 and PO_4^{2-})
Flow of substances up through mound
Ocean crust
H_2S
NH_4^+
HCO_3^-
CH_3SH
CH_4
CO
CN^-
H_2
Nutrients in hot hydrothermal water

Estromatolitos en Socompa (Salta)

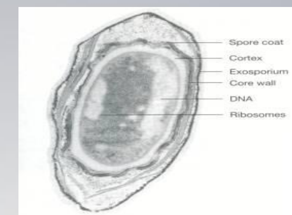
OTRA HIPÓTESIS

LA LITOPANSPERMIA





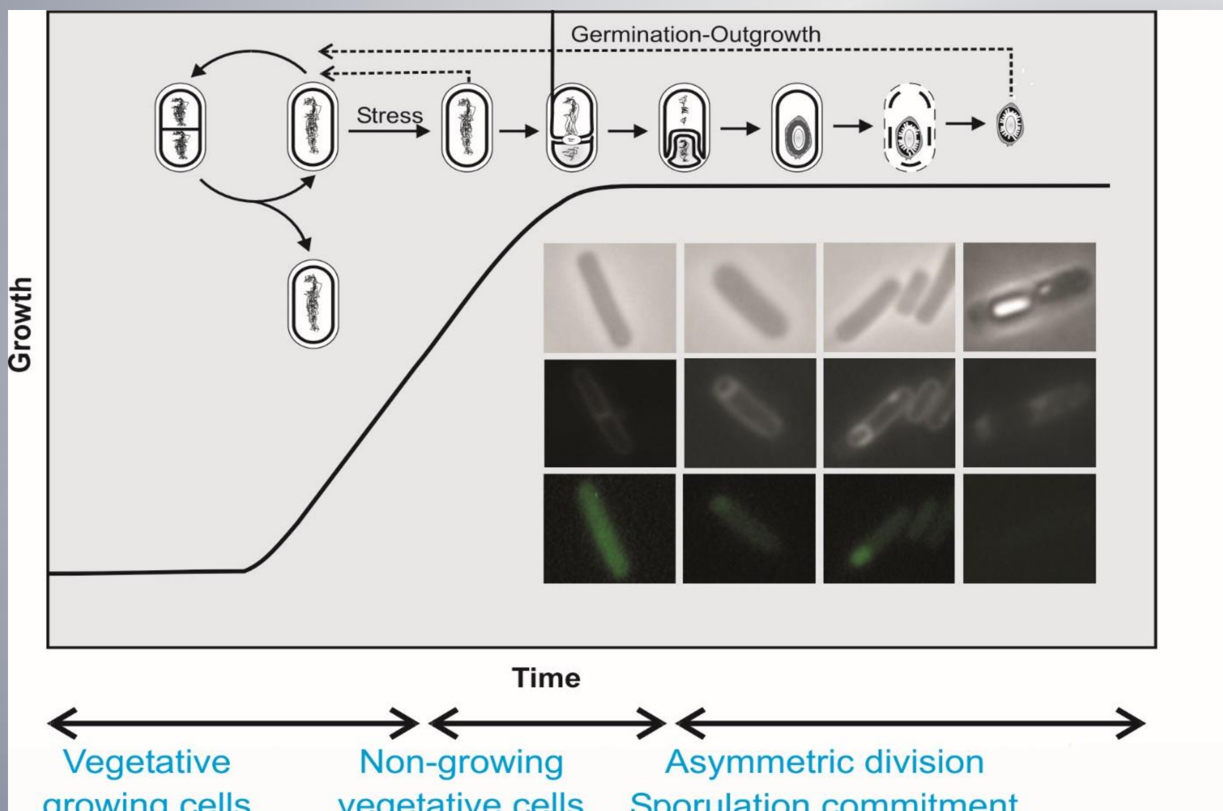
HAMBREADO

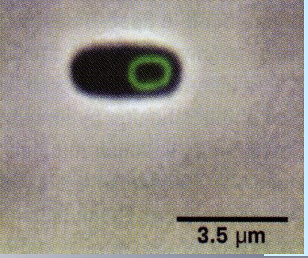


CÉLULA VEGETATIVA

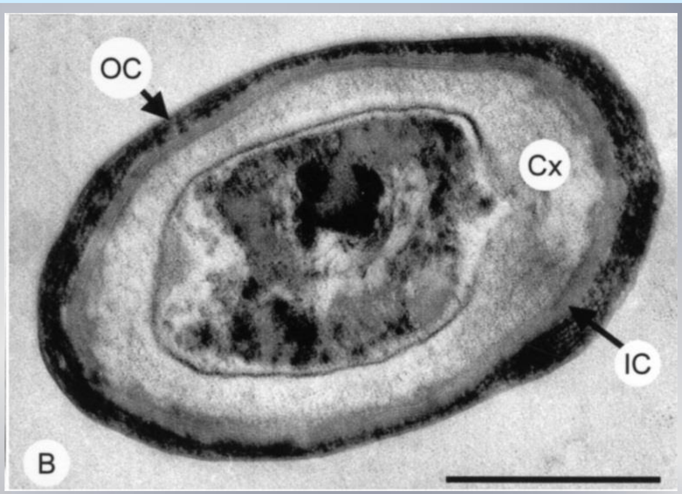
DESARROLLO

ESPORA





ALGUNAS PROPIEDADES DE LAS ESPORAS BACTERIANAS

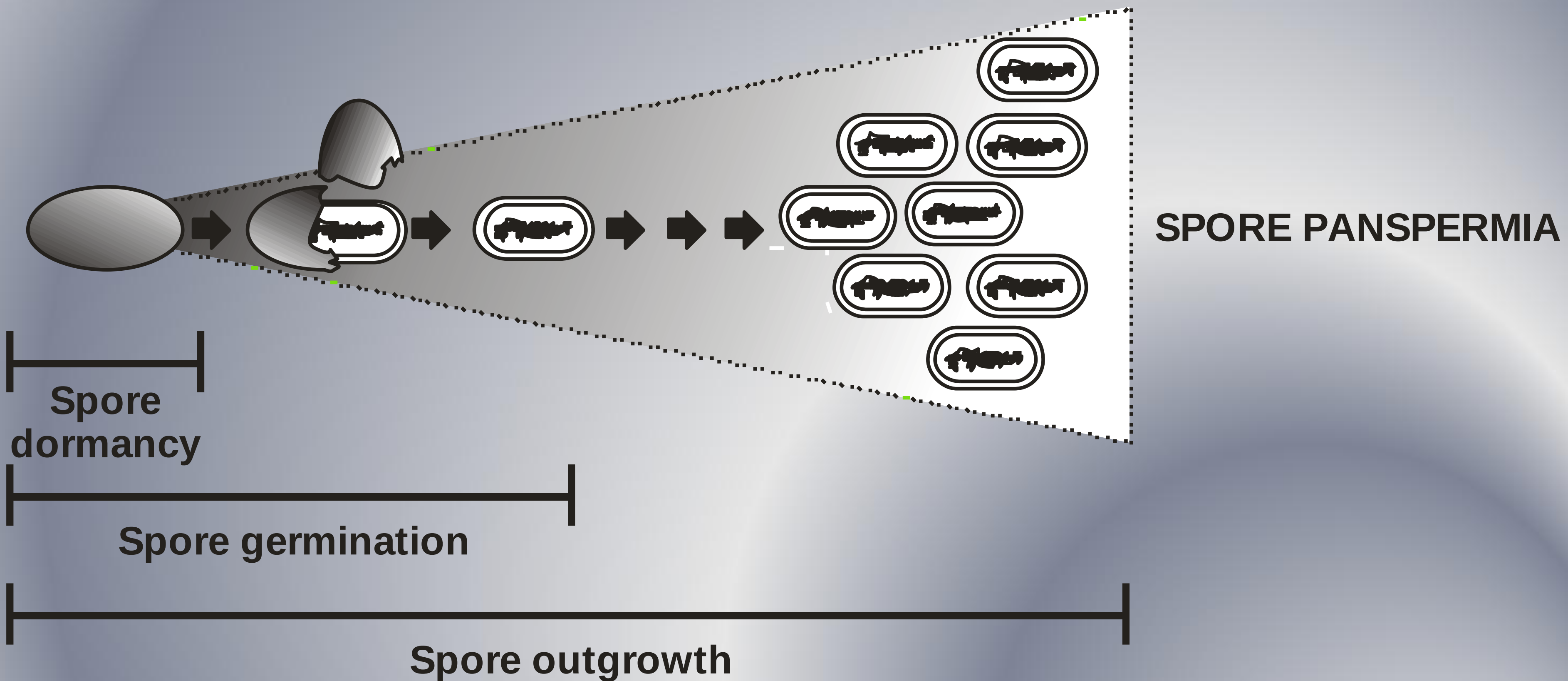


- **Resistencia a las temperaturas extremas,**
- **Resistencia a la desecación y la presión,**
- **Resistencia a los cambiosa de pH y salinidad,**
- **Resistencia a la radiación UV y solar,**
- **Resistencia a los procesos industriales de fabricación,**
- **Resistencia a los ataques por enzimas y detergentes,**

- **100% durmientes, metabolismo cero, agua cero, actividad enzimática cero,**

- **Alta longevidad (las esporas bacterianas son prácticamente inmortales e indestructibles)**

GERMINACIÓN, MULTIPLICACIÓN Y DISEMINACIÓN

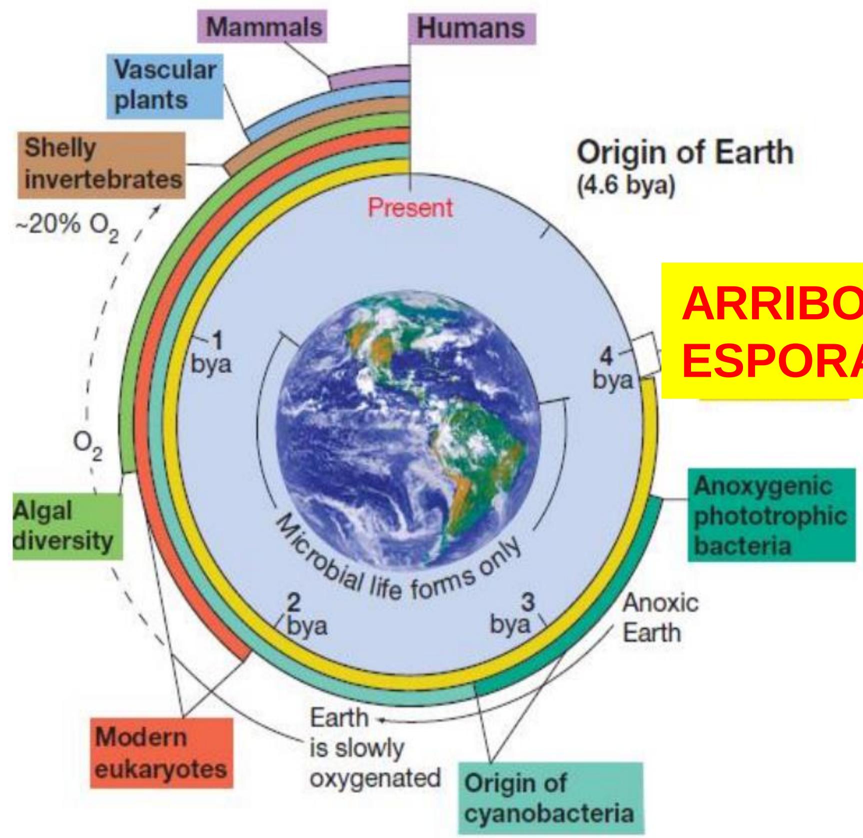


Resistance of *Bacillus* Endospores to Extreme Terrestrial and Extraterrestrial Environments

WAYNE L. NICHOLSON,[1*] NOBUO MUNAKATA,[2] GERDA HORNECK,[3] HENRY J. MELOSH,[4] AND PETER SETLOW[5]

Department of Veterinary Science and Microbiology[1] and Lunar and Planetary Laboratory,[4] University of Arizona, Tucson, Arizona 85721; Radiobiology Division, National Cancer Center Research Institute, Tokyo, Japan 104-0045[2]; Radiobiology Section, DLR, Institute of Aerospace Medicine, Cologne, Germany[3]; and Department of Biochemistry, University of Connecticut Health Center, Farmington, Connecticut 06032[5]

Vida en la Tierra a traves del tiempo

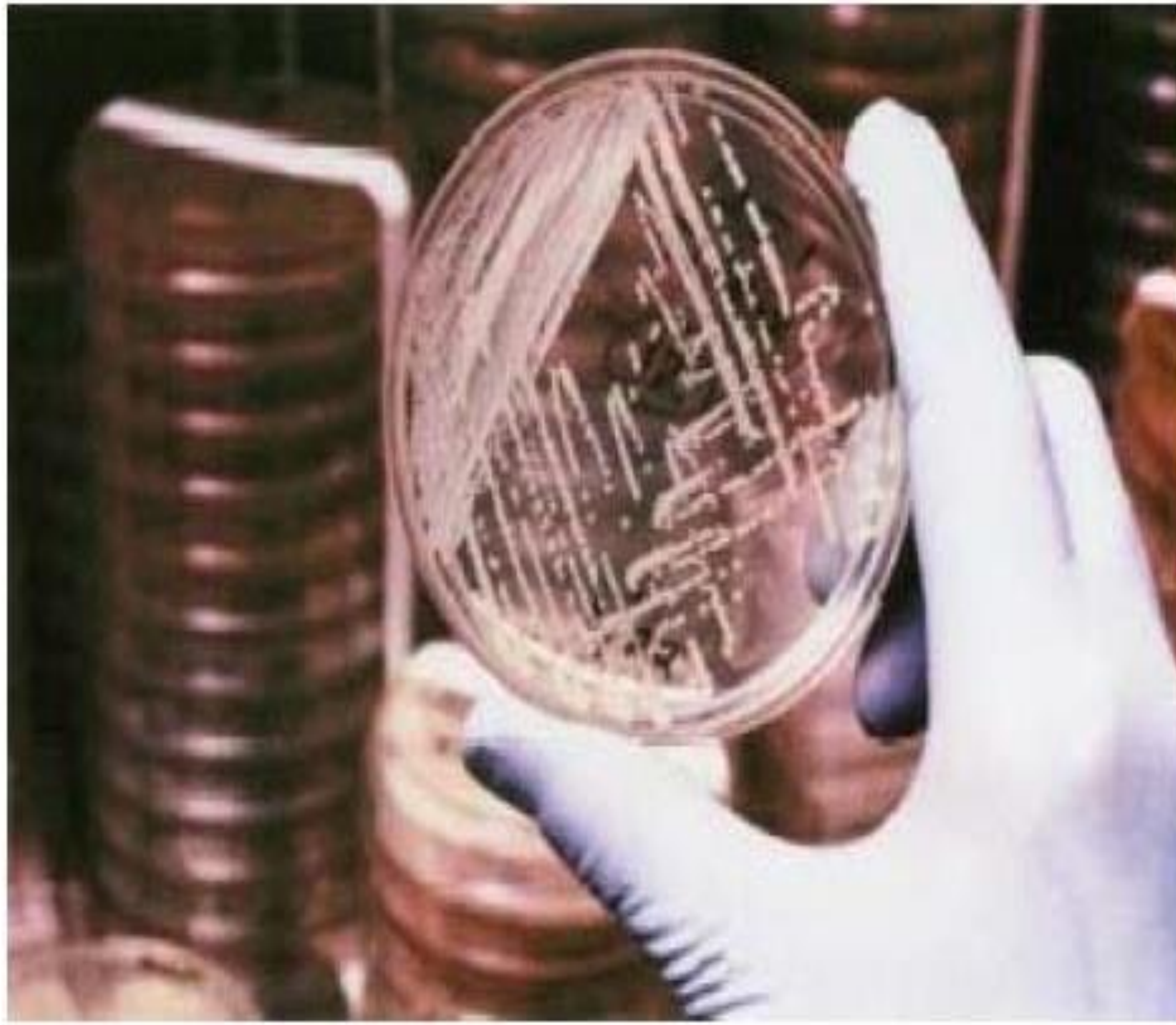


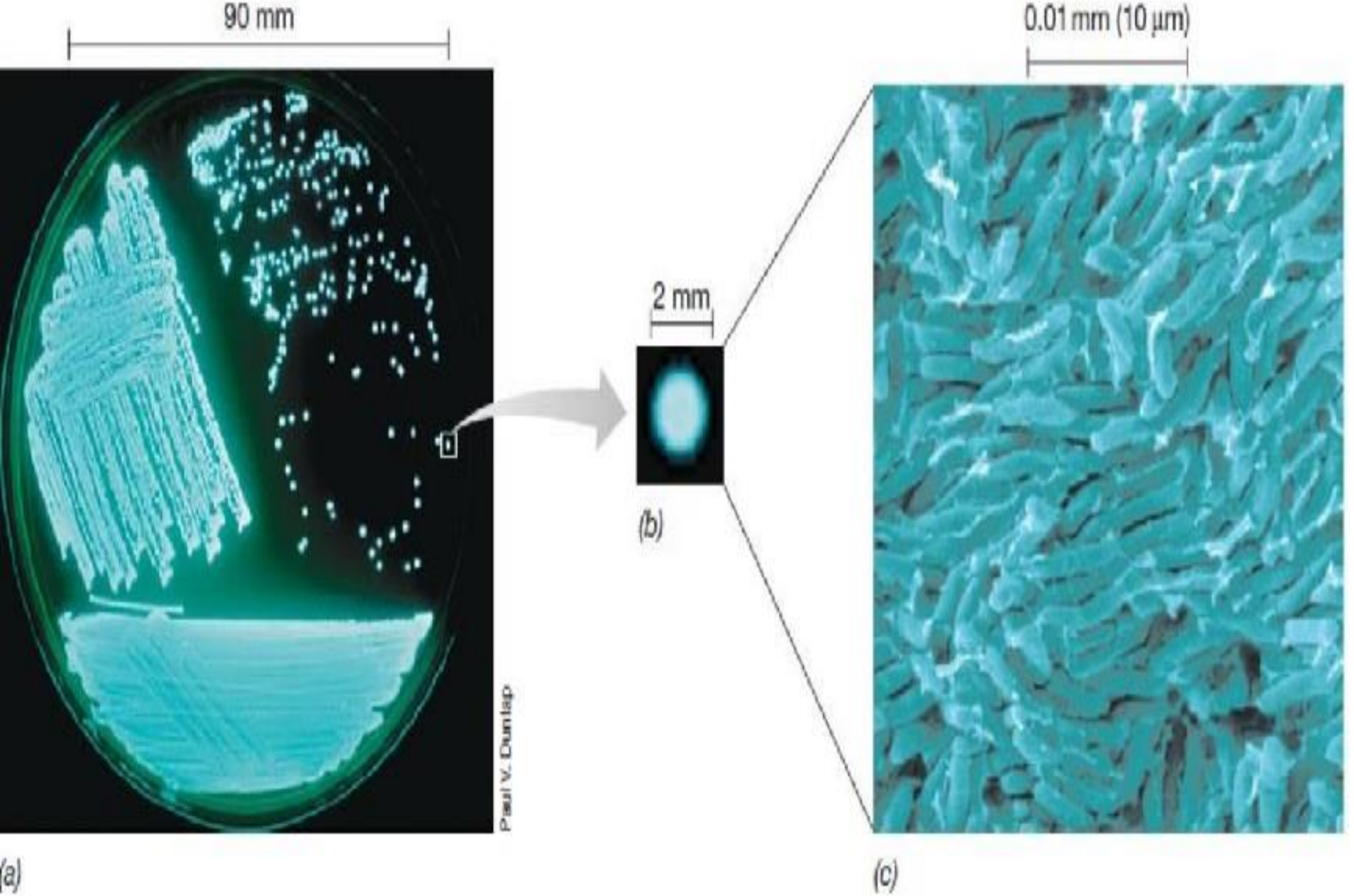
ARRIBO DE LAS ESPORAS

SEA CUAL SEA LA TEORÍA MÁS ACERTADA

LOS MICROBIOS, PARECIERA SER, ESTUVIERON PRIMERO

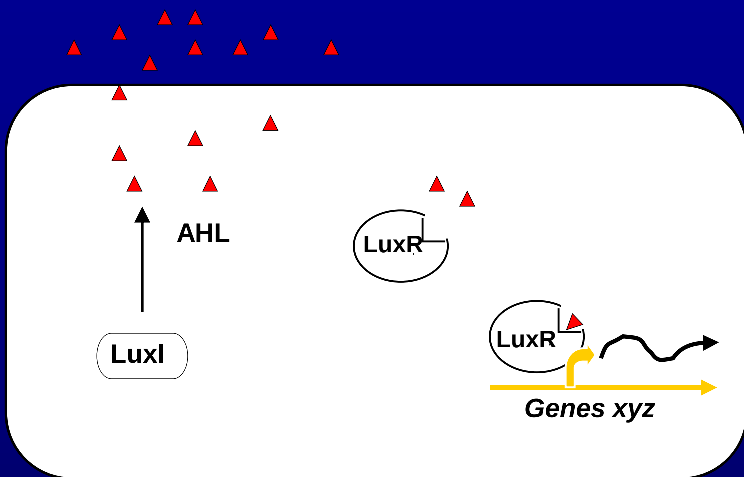
Un cultivo puro
es aquel en que
todos los
microorganismos
provienen
de una sola
célula

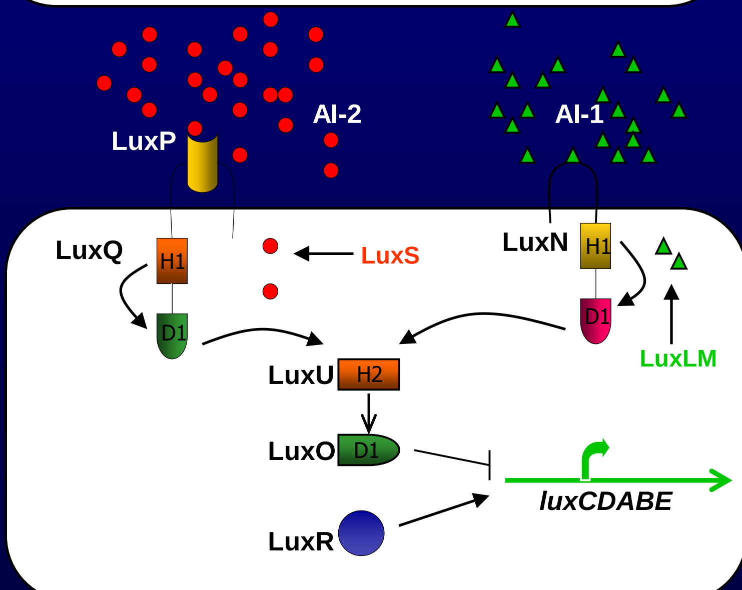



90 mm
Paul V. Dunlap
2 mm
0.01 mm (10 µm)
(a)
(b)
(c)

Señalización bacteri

	AI-1 (AHL)	AIPs	AI-2
Gram (+)	-	+	+
Gram (-)	+	-	+





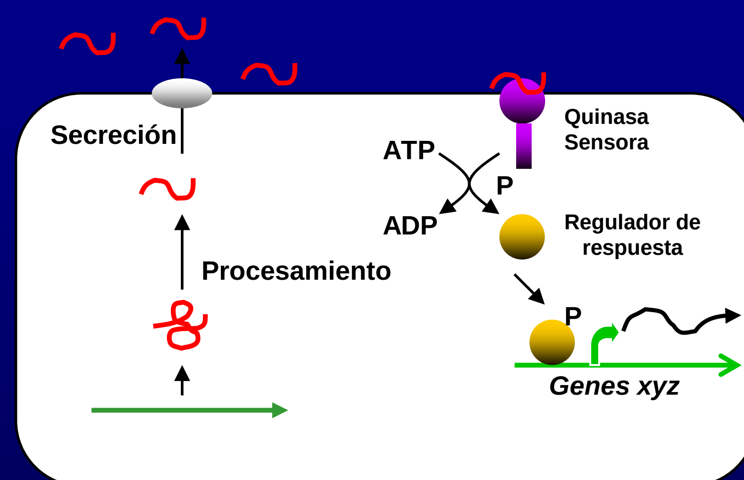


Table 1. Phylogenetic association of known AHL systems

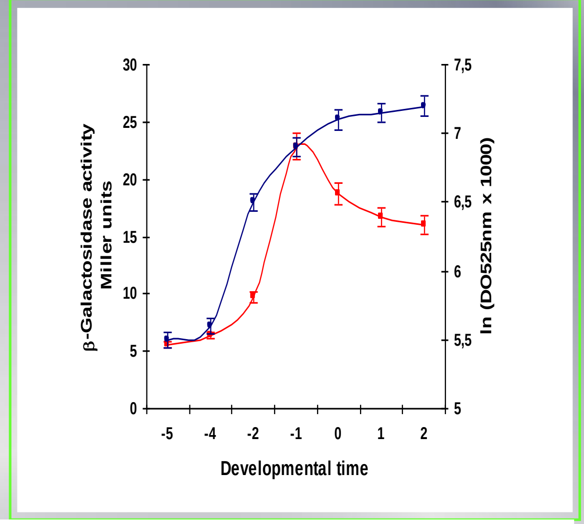
Class	Order	No. families with AHL system/ total families	No. genera with AHL system/ total genera	No. species with AHL system*
Alpha *Proteobacteria*	Rhodospirillales	0/2	0/24	0
	Rickettsiales	0/3	0/17	0
	Rhodobacterales	1/1	2/23	2
	Sphingomonadales	0/1	0/9	0
	Caulobacterales	0/1	0/4	0
	Rhizobiales	3/10	5/56	8
	All orders (6)	4/18 (22%)	7/133 (5%)	
Beta *Proteobacteria*	Burkholderiales	2/5	2/33	3
	Hydrogenophilales	0/1	0/2	0
	Methylophilales	0/1	0/3	0
	Neisseriales	1/1	1/14	1
	Nitrosomonadales	1/3	1/4	1
	Rhodocyclales	0/1	0/8	0
	All orders (6)	4/12 (33%)	4/56 (7%)	
Gamma *Proteobacteria*	Chromatiales	0/2	0/30	0
	Acidithiobacillales	0/2	0/2	0
	Zanthomonadales	0/1	0/9	0
	Cardiobacteriales	0/1	0/3	0
	Thiotrichales	0/3	0/15	0
	Legionellales	0/2	0/3	0
	Methylococcales	0/1	0/6	0
	Oceanspirillales	0/2	0/12	0
	Pseudomonadales	1/2	1/28	8
	Altermonadales	0/1	0/12	0
	Vibrionales	1/1	2/6	3
	Aeromonadales	1/2	1/7	2
	Enterobacteriales	1/1	6/41	14
	Pasteurellales	0/1	0/6	0
	All orders (14)	4/22 (18%)	10/180 (5%)	
Delta *Proteobacteria*	All orders (7)	0/18	0/55	0
Epsilon *Proteobacteria*	All orders (1)	0/2	0/6	0
Proteobacteria	All orders (34)	12/72 (17%)	21/438 (4%)	42

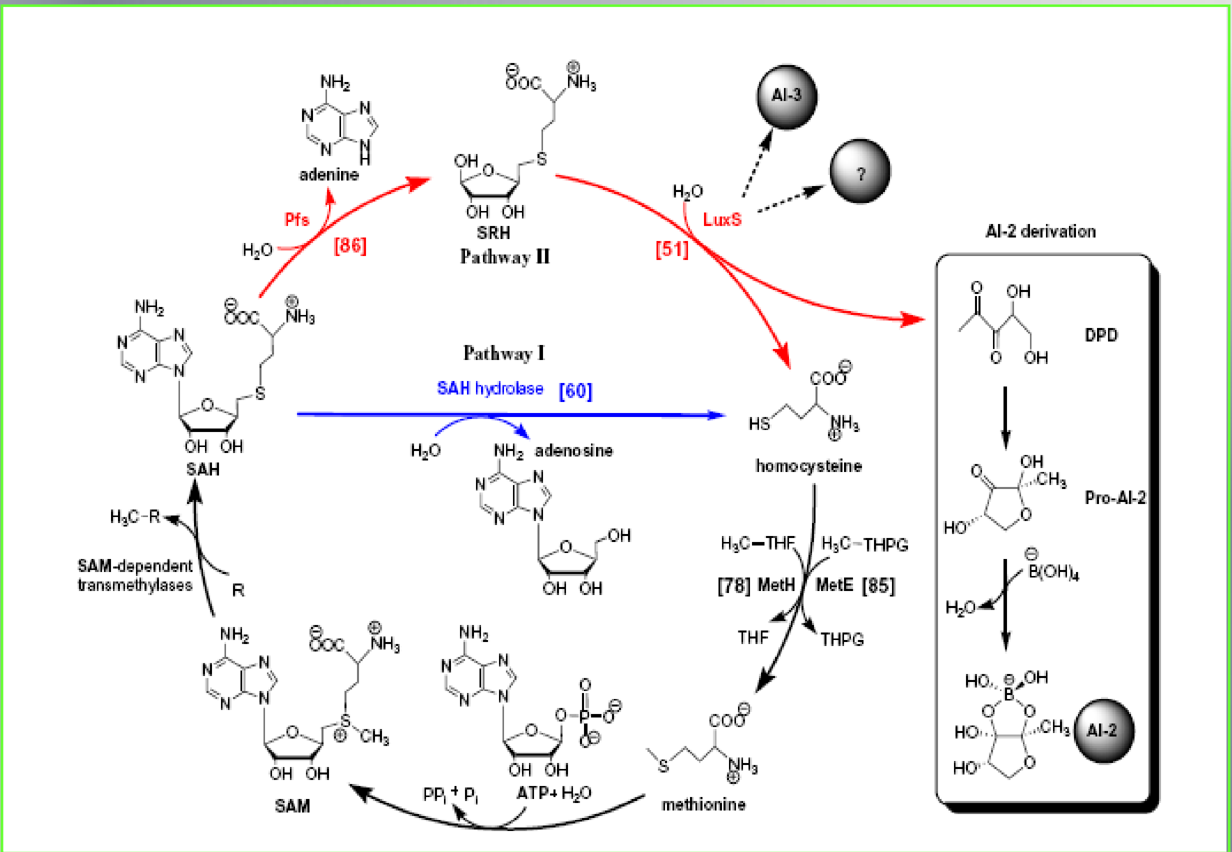
* Note that lists of bacterial species with AHL systems are notoriously difficult to keep up-to-date.

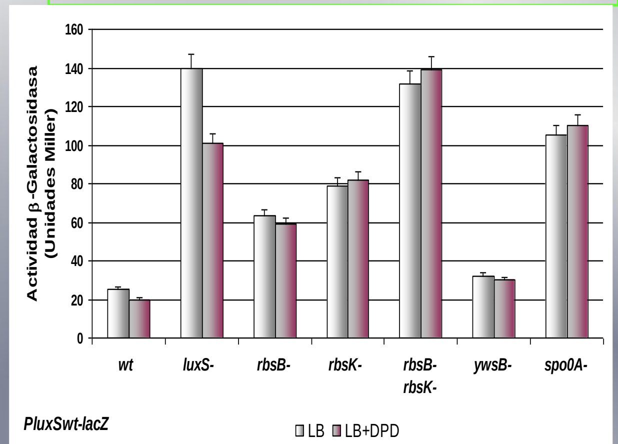

26 11:56

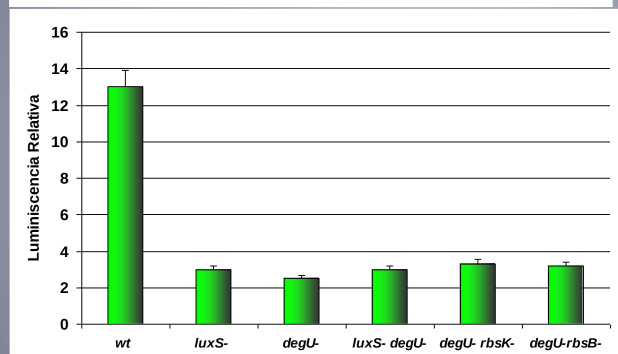
Social behavior and cell to cell communication

	AI-1 (AHL)	AIPs	AI-2
Gram (+)	-	+	+
Gram (-)	+	-	+



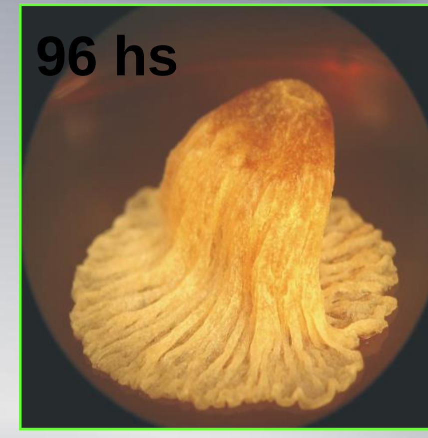




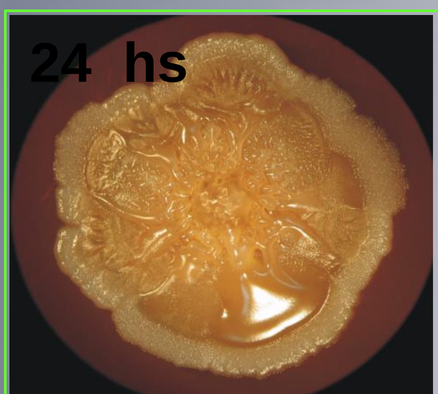


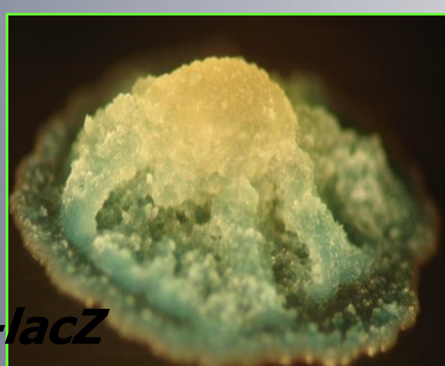
AI-2, a morphogen like signal for intraspecific behavior

AI-2 +

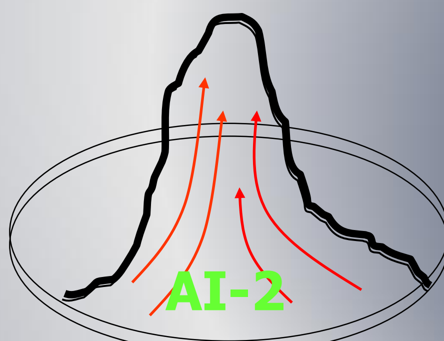


AI-2 -





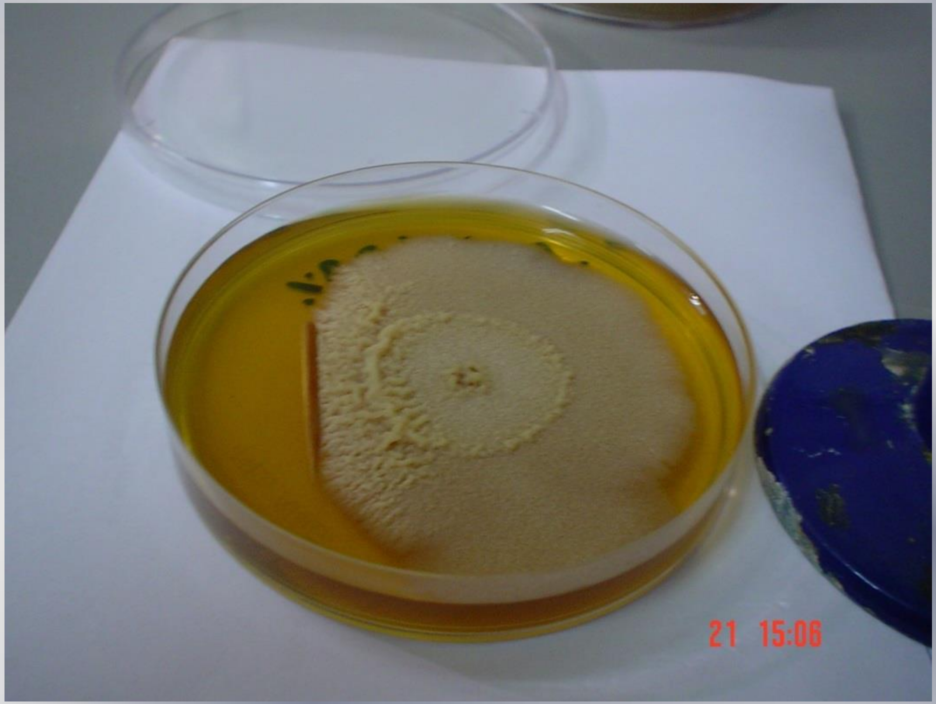
luxS-lacZ



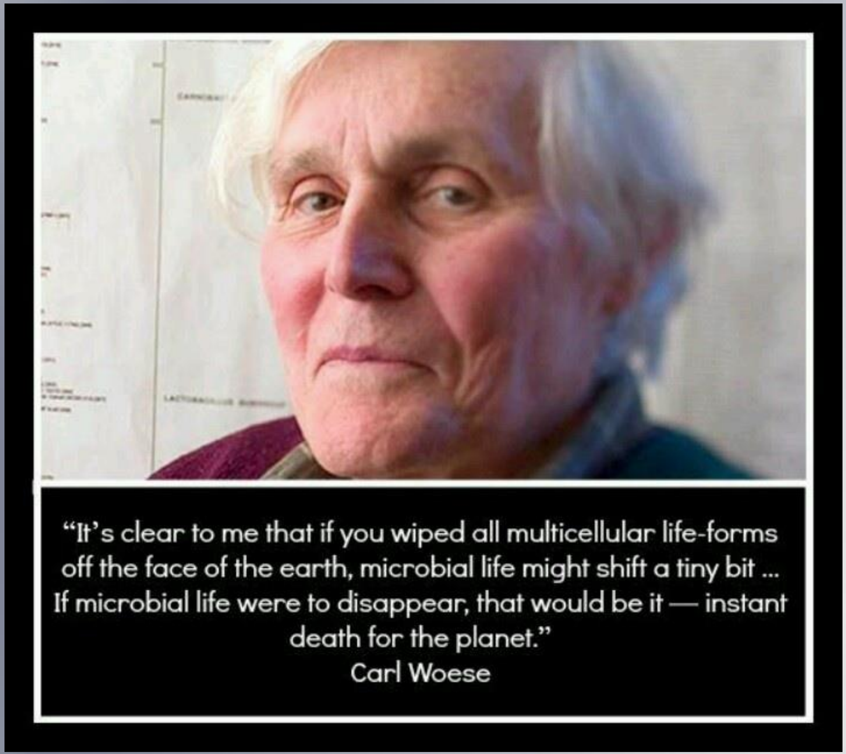

15 13:14

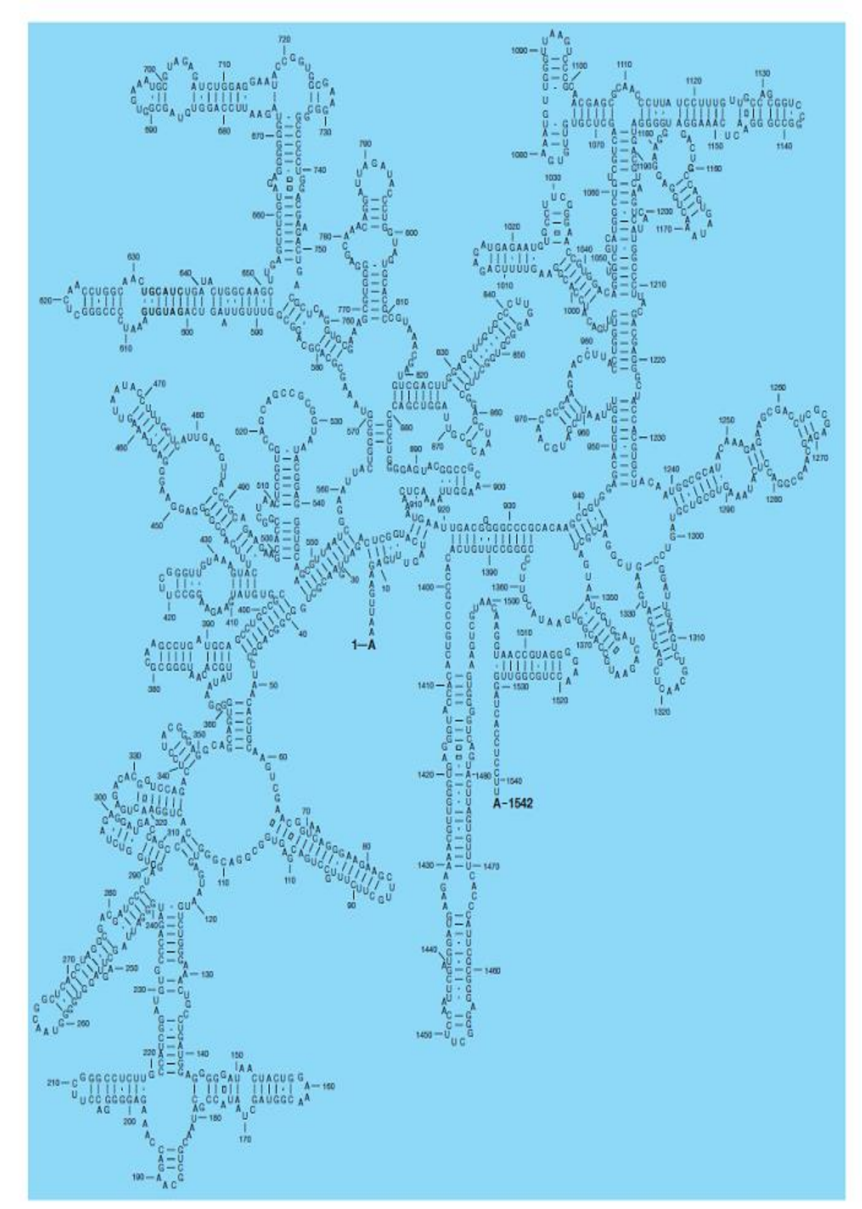

IND. ARG

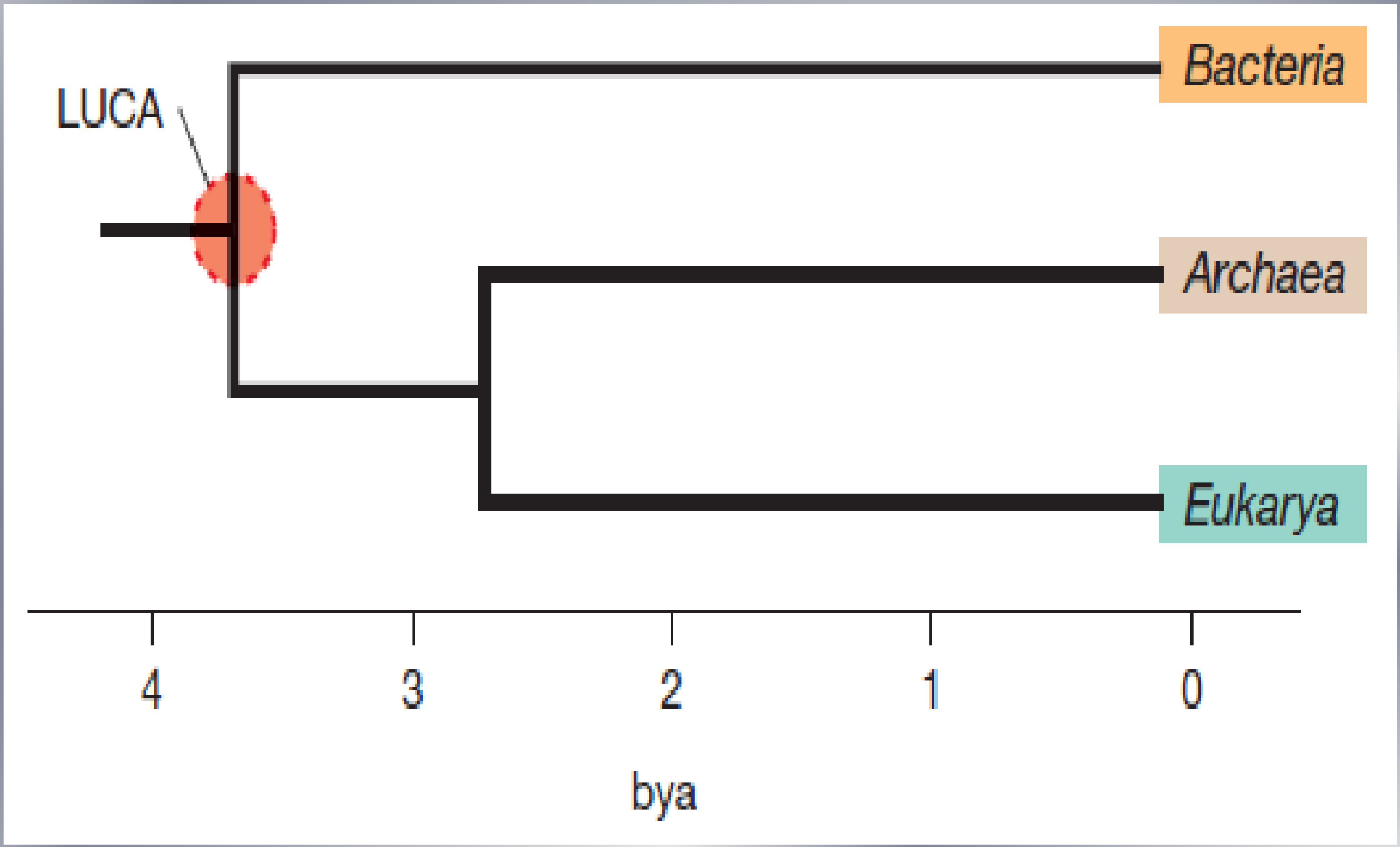

6 12:41

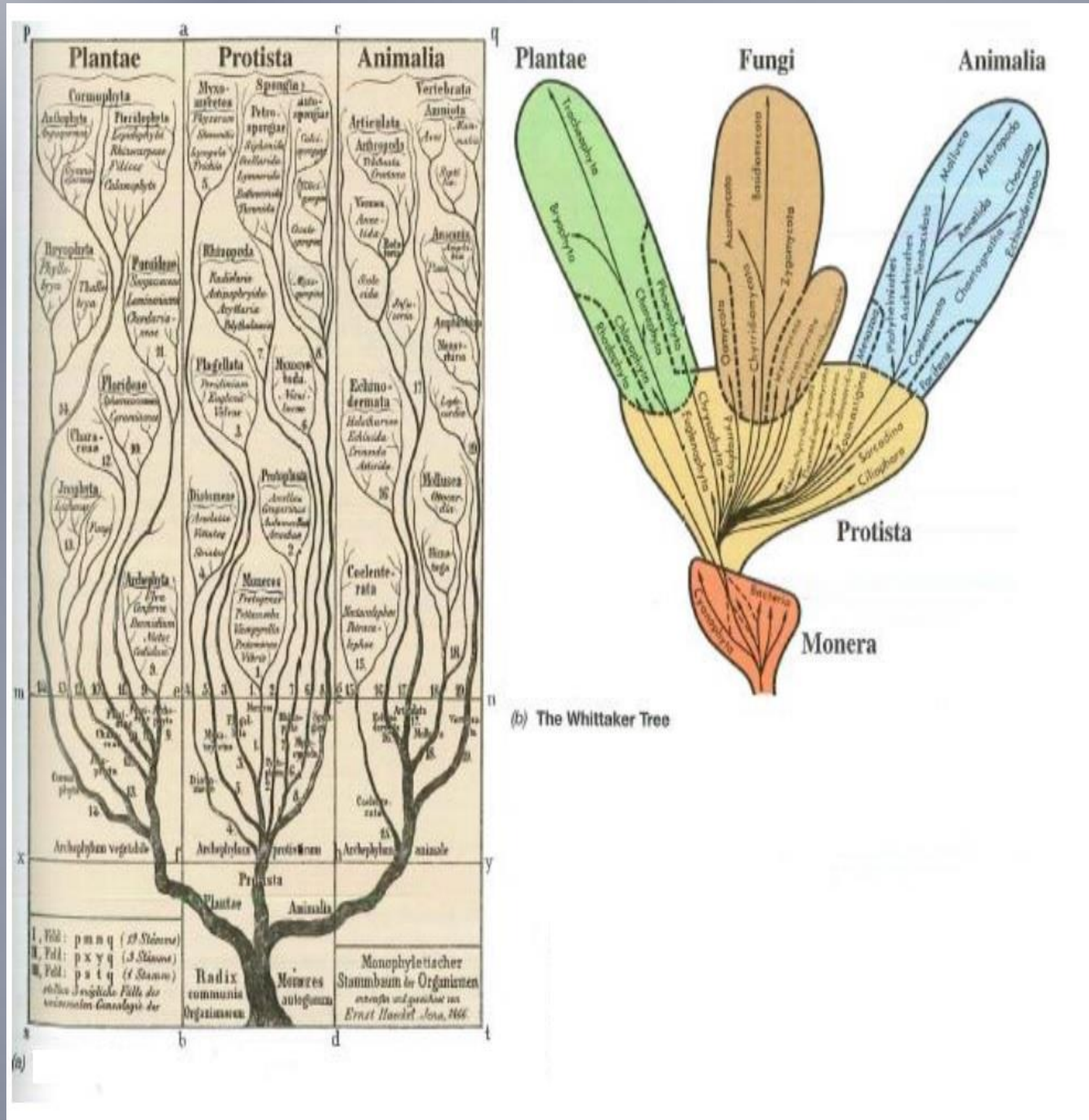

21 15:06

CARL WOESE

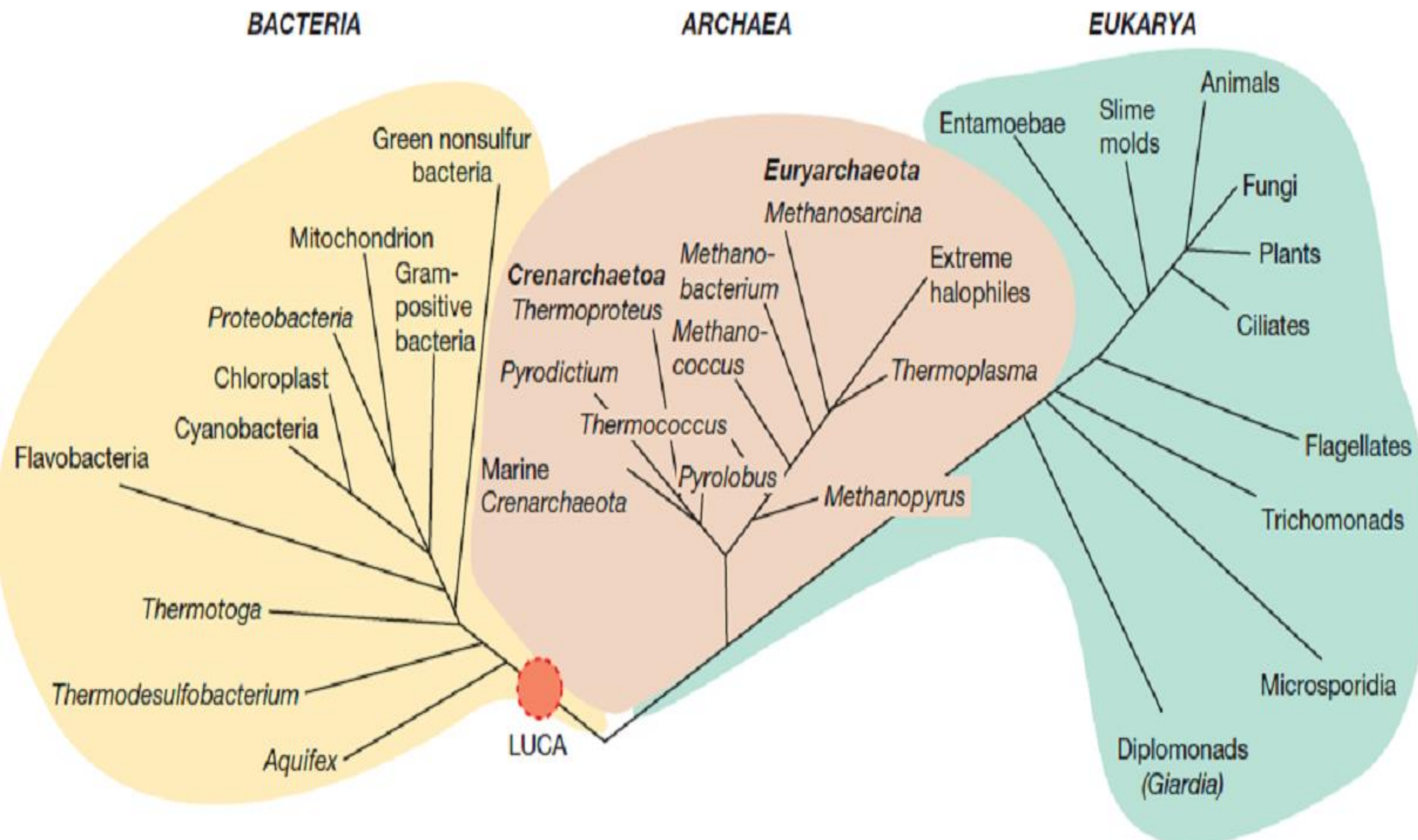

"It's clear to me that if you wiped all multicellular life-forms off the face of the earth, microbial life might shift a tiny bit ... If microbial life were to disappear, that would be it — instant death for the planet."
Carl Woese


1–A
A–1542


LUCA
Bacteria
Archaea
Eukarya
4
3
2
1
0
bya



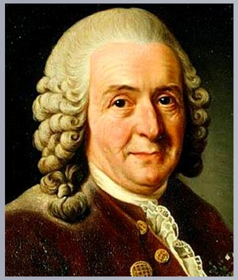
ESTE ÁRBOL ES ABANDONADO POR….


BACTERIA
ARCHAEA
EUKARYA
Green nonsulfur bacteria
Mitochondrion
Gram-positive bacteria
Proteobacteria
Chloroplast
Cyanobacteria
Flavobacteria
Thermotoga
Thermodesulfobacterium
Aquifex
LUCA
Crenarchaetoa
Thermoproteus
Pyrodictium
Thermococcus
Marine Crenarchaeota
Pyrolobus
Euryarchaeota
Methanosarcina
Methano-bacterium
Methano-coccus
Extreme halophiles
Thermoplasma
Methanopyrus
Entamoebae
Slime molds
Animals
Fungi
Plants
Ciliates
Flagellates
Trichomonads
Microsporidia
Diplomonads (Giardia)

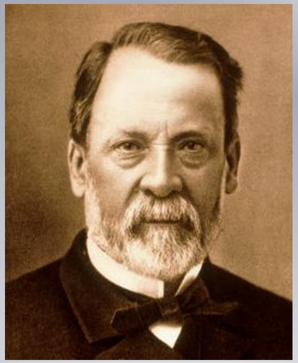
HISTORIA DE LA MICROBIOLOGÍA

Robert Hooke [1665]
Primera observación de las células.

Anton van Leeuwenhoek [1673]
Primera observación de microorganismos vivos.

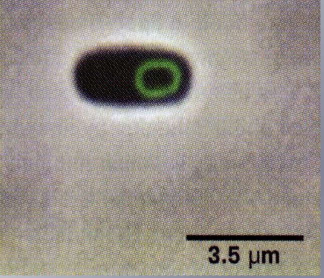


Carl Nilsson Linæus [1735]
Nomenclatura de los microorganismos.



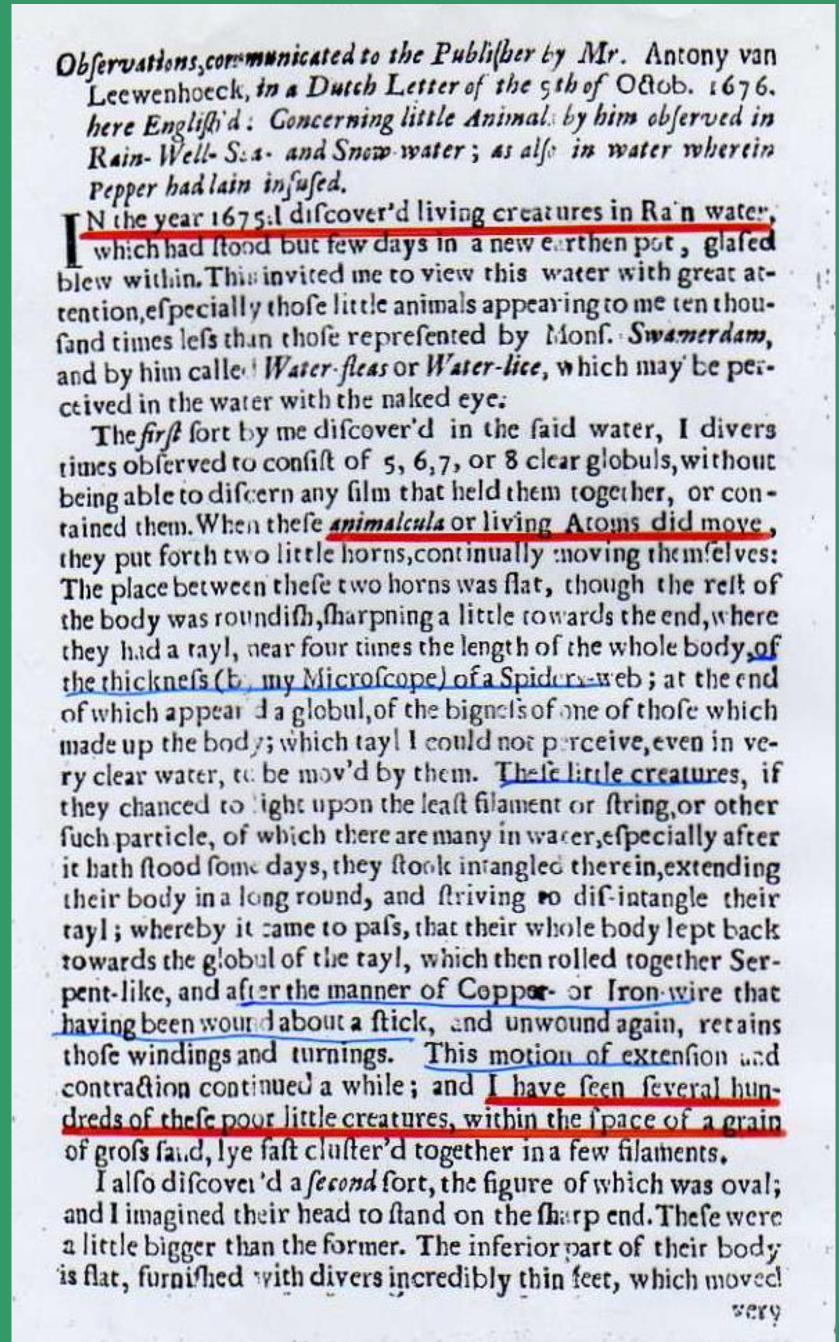
Louis Pasteur [1857 a 1864]
Fermentación, desmoronamiento de la teoría de la generación espontánea, pasteurización.

Robert Koch [1876 a 1883]
Teoría germinal de la enfermedad, cultivos puros, *Mycobacterium tuberculosis*, vibrio cholerae.



FINES DEL SIGLO XVII DESCUBRIMIENTO DE LAS BACTERIAS

PADRE DE LA MICROBIOLOGÍA



Obſervations, communicated to the Publiſher by Mr. Antony van Leewenhoeck, *in a Dutch Letter of the 9th of* Octob. 1676. *here Engliſh'd: Concerning little Animals by him obſerved in Rain- Well- Sea- and Snow-water; as alſo in water wherein Pepper had lain infuſed.*

IN the year 1675 I diſcover'd living creatures in Rain water, which had ſtood but few days in a new earthen pot, glaſed blew within. This invited me to view this water with great attention, eſpecially thoſe little animals appearing to me ten thouſand times leſs than thoſe repreſented by Monſ. *Swamerdam*, and by him called *Water-fleas* or *Water-lice*, which may be perceived in the water with the naked eye.

The *firſt* ſort by me diſcover'd in the ſaid water, I divers times obſerved to conſiſt of 5, 6, 7, or 8 clear globuls, without being able to diſcern any film that held them together, or contained them. When theſe *animalcula* or living Atoms did move, they put forth two little horns, continually moving themſelves: The place between theſe two horns was flat, though the reſt of the body was roundiſh, ſharpning a little towards the end, where they had a tayl, near four times the length of the whole body, of the thickneſs (by my Microſcope) of a Spiders-web; at the end of which appear'd a globul, of the bigneſs of one of thoſe which made up the body; which tayl I could not perceive, even in very clear water, to be mov'd by them. Theſe little creatures, if they chanced to light upon the leaſt filament or ſtring, or other ſuch particle, of which there are many in water, eſpecially after it hath ſtood ſome days, they ſtook intangled therein, extending their body in a long round, and ſtriving to dif-intangle their tayl; whereby it came to paſs, that their whole body lept back towards the globul of the tayl, which then rolled together Serpent-like, and after the manner of Copper- or Iron-wire that having been wound about a ſtick, and unwound again, retains thoſe windings and turnings. This motion of extenſion and contraction continued a while; and I have ſeen ſeveral hundreds of theſe poor little creatures, within the ſpace of a grain of groſs ſand, lye faſt cluſter'd together in a few filaments.

I alſo diſcover'd a *ſecond* ſort, the figure of which was oval; and I imagined their head to ſtand on the ſharp end. Theſe were a little bigger than the former. The inferior part of their body is flat, furniſhed with divers incredibly thin feet, which moved very

AHORA EN EL SIGLO XXI SABEMOS QUE LAS BACTERIAS ESTÁN POR TODAS PARTES MALAS

Prokaryotes: The unseen majority

William B. Whitman†, David C. Coleman‡, and William J. Wiebe§*

*Departments of *Microbiology, ‡Ecology, and §Marine Sciences, University of Georgia, Athens GA 30602*

ABSTRACT The number of prokaryotes and the total amount of their cellular carbon on earth are estimated to be 4–6 × 10^{30} cells and 350–550 Pg of C (1 Pg = 10^{15} g), respectively. Thus, the total amount of prokaryotic carbon is 60–100% of the estimated total carbon in plants, and inclusion of prokaryotic carbon in global models will almost double estimates of the amount of carbon stored in living organisms. In addition, the earth's prokaryotes contain 85–130 Pg of N and 9–14 Pg of P, or about 10-fold more of these nutrients than do plants, and represent the largest pool of these nutrients in living organisms. Most of the earth's prokaryotes occur in the open ocean, in soil, and in oceanic and terrestrial subsurfaces, where the numbers of cells are 1.2 × 10^{29}, 2.6 × 10^{29}, 3.5 × 10^{30}, and 0.25–2.5 × 10^{30}, respectively. The numbers of heterotrophic prokaryotes in the upper 200 m of the open ocean, the ocean below 200 m, and soil are consistent with average turnover times of 6–25 days, 0.8 yr, and 2.5 yr, respectively. Although subject to a great deal of uncertainty, the estimate for the average turnover time of prokaryotes in the subsurface is on the order of 1–2 × 10^3 yr. The cellular production rate for all prokaryotes on earth is estimated at 1.7 × 10^{30} cells/yr and is highest in the open ocean. The large population size and rapid growth of prokaryotes provides an enormous capacity for genetic diversity.

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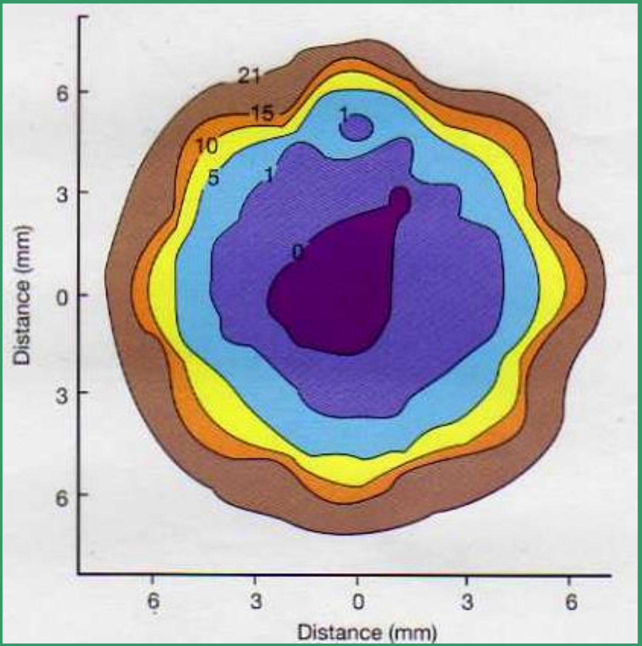
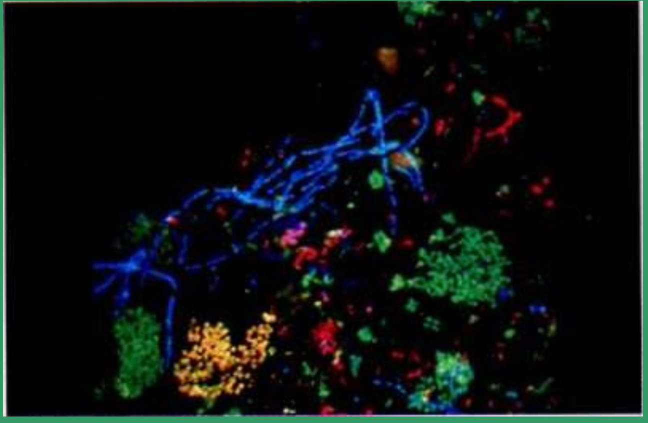




AHORA QUE LOS DESCUBRIMOS:
¿TODOS LOS MICROBIOS SON MALOS Y RESPONSABLES DE LOS MALES QUE AZOTARON LA HUMANIDAD?

LOS CUATRO JINETES DEL APOCALIPSIS:

1- LA MUERTE
2- LA GUERRA
3- EL HAMBRE
4- LA PESTE

Alberto Durero 1498

1. LOS CUATRO JINETES DEL APOCALIPSIS: la Peste, la Guerra, el Hambre y la Muerte. Alberto Durero talló en 1498 este grabado en madera, que muestra a la humanidad subyugada por estos azotes implacables. La peste negra que barrió Europa en el siglo XIV quedó en la memoria colectiva como una de las peores mortandades de la época.

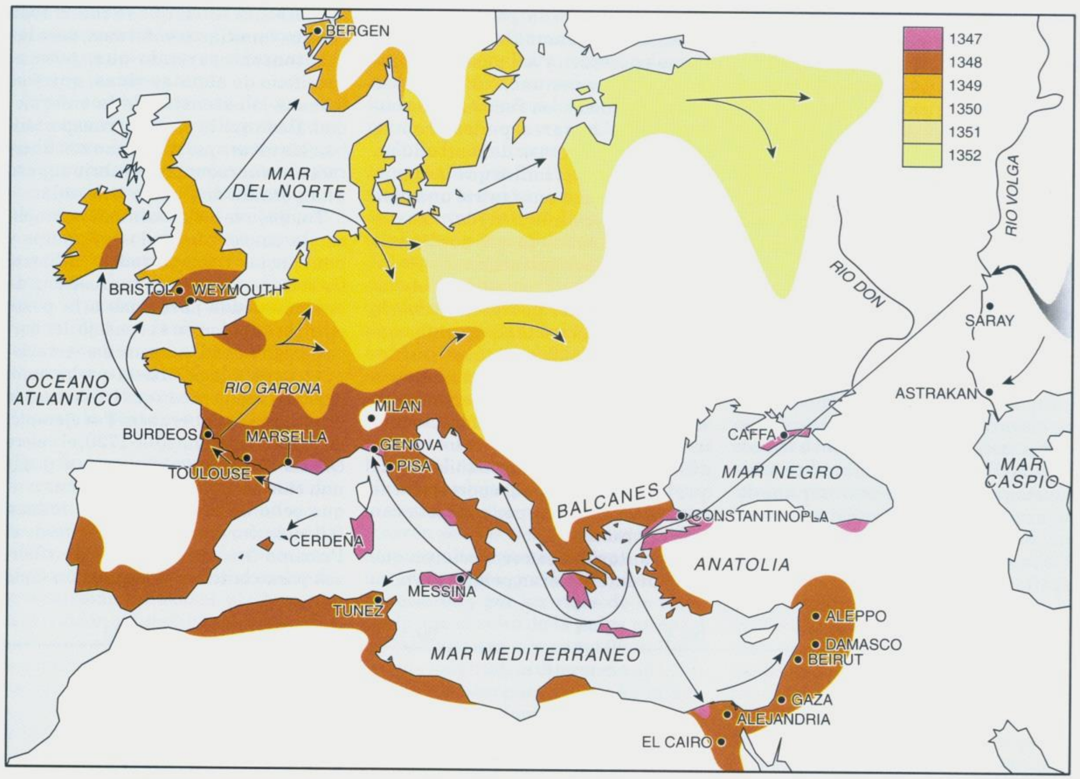
AHORA QUE LOS DESCUBRIMOS:

¿TODOS LOS MICROBIOS SON MALOS Y RESPONSABLES DE LOS MALES QUE AZOTARON LA HUMANIDAD?

2. VESTIMENTA USADA POR LOS MEDICOS durante el brote de peste que afectó a Marsella en 1720. Recubría a su portador de pies a cabeza; a ésta se le daba apariencia de pájaro, creyéndose que protegía del contagio. En el pico se depositaban hierbas aromáticas a modo de filtro del aire contagiado; la vara contenía incienso para despejar los miasmas. Incluso los orificios de los ojos ofrecían protección, recubiertos de cristal.

14

FINES DEL SIGLO XIV, POR LA RUTA DE LA SEDA ENTRADA DE LA PESTE NEGRA



3. LA PESTE NEGRA alcanzó Europa, procedente del Asia Central, a través de la Ruta de la Seda, presentándose en Caffa en torno a 1347. Desde este importante puerto del Mar Negro asaltó las ciudades costeras más importantes de Europa y del norte de Africa. La mayor parte de Europa resultó afectada antes de que la epidemia llegara a su fin, en 1352. Milán fue la más importante de las ciudades que se salvaron, a causa, según se cree, de su lejanía del mar.

NO, NO TODAS LAS BACTERIAS

O MICROBIOS

SON PERJUDICIALES

INTERACCIÓN ENTRE LA FLORA INTESTINAL PROBIÓTICA Y EL SISTEMA INMUNOLÓGICO

¿ QUÉ ENTENDEMOS POR FLORA INTESTINAL O COMENSAL?

ESTÁ INTEGRADA PRINCIPALMENTE POR BACTERIAS DE LAS “BUENAS”

¿ CUÁNDO Y DESDE DÓNDE LA ADQUIRIMOS ?

INTERACCIÓN ENTRE LA FLORA INTESTINAL PROBIÓTICA Y EL SISTEMA INMUNOLÓGICO

1

DURANTE EL EMBARAZO "NINGUNA BACTERIA"

2

EN EL MOMENTO DEL PARTO POR LA FLORA VAGINAL DE LA MADRE

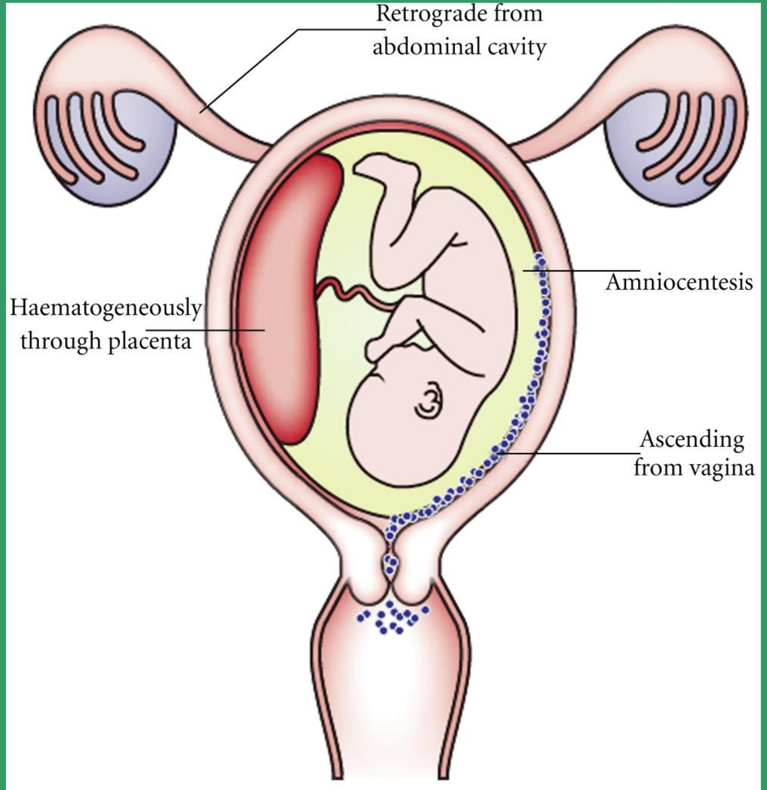
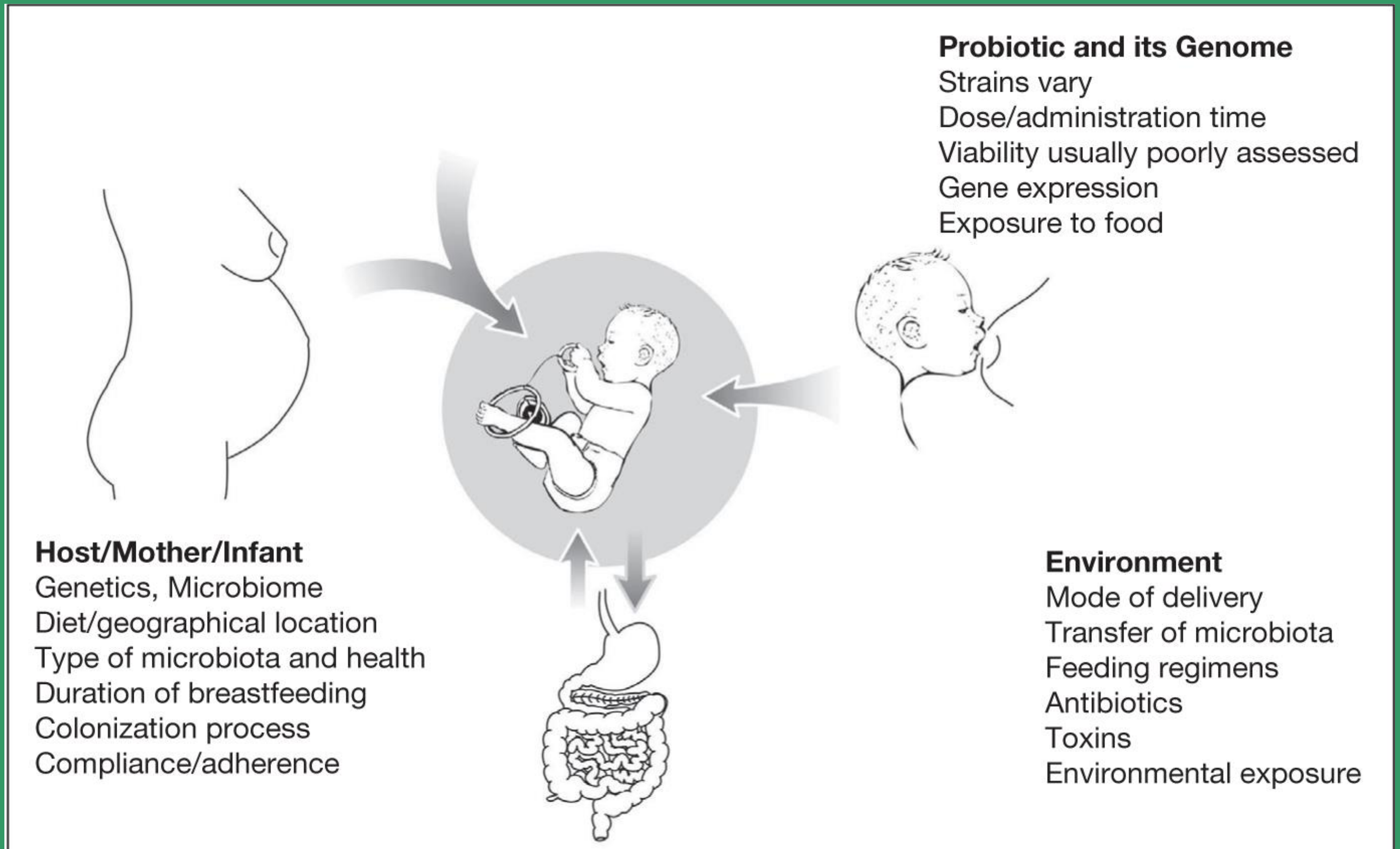


FIGURE 3: Potential routes of intrauterine infection (Source: Goldenberg et al. [16])

INTERACCIÓN ENTRE LA FLORA INTESTINAL PROBIÓTICA Y EL SISTEMA INMUNOLÓGICO

3

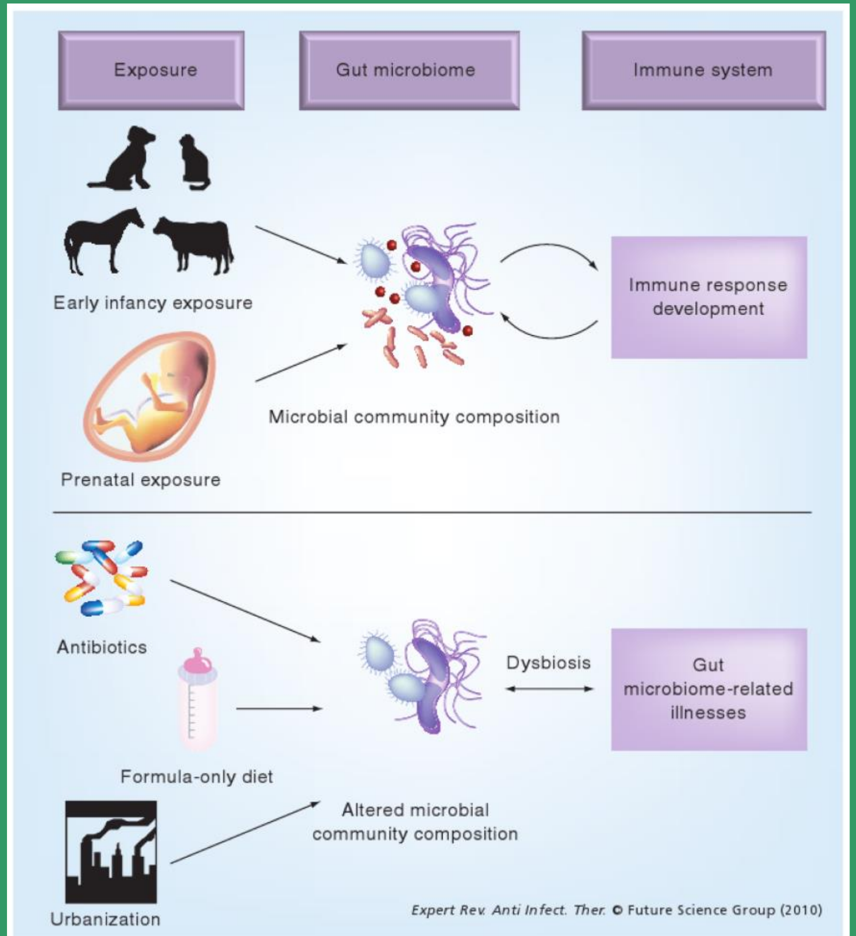
LUEGO DEL NACIMIENTO ADQUIRIMOS PARTE DE LA FLORA A TRAVÉS DEL AMAMANTA-MIIENTO



INTERACCIÓN ENTRE LA FLORA INTESTINAL PROBIÓTICA Y EL SISTEMA INMUNOLÓGICO

4

POR ÚLTIMO DEL MEDIO AMBIENTE Y LOS ALIMENTOS



1 A 4 FACTORES QUE AFECTAN LA FLORA INTESTINAL DEL INFANTE Y EL DESARROLLO TEMPRANO DEL SISTEMA INMUNOLÓGICO

"5"
Desde la placenta???

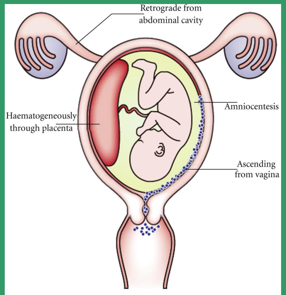


FIGURE 3: Potential routes of intrauterine infection (Source: Goldenberg et al. [16])

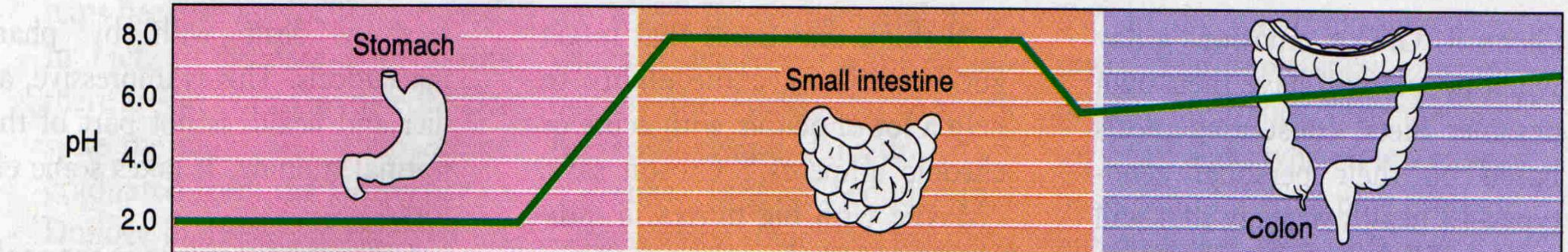
The placenta harbors a unique microbiome (Mayo de 2014)

Humans and their microbiomes have coevolved as a physiologic community composed of distinct body site niches with metabolic and antigenic diversity. **The placental microbiome has not been robustly interrogated, despite recent demonstrations of intracellular bacteria with diverse metabolic and immune regulatory functions.** A population-based cohort of placental specimens collected under sterile conditions from 320 subjects with extensive clinical data was established for comparative 16S ribosomal DNA-based and whole-genome shotgun (WGS) metagenomic studies. Identified taxa and their gene carriage patterns were compared to other human body site niches, including the oral, skin, airway (nasal), vaginal, and gut microbiomes from nonpregnant controls**. We characterized a unique placental microbiome niche, composed of nonpathogenic commensal microbiota from the Firmicutes, Tenericutes, Proteobacteria, Bacteroidetes, and Fusobacteria phyla.** In aggregate, the placental microbiome profiles were most akin (Bray-Curtis dissimilarity <0.3) to the human oral microbiome. 16S-based operational taxonomic unit analyses **revealed associations of the placental microbiome with a remote history of antenatal infection** (permutational multivariate analysis of variance, P = 0.006), **such as urinary tract infection in the first trimester, as well as with preterm birth <37 weeks** (P = 0.001).

Comment on "the placenta harbors a unique microbiome".

Y CONTINUA………

INTERACCIÓN ENTRE LA FLORA INTESTINAL Y EL SISTEMA INMUNOLÓGICO



Transit time	15–20 min	2–3 hr	24–72 hr
Typical microflora	10^2–10^3/ml Lactobacilli, streptococci, yeasts, *H. pylori*	10^4–10^8/ml Lactobacilli, streptococci, enterobacteria, bifidobacteria, bacteroides, clostridia	10^{12}/ml Lactobacilli, streptococci, enterobacteria, bifidobacteria, bacteroides, clostridia, yeasts, peptococci, *Ruminococcus* spp., *Butyrovibrio* spp., *Fusobacterium* spp., *Eubacterium* spp., *Peptostreptococcus*, *Atopobium* spp.,
Microbial processes		Limited proteolysis & saccharolysis, toxin and SCFA production	Proteolysis, saccharolysis, toxin and SCFA production
Physiological processes	Digestion, storage	Absorption of minerals, sugars, amino acids, etc.	Absorption of water, minerals, organic acids

INTERACCIÓN ENTRE LA FLORA INTESTINAL Y EL SISTEMA INMUNOLÓGICO

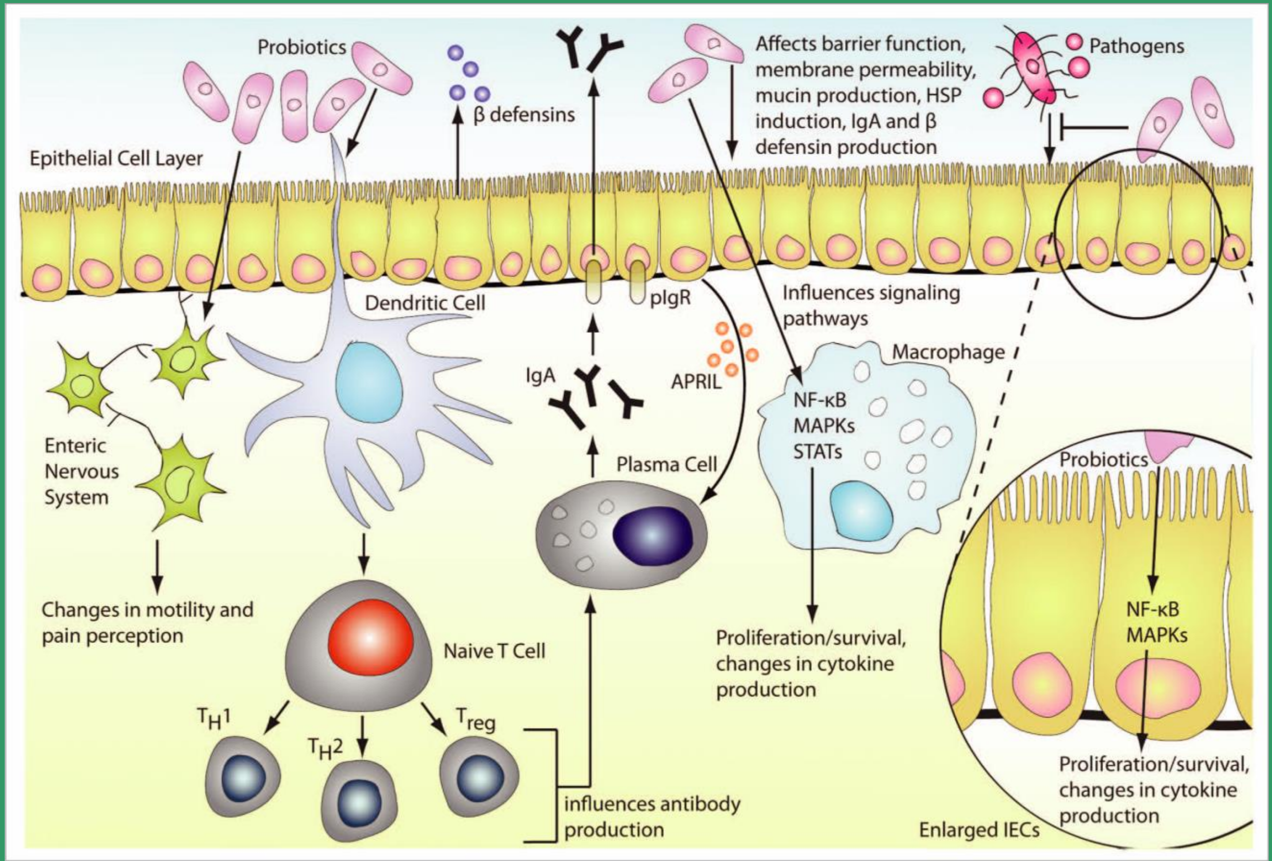


Figure 1. Probiotics benefit the host by communicating with a variety of cell types. Intestinal epithelial cell (IEC) barrier function is enhanced through probiotic modulation of tight junctions as well as enhanced mucin production. Probiotics interfere with pathogens by increasing β defensin secretion from IECs and IgA from plasma cells and by directly blocking the signaling pathways hijacked by pathogens. Cytokine secretion by IECs, macrophages and dendritic cells is regulated by probiotics through modulation of key signaling pathways such as NFκB and MAPKs. Changes in these pathways can also affect proliferation and survival of target cells. Through interactions with dendritic cells, probiotics can influence T cell subpopulations and skew them towards a Th1, Th2 or Treg response. Probiotics can also cause changes in gut motility and pain perception by modulating pain receptor expression and secreting potential neurotransmitter molecules. APRIL, a proliferation-inducing ligand; hsp, heat shock protein; IEC, intestinal epithelial cell; Ig, immunoglobulin; MAPK, mitogen-activated protein kinase; NFκB, nuclear factor-kappaB; pIgR, polymeric immunoglobulin receptor; STAT, signal transducers and activator of transcription; Treg, T regulatory cell.

Probiotics-host communication

Modulation of signaling pathways in the intestine

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[1]Interdepartmental Program of Cell and Molecular Biology; and [2]Department of Pathology and Immunology; Baylor College of Medicine; Houston, TX USA;
[3]Department of Pathology; Texas Children's Hospital; Houston, TX USA

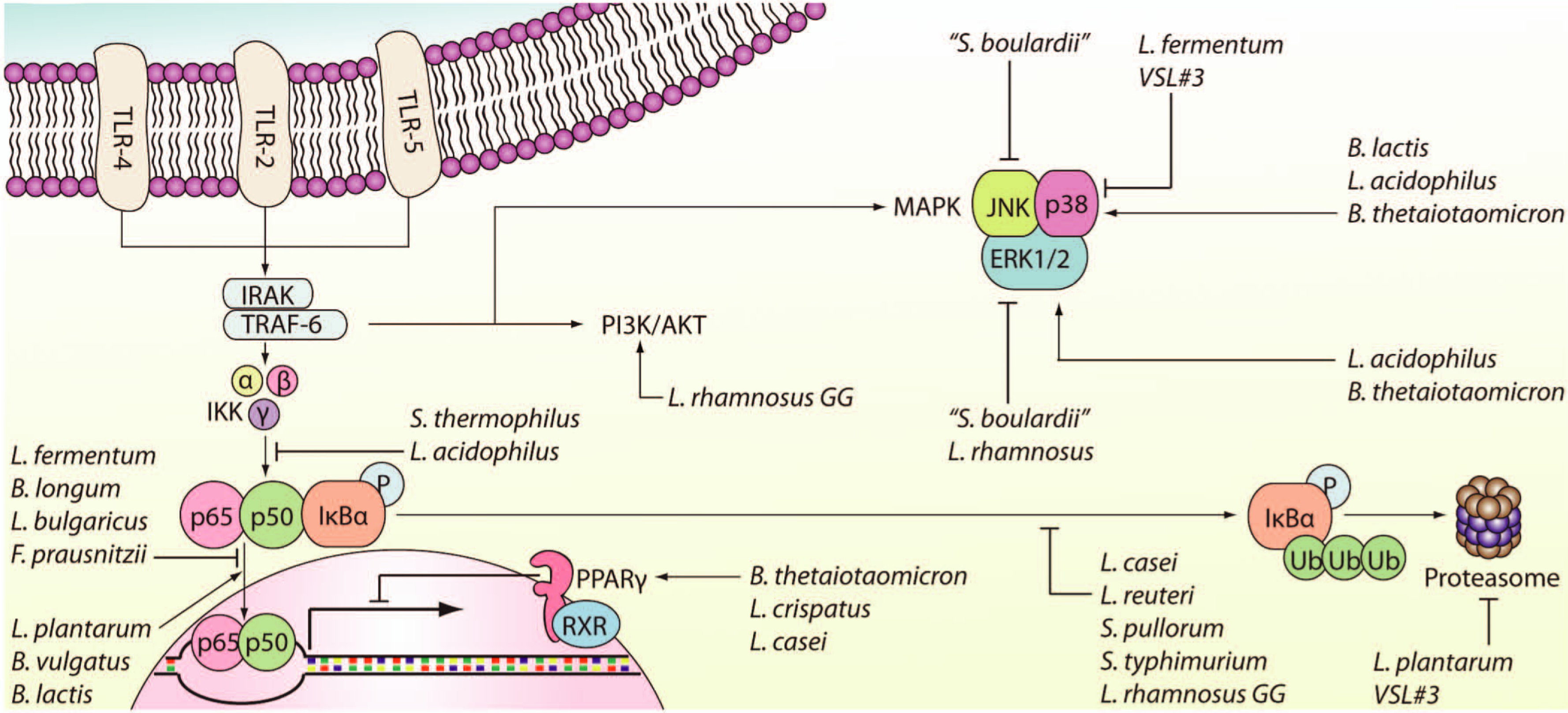
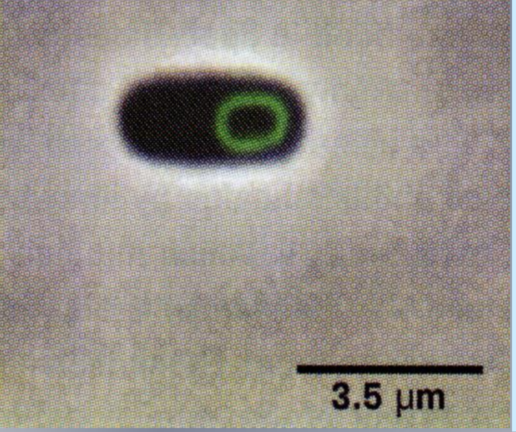
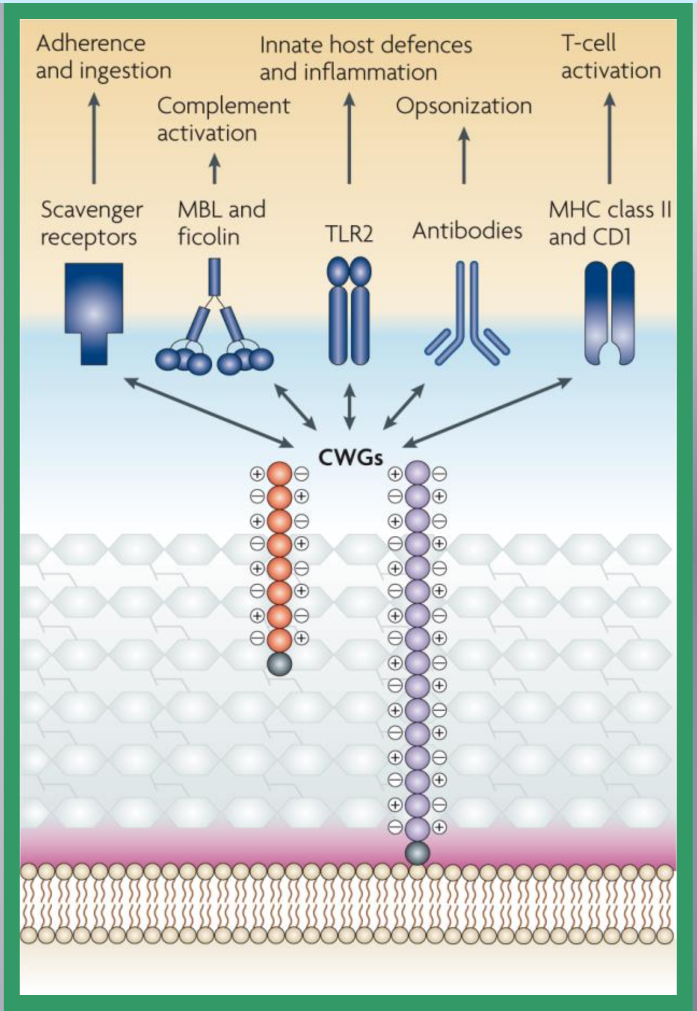
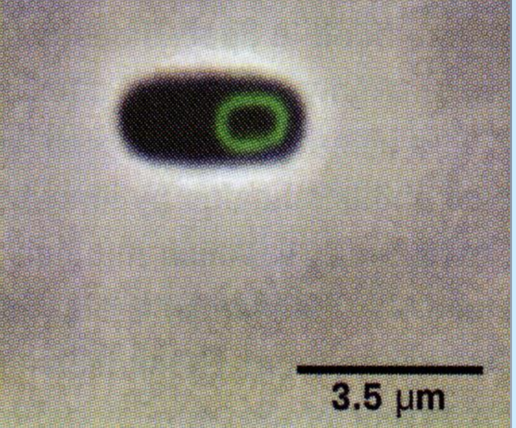


Figure 2. Probiotics modulate key signaling pathways in intestinal epithelial cells. Various probiotics prevent NFκB activation by inhibiting IκBα phosphorylation, ubiquitination, proteasomal degradation, or translocation of NFκB into the nucleus (suppression is indicated by a block sign "⊣"). Probiotics can also enhance RelA export from the nucleus via PPARγ. Other probiotics increase NFκB activation through enhanced translocation into the nucleus (activation is indicated by an arrow sign "→"). Apoptosis of intestinal epithelial cells can be prevented by probiotic modulation of the PI3K/Akt pathway. Probiotic-induced changes in phosphorylation levels of p38, JNK, and ERK1/2 MAPKs can affect cytokine secretion and apoptosis. ERK, extracellular signal-regulated kinases; IκBα, inhibitor of NFκB α; IKK, IκB kinase; IRAK, interleukin-1 receptor-associated kinase; JNK, c-Jun N-terminal kinase; P, phosphorylation; PPARγ, peroxisome proliferator activated receptor-γ; RXR, retinoid X receptor; TLR, Toll-like receptor; Ub, ubiquitin.

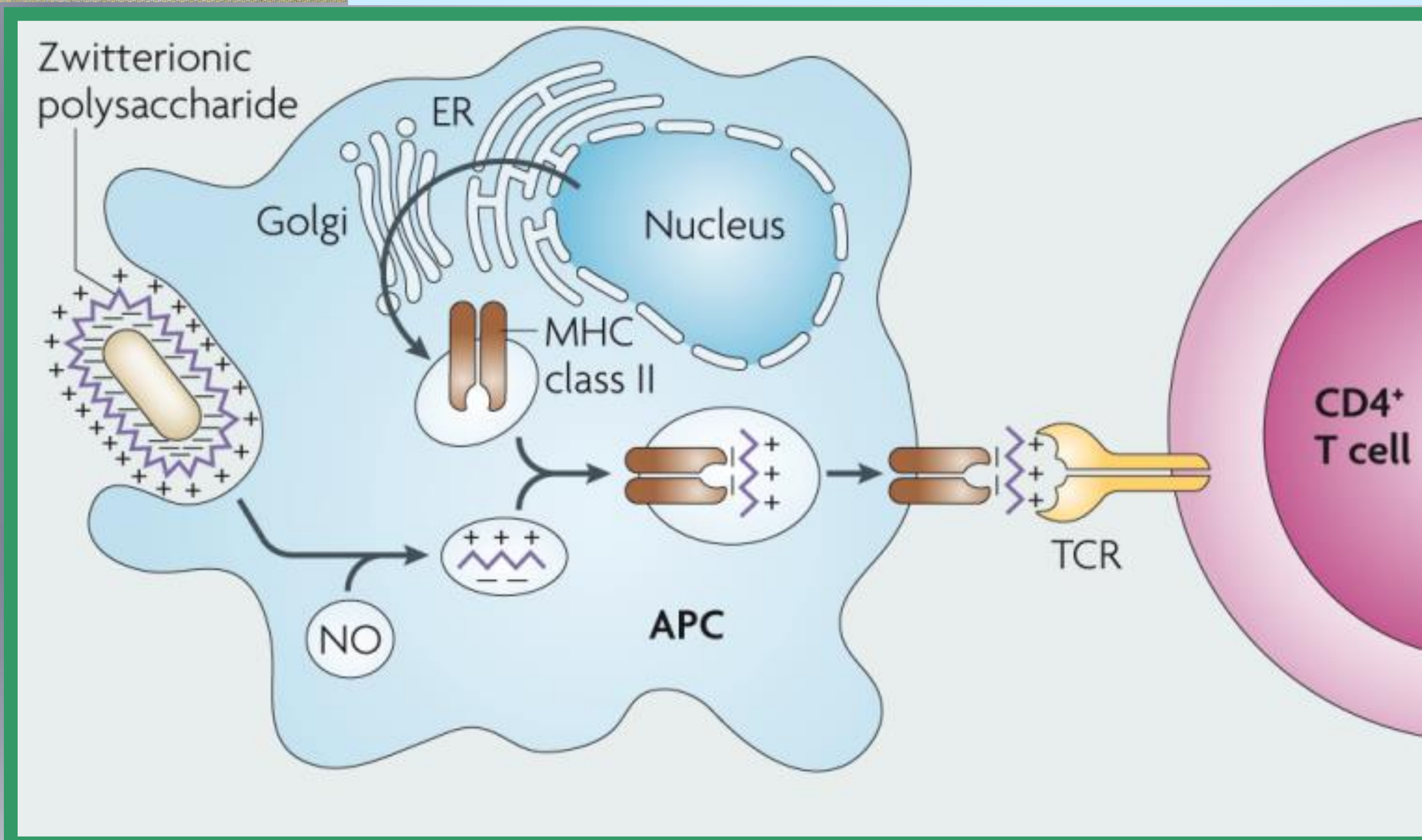


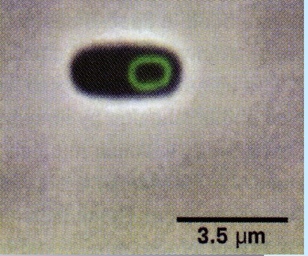
INTERACCIÓN ENTRE LA FLORA INTESTINAL Y EL SISTEMA INMUNOLÓGICO





INTERACCIÓN ENTRE LA FLORA INTESTINAL Y EL SISTEMA INMUNOLÓGICO



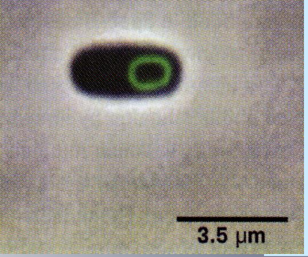


ALGUNOS MICROBIOS SON MUY BUENOS COMPAÑEROS

The gut flora as a forgotten organ

Ann M. O'Hara[1] & Fergus Shanahan[1,2+]

Alimentary Pharmabiotic Centre, University College Cork, National University of Ireland, Cork, Ireland



ALGUNOS MICROBIOS SON MUY BUENOS COMPAÑEROS

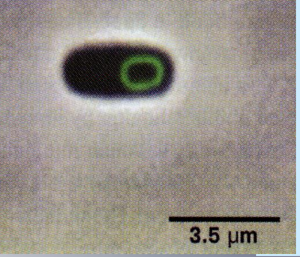
EXISTE UNA RELACIÓN ENTRE LA FLORA NORMAL Y EL SISTEMA INMUNOLÓGICO

↓

EXISTE UNA RELACIÓN ENTRE EL SISTEMA INMUNOLÓGICO Y EL SISTEMA NERVIOSO

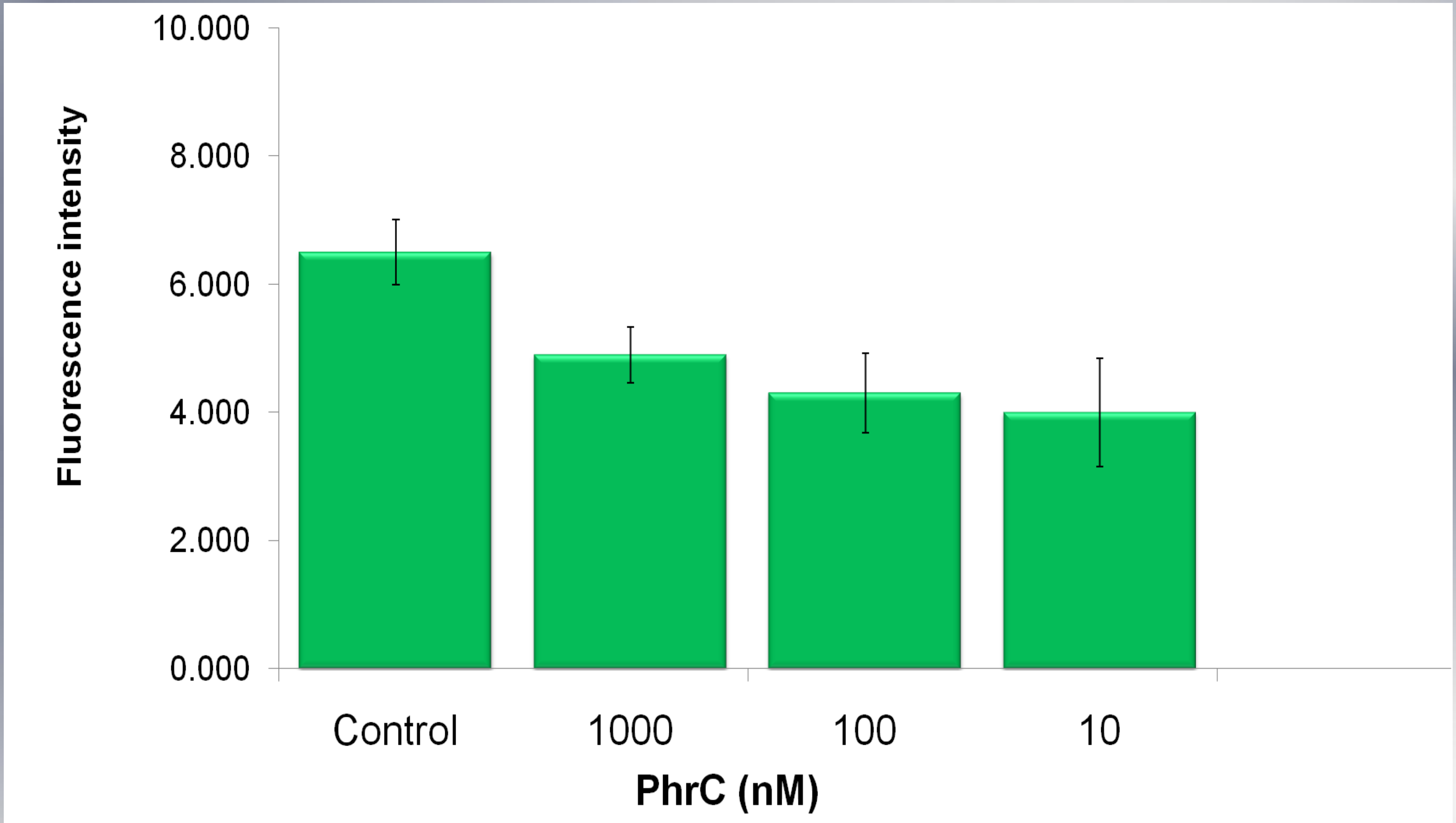
↓

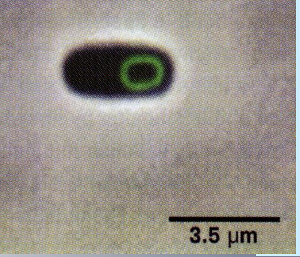
ENTONCES DEBE EXISTIR UNA RELACIÓN (DIRECTA O INDIRECTA) ENTRE LA FLORA NORMAL Y EL SISTEMA NERVIOSO



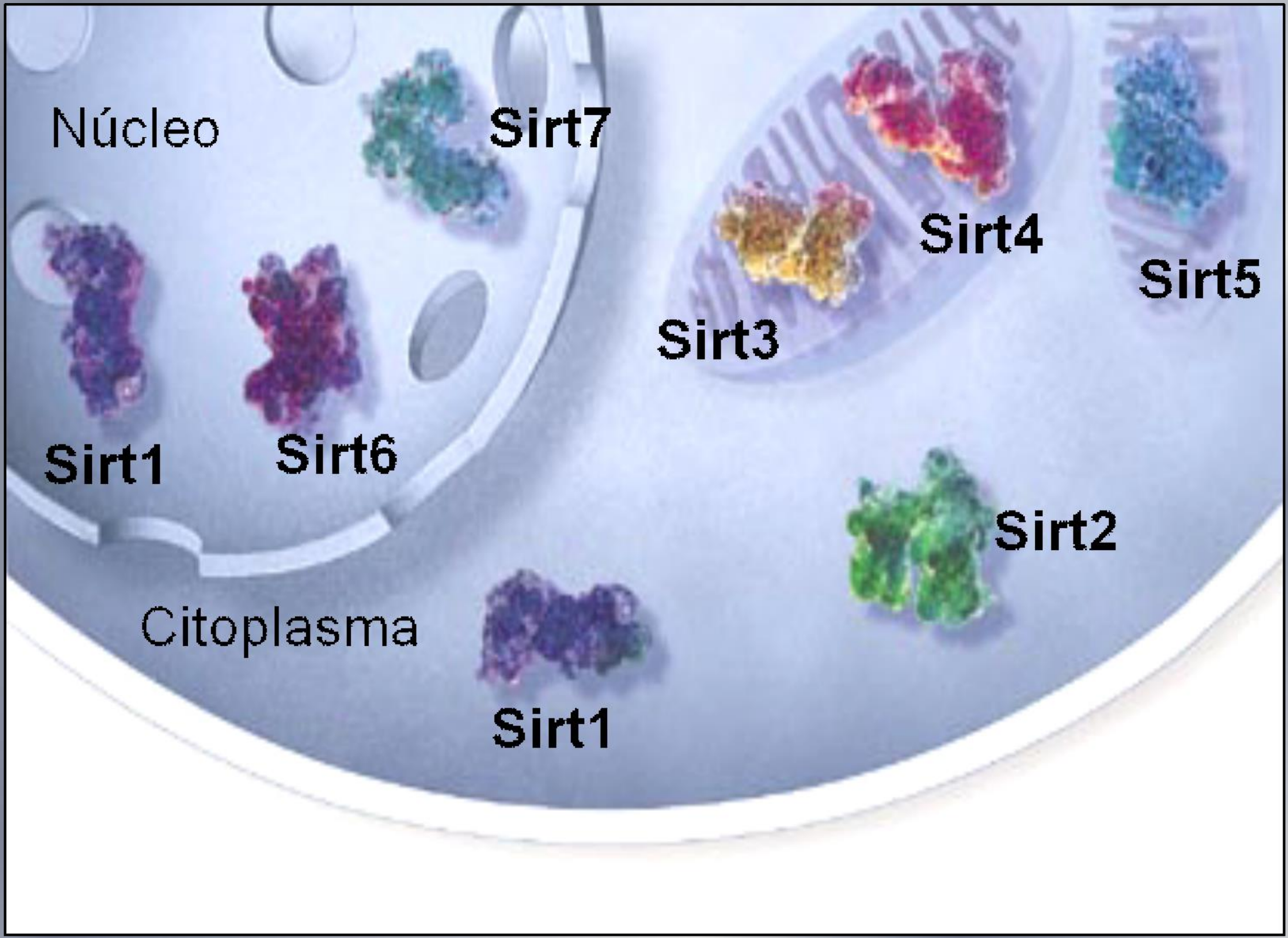
¿CUÁLES SON LOS EFECTOS BENEFICIOSOS DE LOS MICROORGANISMOS PROBIÓTICOS?

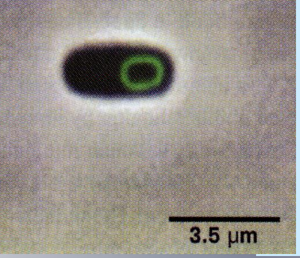
B. SUBTILIS DISMINUYE LA GENERACIÓN DE ROS EN NEURONAS DE CEREBELO ¿AUMENTO DEL LIFESPAN?





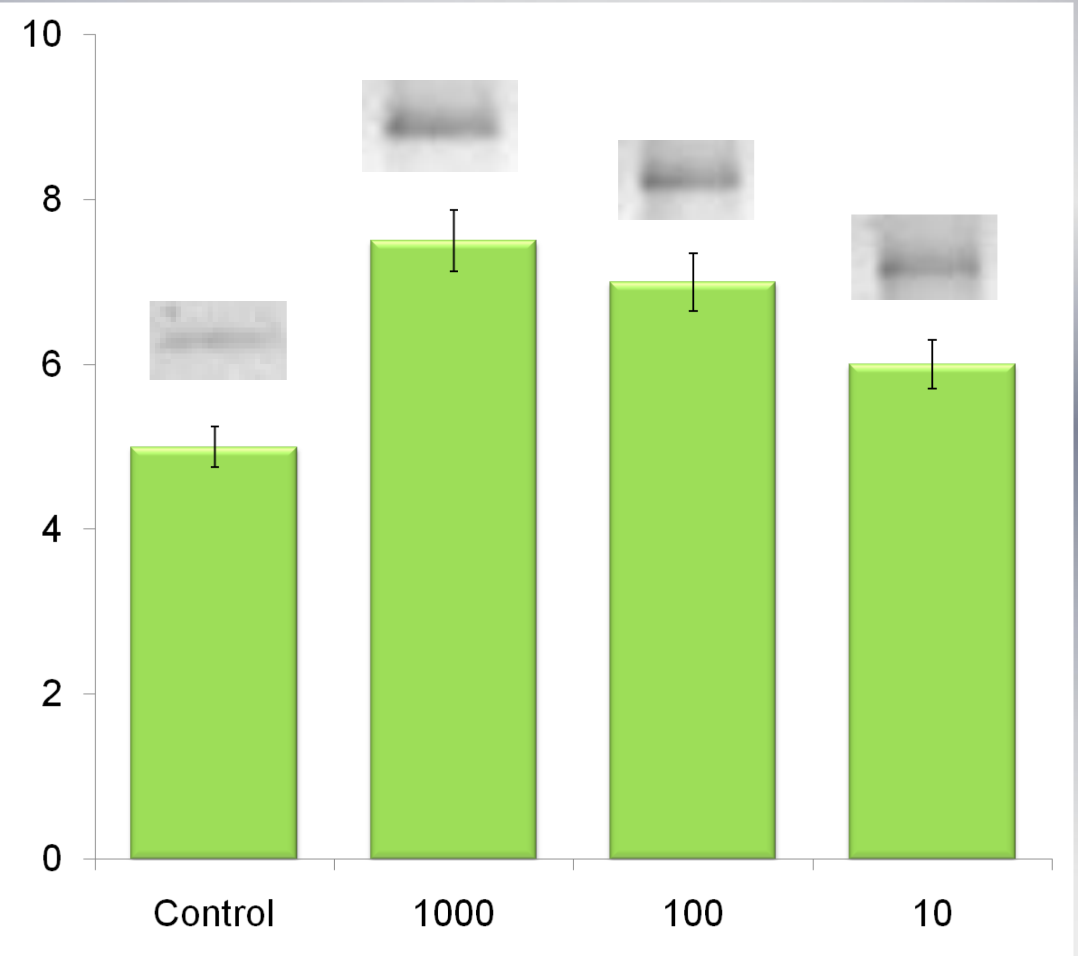
¿CUÁLES SON LOS EFECTOS BENEFICIOSOS DE LOS MICROORGANISMOS PROBIÓTICOS?

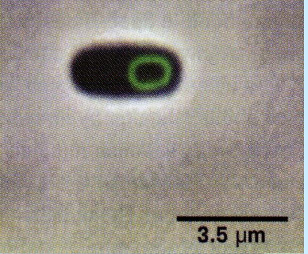




¿CUÁLES SON LOS EFECTOS BENEFICIOSOS DE LOS MICROORGANISMOS PROBIÓTICOS?

B. Subtilis estimula la producción de Sirt7 en cultivo de neuronas

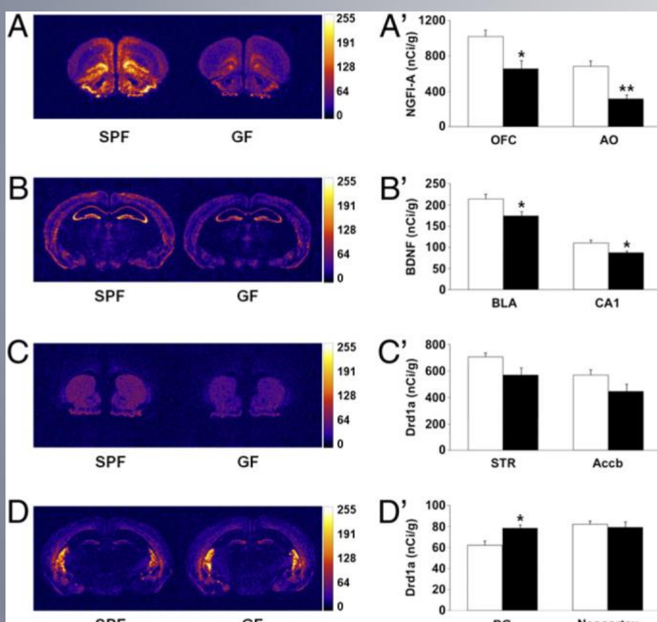




ALGUNOS MICROBIOS SON MUY BUENOS COMPAÑEROS

Normal gut microbiota modulates brain development and behavior

Rochellys Diaz Heijtz[a,b,1], Shugui Wang[c], Farhana Anuar[d], Yu Qian[a,b], Britta Björkholm[d], Annika Samuelsson[d], Martin L. Hibberd[c], Hans Forssberg[b,e], and Sven Pettersson[c,d,1]



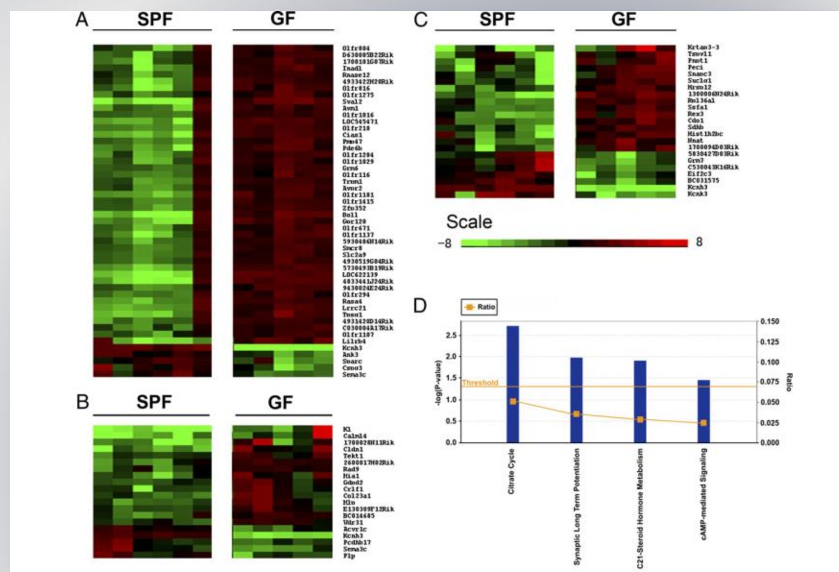
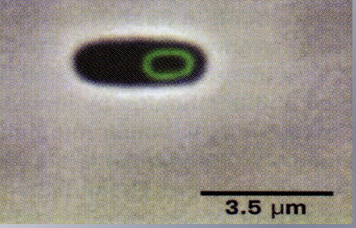
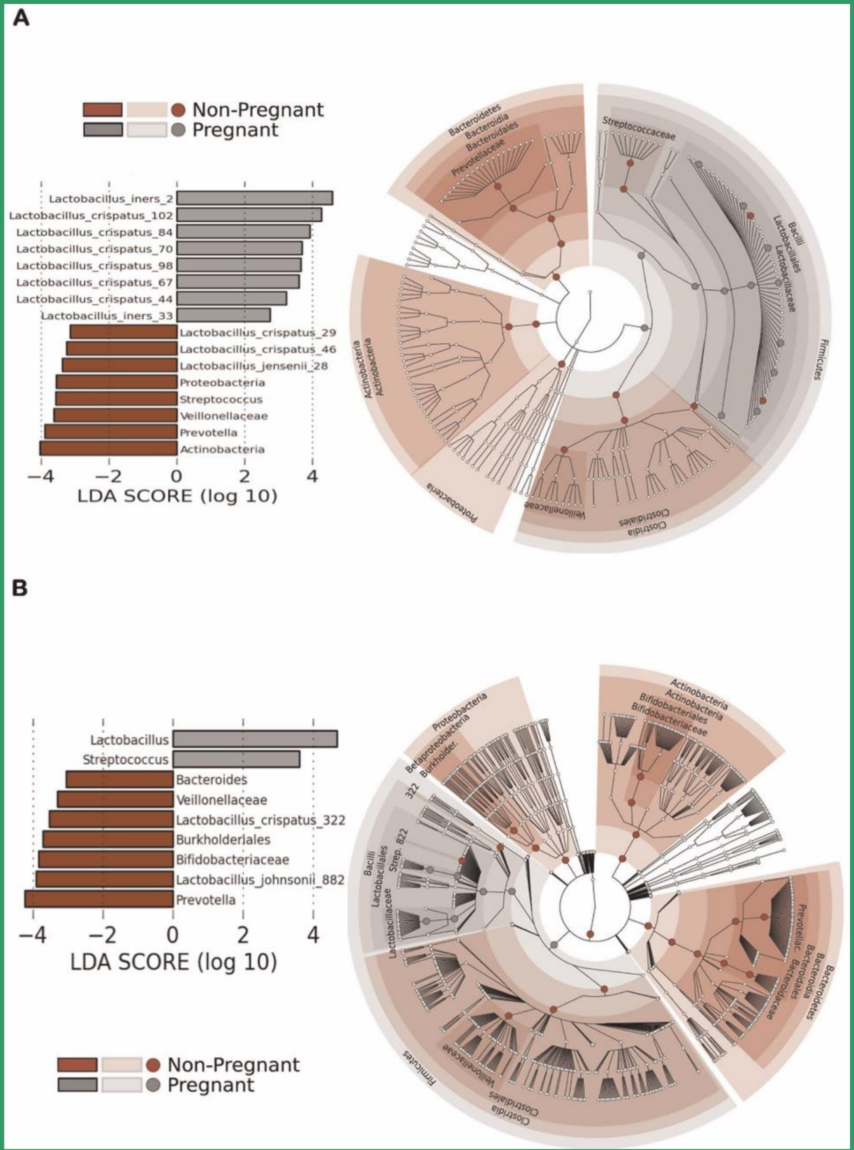


Fig. 5. Expression profiling of GF mice and SPF mice brains. A heatmap of genes showing statistically significant ($q < 5\%$) and fold change (>2) differences, between SPF ($n = 6$) and GF ($n = 5$) mice in the hippocampus (*A*), frontal cortex (*B*), and striatum (*C*). Each row represents the relative levels of expression of a single gene across all mice; each column represents the levels of expression for a single mouse. The colors red and green denote high and low expression, respectively. Differentially expressed genes were investigated for functional clustering by using Ingenuity Pathway Analysis software for canonical pathways (*D*), as described in *Experimental Procedures*.



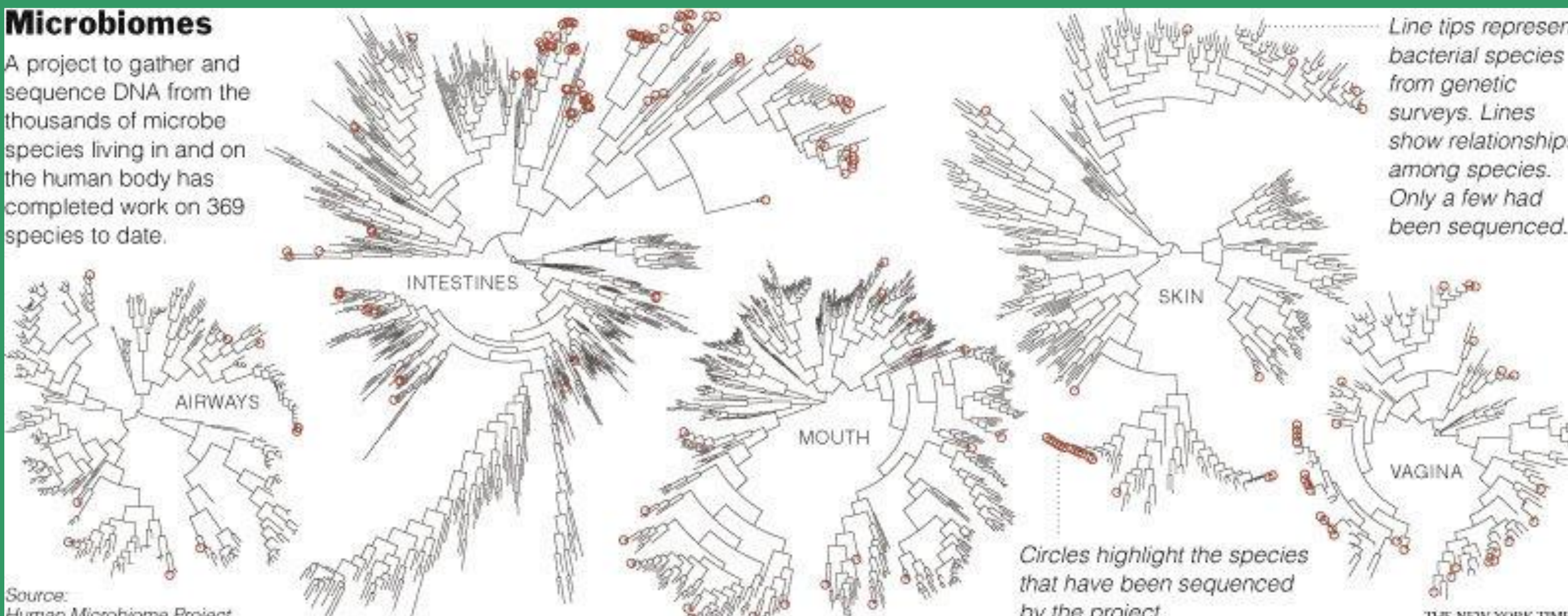
POR CADA CÉLULA HUMANA DE NUESTRO CUERPO PORTAMOS 10 BACTERIAS

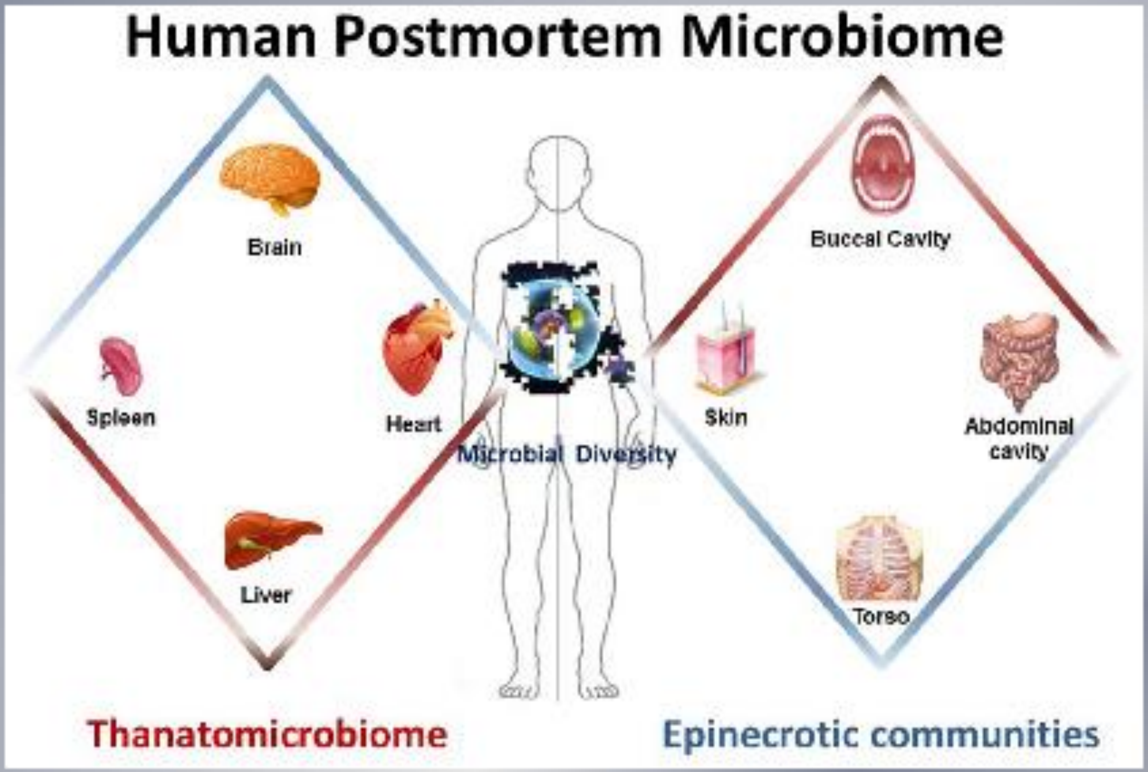
SOMOS NUESTRAS CÉLULAS (HUMANAS) MÁS NUESTRAS BACTERIAS COMENSALES QUE INTERACCIONAN ENTRE SÍ Y CON NUESTRAS CÉLULAS Y QUE NOS CONFORMARÍAN COMO SUJETO



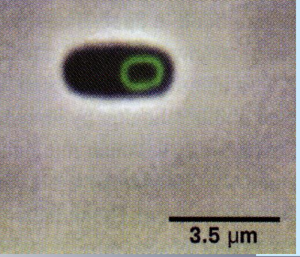
PROYECTO MICROBIOMA HUMANO SECUENCIACIÓN DE LOS GENES TOTALES DE NUESTRA FLORA COMENSAL

HUMAN MICROBIOME PROJECT





The human postmortem microbiome. The components of the human postmortem microbiome include the thanatomicrobiome (the microbiome of internal organs of cadavers) and epinecrotic microbial communities (the microbiome on surfaces of decaying remains).



¿ QUÉ BUSCAMOS?

1 3 9 16 30 54 69 93 130

AÑOS DE VIDA

Muchas gracias!

Roberto Ricardo Grau

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