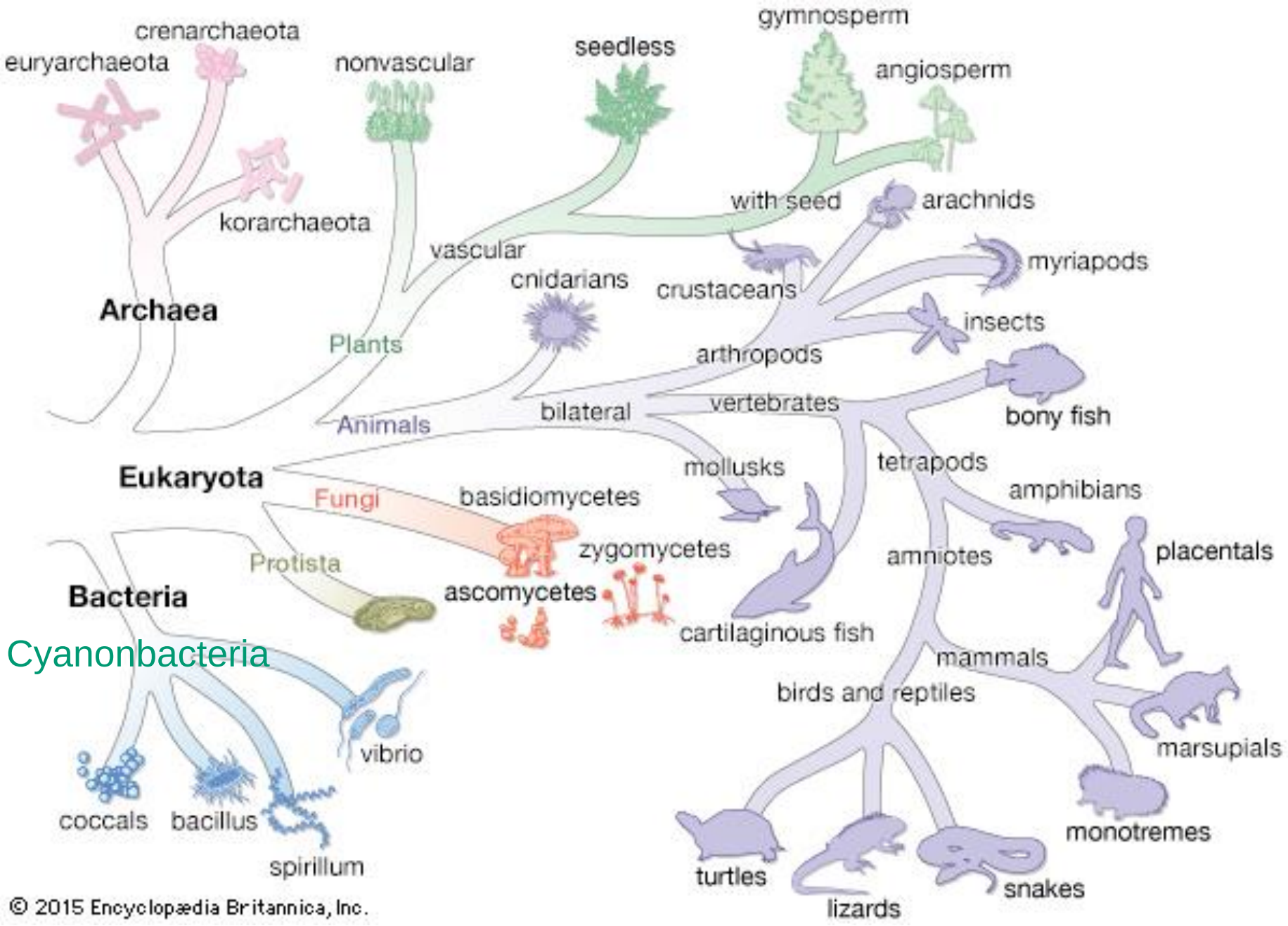
At Home with your microbes – new friends everywhere?

- What are microbes ?
- History ~ 4 billion years
- How much
- How are we related
- Friends vs ‘terrorists’

- Specific examples
  - Microbiome in asthma and allergy


crenarchaeota
euryarchaeota
korarchaeota
Archaea
nonvascular
seedless
gymnosperm
angiosperm
with seed
vascular
Plants
cnidarians
crustaceans
arachnids
myriapods
insects
arthropods
bilateral
vertebrates
bony fish
Animals
Eukaryota
mollusks
tetrapods
amphibians
Fungi
basidiomycetes
zygomycetes
amniotes
placentals
Protista
Bacteria
ascomycetes
cartilaginous fish
mammals
birds and reptiles
marsupials
Cyanonbacteria
vibrio
coccals
bacillus
spirillum
monotremes
turtles
lizards
snakes
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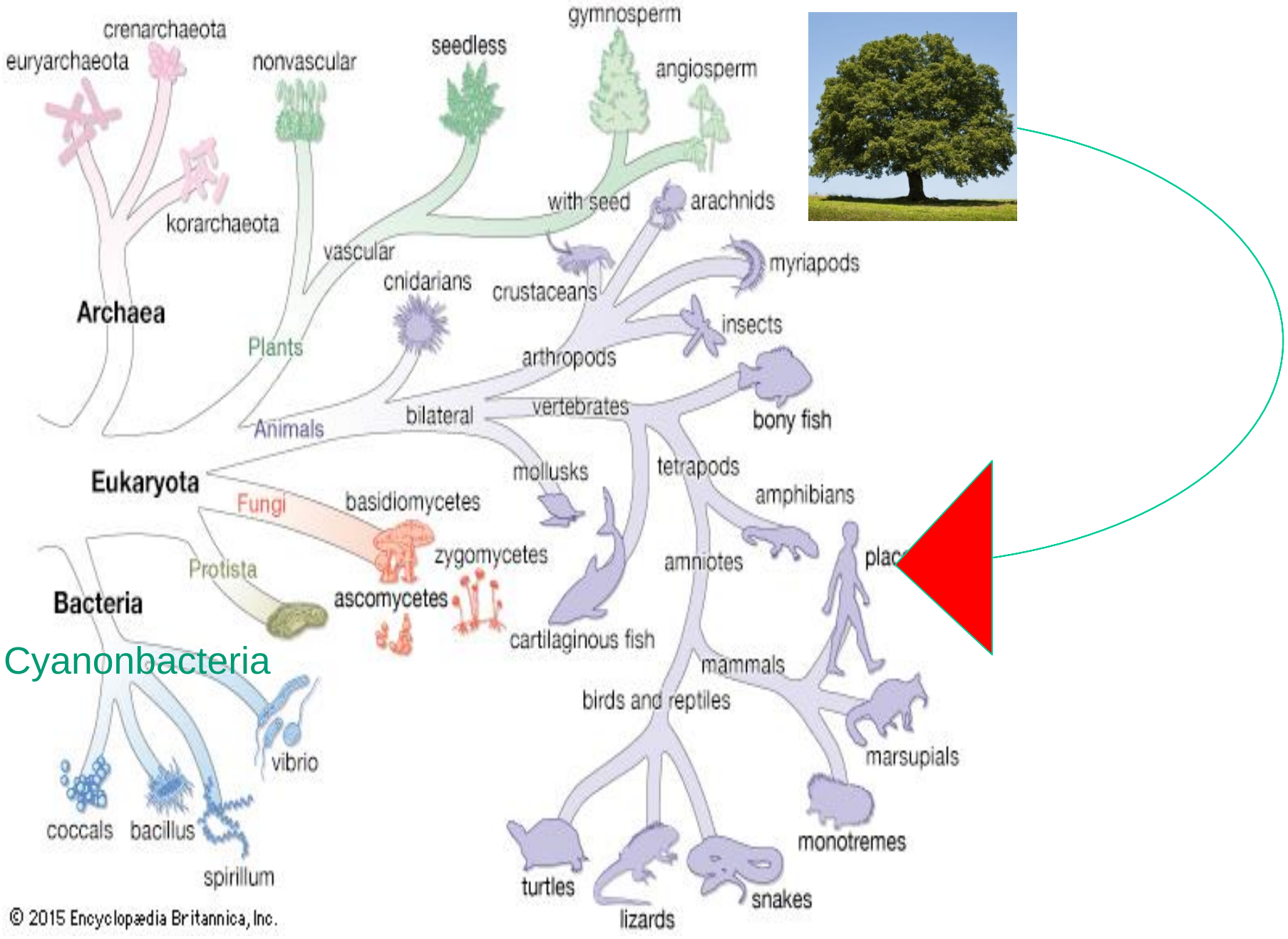
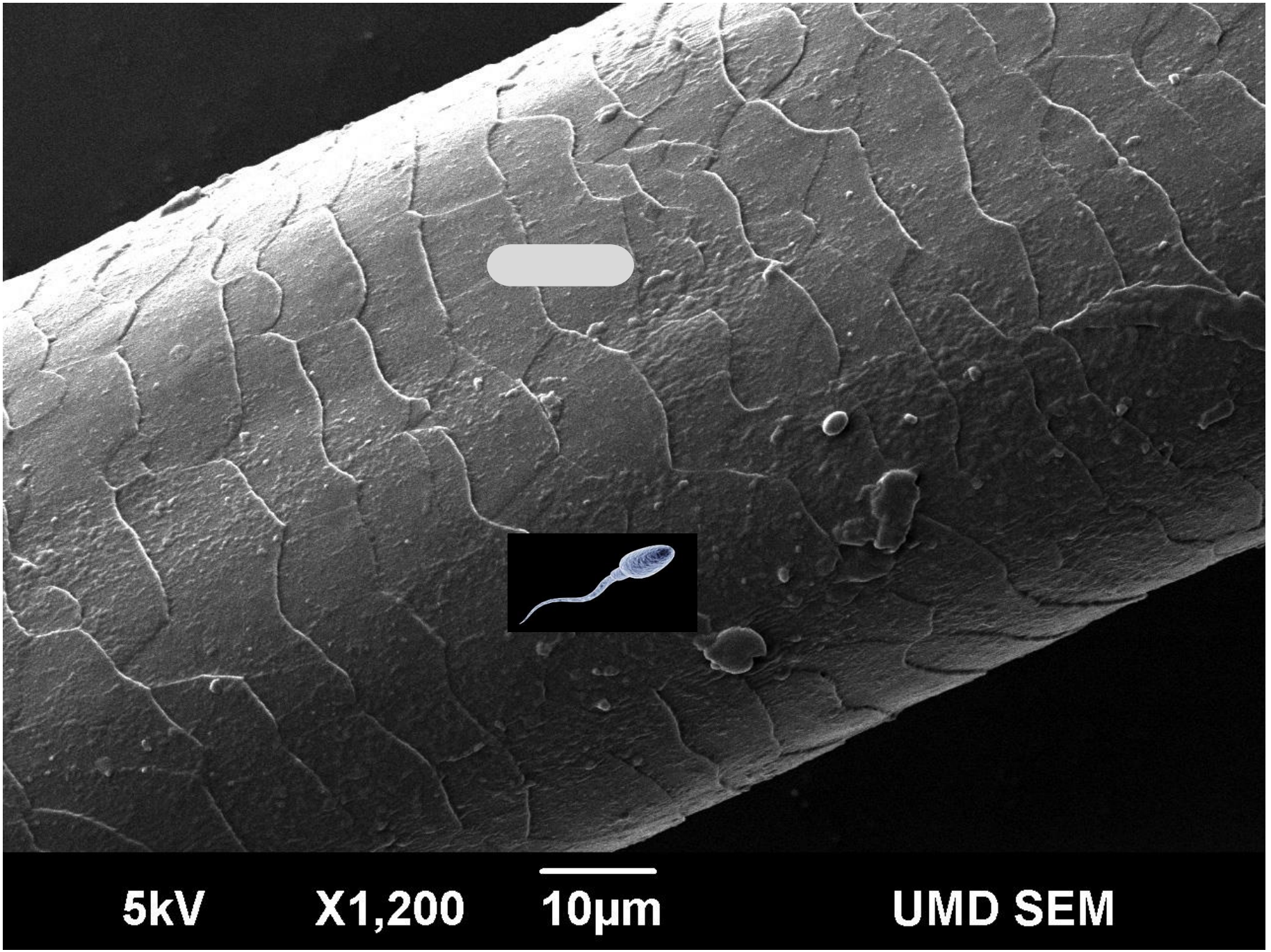
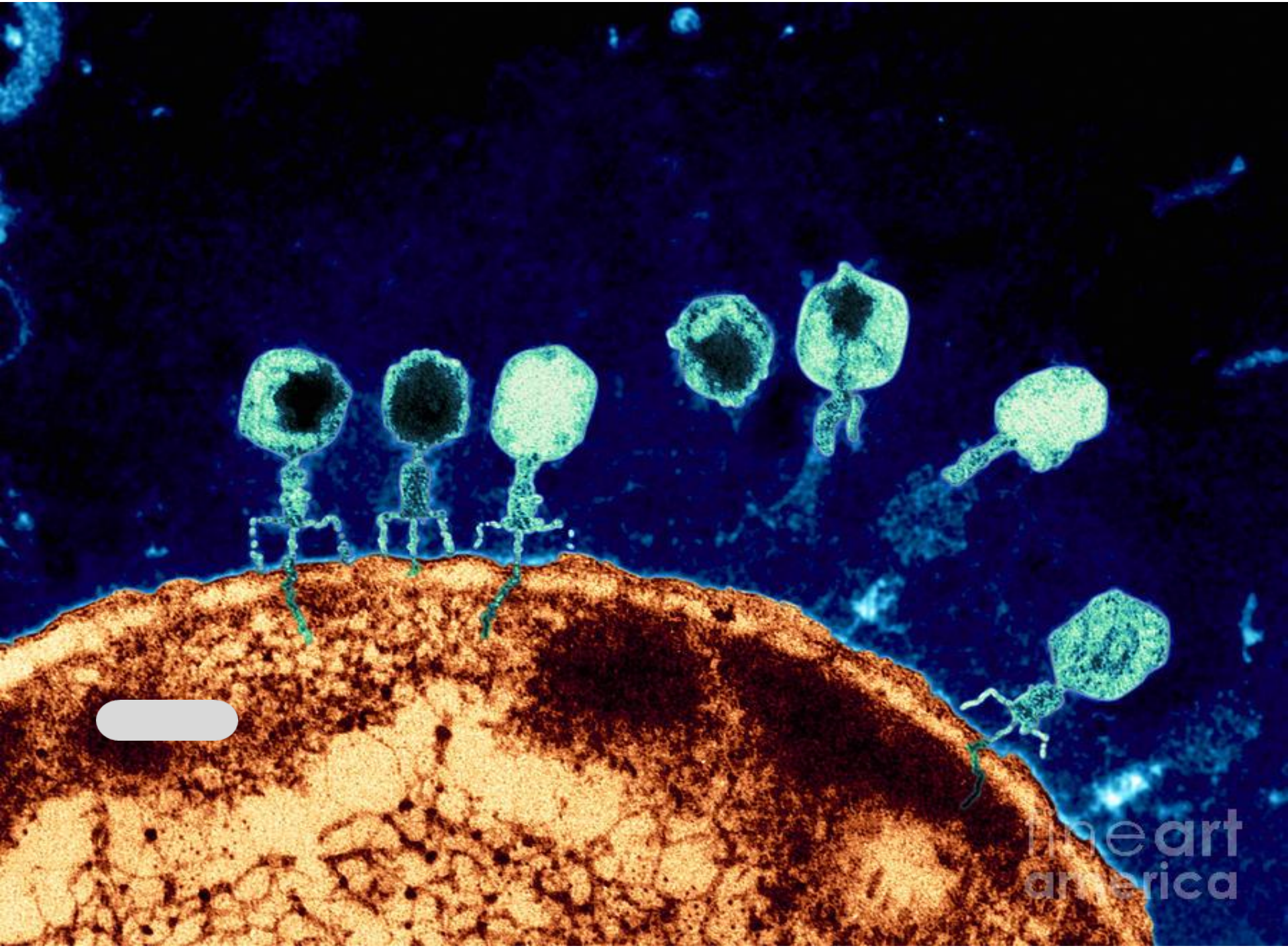
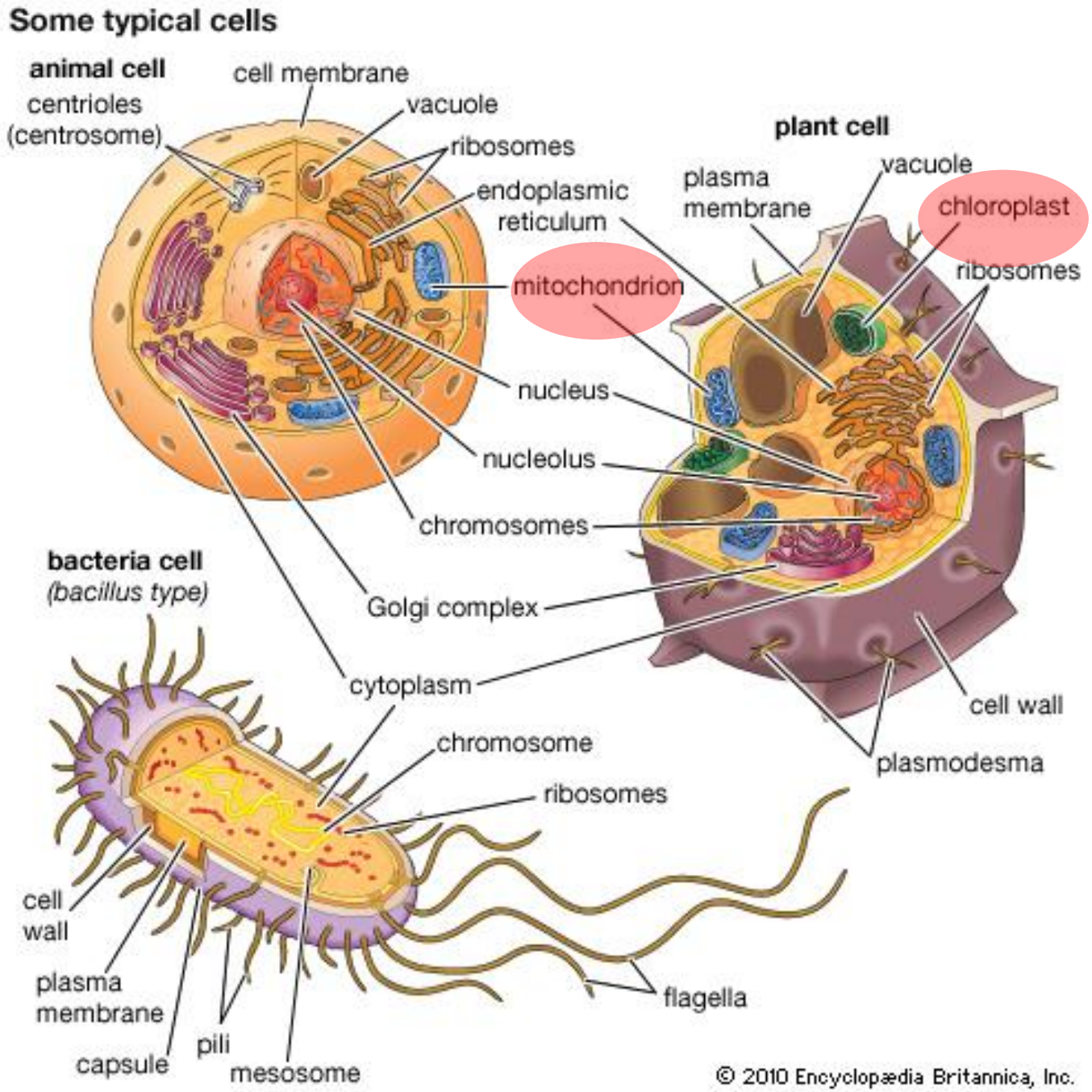


Cyanonbacteria


5kV
X1,200
10µm
UMD SEM




Some typical cells
animal cell
centrioles (centrosome)
cell membrane
vacuole
ribosomes
endoplasmic reticulum
mitochondrion
nucleus
nucleolus
chromosomes
Golgi complex
cytoplasm
plant cell
plasma membrane
vacuole
chloroplast
ribosomes
cell wall
plasmodesma
bacteria cell
(bacillus type)
chromosome
ribosomes
cell wall
plasma membrane
capsule
pili
mesosome
flagella
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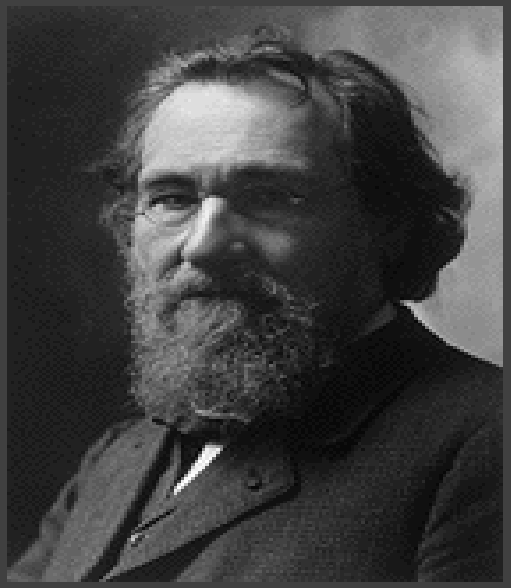
- Antonie van Leeuwenhoek – 1676
- 1828 bacterium = staff or cane
- 1859 Louis Pasteur microbes cause fermentation
- 1876 Robert Koch – cause disease
- 1900s Elie Metchnikoff - phagocytosis
- 1910 Paul Ehrlich – magic bullets

- Wet weight (69% water) all humans on Earth = 350 million tons (7000 Titanics)
- Ants = 300 million tons
- Termites = 445 million tons

- **Dry weight of bacteria 350-500 billion tons**

- 1908 Nobel prize for medicine
- phagocytosis



- Paul Ehrlich
- 1845-1915

- Elie Metchnikoff
- 1845-1916

“magic bullet”

health effects lactobacilli

Paul Ehrlich
1845-1915

“magic bullet” - chemical dyes – killed bacteria

Dyes were used as stains to show bacteria under the microscope

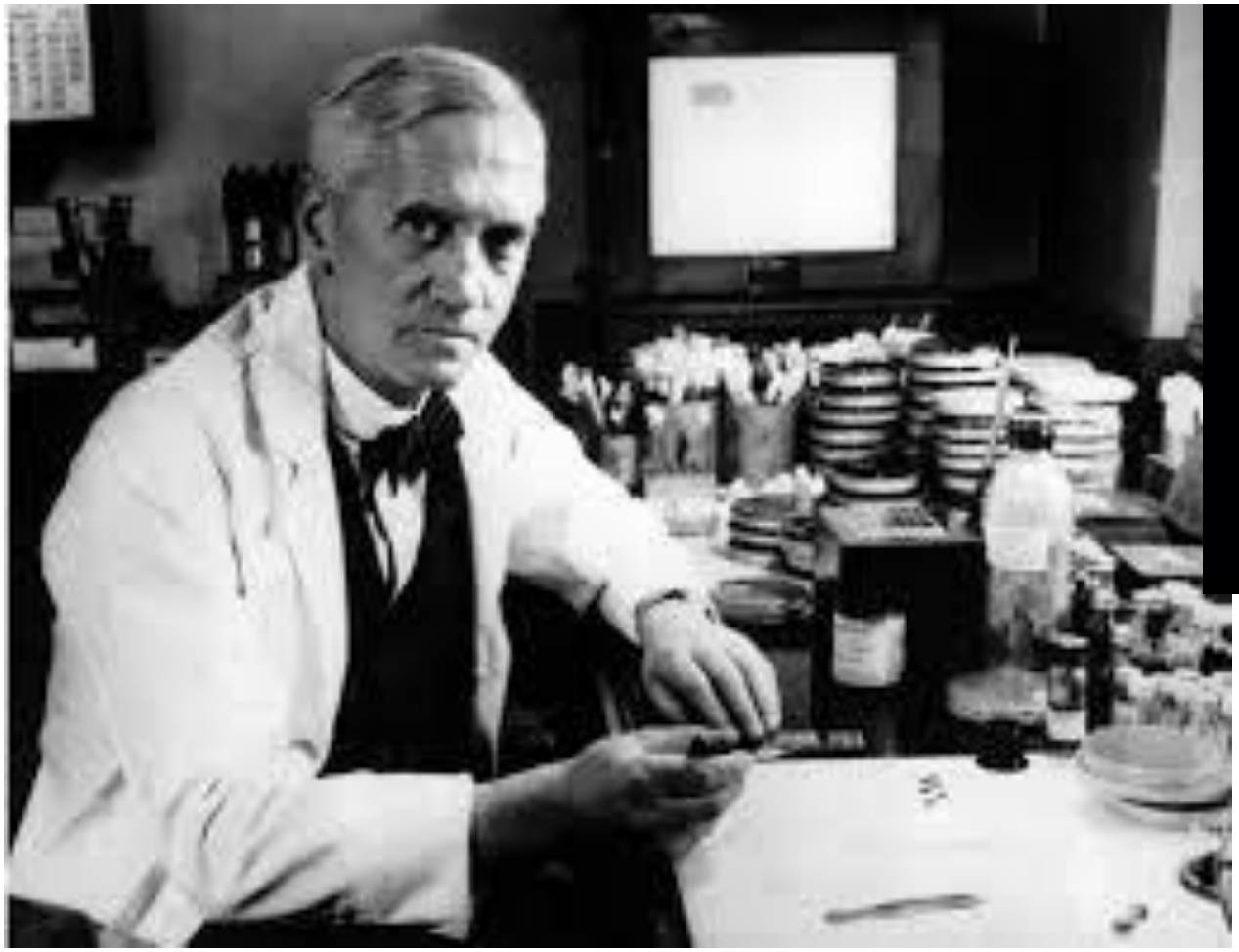
Paul Ehrlich

The Terrorists

Infectious Diseases killed 1 in 3 children
Puerperal fever killed many mothers
Plague, TB, Typhoid, Cholera + + +

Antibiotic therapy transformed
medicine and with sanitation human health

Microbes = Disease and must be eradicated



1928

Microbes have provided almost all of the compounds that are made into antibiotics

The Terrorists

Paul Ehrlich

Infectious Diseases killed 1 in 3 children
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Plague TB, Typhoid, Cholera + + +

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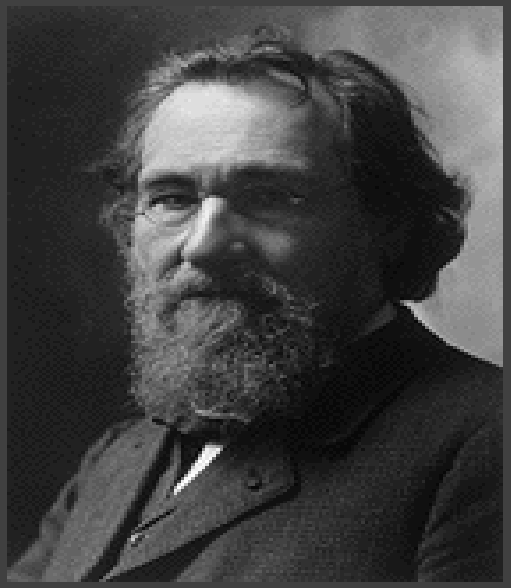
1908 Nobel prize for medicine

phagocytosis



- Elie Metchnikoff
- 1845-1916

health effects lactobacilli

THE PROLONGATION OF LIFE

OPTIMISTIC STUDIES

BY

ÉLIE METCHNIKOFF

SUB-DIRECTOR OF THE PASTEUR INSTITUTE, PARIS

THE ENGLISH TRANSLATION

EDITED BY

P. CHALMERS MITCHELL

M.A., D.Sc. Oxon., Hon. LL.D., F.R.S.

Secretary of the Zoological Society of London; Corresponding Member of the Academy of Natural Sciences of Philadelphia

G. P. PUTNAM'S SONS

NEW YORK & LONDON

The Knickerbocker Press

1908

In answer to the question, I have formed the theory that the large intestine has been increased in mammals to make it possible for these animals to run long distances without having to stand still for defæcation. The organ, then, would simply have the function of a reservoir of waste matter.

M. Grigoroff, a Bulgarian student at Geneva, has been surprised by the number of centenarians to be found in Bulgaria, a region in which yahourth, a soured milk, is the stable food. Some of the centenarians, described by M. Chemin in his memoir, lived chiefly on a milk diet. Marie Priou, for example, who died in the Haute-Garonne in 1838 at the age of 158 years, had lived for the last ten years of her life entirely on cheese and goat's milk (*op. cit.* p. 100). Ambroise Jantet, a labourer of Verdun, who died in 1751 at the age of 111 years, "ate nothing but unleavened bread and drank nothing but skimmed milk" (p.

Friends vs terrorists

- Microbes in every corner of our planet
- 1000 x times mass of all humans on earth
- All animal and plant cells have incorporated bacteria into their structure
- Have been here ~ 4 billion years
  - Homo sapiens 200k
  - Civilisation 6k
  - Industrial 0.2k
- Bread, Wine, Yoghurt, Cheese,
- Antibiotics many other molecules eg insulin

What is a microbiome?

- Collection of bacteria in an ecosystem
- GUT
- Skin
- Lungs
- Placenta
- Breast milk
- Homes
- Soil
- Water

Bacteria can now be identified very easily by their unique DNA signature
Specific genes for specific metabolism

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 31, 2013 VOL. 368 NO. 5

Duodenal Infusion of Donor Feces for Recurrent *Clostridium difficile*

Els van Nood, M.D., Anne Vrieze, M.D., Max Nieuwdorp, M.D., Ph.D., Susana Fuentes, Ph.D., Erwin G. Zoetendal, Ph.D., Willem M. de Vos, Ph.D., Caroline E. Visser, M.D., Ph.D., Ed J. Kuijper, M.D., Ph.D., Joep F.W.M. Bartelsman, M.D., Jan G.P. Tijssen, Ph.D., Peter Speelman, M.D., Ph.D., Marcel G.W. Dijkgraaf, Ph.D., and Josbert J. Keller, M.D., Ph.D.

ABSTRACT

The POWER of POOP

promoting safe, accessible fecal microbiota transplant
for all who need it

Search...

tory

PIAZZA ON JULY 12, 2014 · (3)

ey Fogge Piazza Location:
SA What percentage better are
vas your diagnosis and what
try before FMT? Clostridium
rous doses of vancomycin… Read More ›

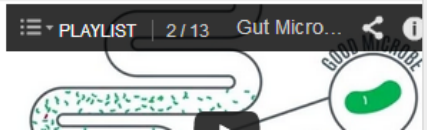
Recent Posts

Danny's Story

BY DANNY'S GRANDMOTHER ON JUNE 28, 2014 · (1)

"Danny" is a seven year old boy. His FMT success story is told in the words of his grandmother. What percentage recovered is Danny? The chronic constipation is 95% better. The C-diff is cured. What was his diagnosis and… Read More ›

Gut Microbes – Importance in Health and Disease



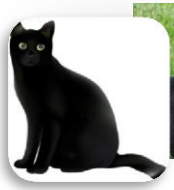

70%
Isopropyl
Rubbing
Alcohol
LIVING
SOLUTIONS
Faultless
America's #1 Choice
Goodhealth
Combination
Douche, Enema and
Water Bottle System
Lysol
DUAL
ACTION
WIPES
Sparkletts
DISTILLED
WATER
Walgreens
Rolled Gauze
Vinyl Gloves
Face Mask
Face Mask

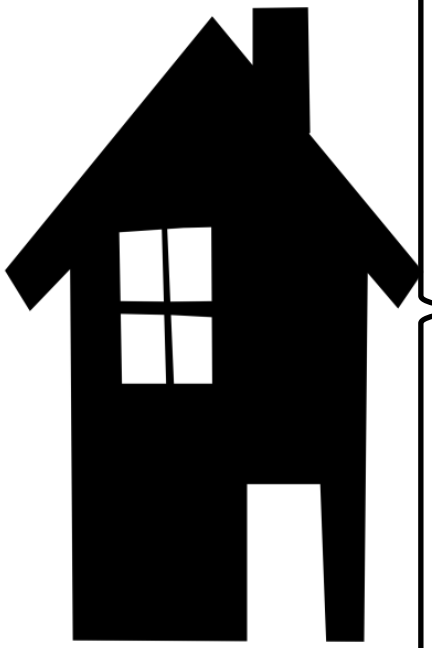
Choose your donor carefully

Domestic microbiome

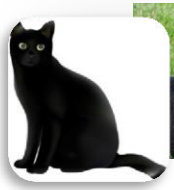
- Locality → Indoor → Gut, skin, ?airway
- Animals important
- Species richness and abundance – important
- Richness +/- specific taxa (Gene sequencing)
- Farm vs urban
- developed vs developing

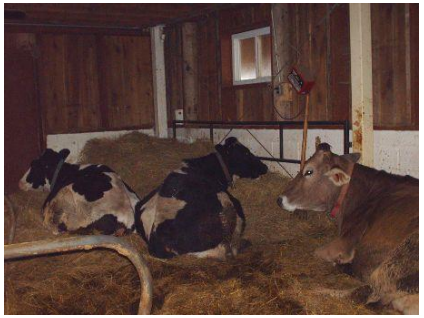
Asthma and Allergy





Asthma and Allergy









Infant yoghurt consumption

		Eczema			Atopic sensitization	
Child yoghurt consumption	N	OR (95% CI)*	P value	N	OR (95% CI)*	P value
Any yoghurt < 6 mths	366	0.27 (0.08-0.89)	0.03	362	0.38 (0.11-1.28)	0.12
Frequency of consumption< 6 mths*	396	0.45 (0.20-1.04)	0.06	392	0.71(0.41-1.23)	0.22
Any yoghurt 6-12 mths	398	0.40 (0.20-0.80)	0.01	394	0.36 (0.17-0.75)	0.006
Frequency of consumption 6-12 mths*	398	0.75 (0.66-0.85)	<0.001	394	0.74 (0.64-0.85)	<0.0001
Any yoghurt <12 mths	394	0.43 (0.21-0.89)	0.02	390	0.31 (0.15-0.66)	0.002

Pacifier use and oral ‘cleaning’

		Eczema			Atopic sensitization	
	N	OR (95% CI)*	P value	N	OR (95% CI)*	P value
Any pacifier use						
<3 mths		0.71 (0.42-1.20)	0.20		0.76(0.42=1.40)	0.38
3-6 mths		0.70 (0.421.14)	0.15		1.09 (0.62-1.93)	0.76
6-12 mths		0.67 (0.39-1.15)	0.15		0.77 (0.42-1.42)	0.40
0-12 mths		1.20 (0.69-2.09)	0.51		1.26 (0.67-2.37)	0.48
Pacifier cleaned by sucking						
<3 mths		0.59 (0.27-1.30)	0.19		0.42 (0.15-1.22)	0.11
3-6 mths		0.29 (0.11-0.75)	0.01		0.36 (0.12-1.03)	0.06
6-12 mths		0.34 (0.12-0.97)	0.04		0.53 (0.18-1.53)	0.24
0-12 mths		0.52 (0.27-1.01)	0.054		0.59 (0.28-1.250	0.17

diversity and specific taxa

+

allergens

Effects of early-life exposure to allergens and bacteria on recurrent wheeze and atopy in urban children

Susan V. Lynch, PhD,[a]* Robert A. Wood, MD,[b]* Homer Boushey, MD,[a] Leonard B. Bacharier, MD,[c] Gordon R. Bloomberg, MD,[c] Meyer Kattan, MD,[d] George T. O'Connor, MD,[e] Megan T. Sandel, MD,[e] Agustin Calatroni, MS,[f] Elizabeth Matsui, MD,[b] Christine C. Johnson, PhD,[g] Henry Lynn, PhD,[f] Cynthia M. Visness, PhD,[f] Katy F. Jaffee, MS,[f] Peter J. Gergen, MD,[h] Diane R. Gold, MD, MPH,[i] Rosalind J. Wright, MD, MPH,[i] Kei Fujimura, PhD,[a] Marcus Rauch, PhD,[a] William W. Busse, MD,[j] and James E. Gern, MD[j] *San Francisco, Calif, Baltimore, Md, St Louis, Mo, New York, NY, Boston, Mass, Chapel Hill, NC, Detroit, Mich, and Madison, Wis*

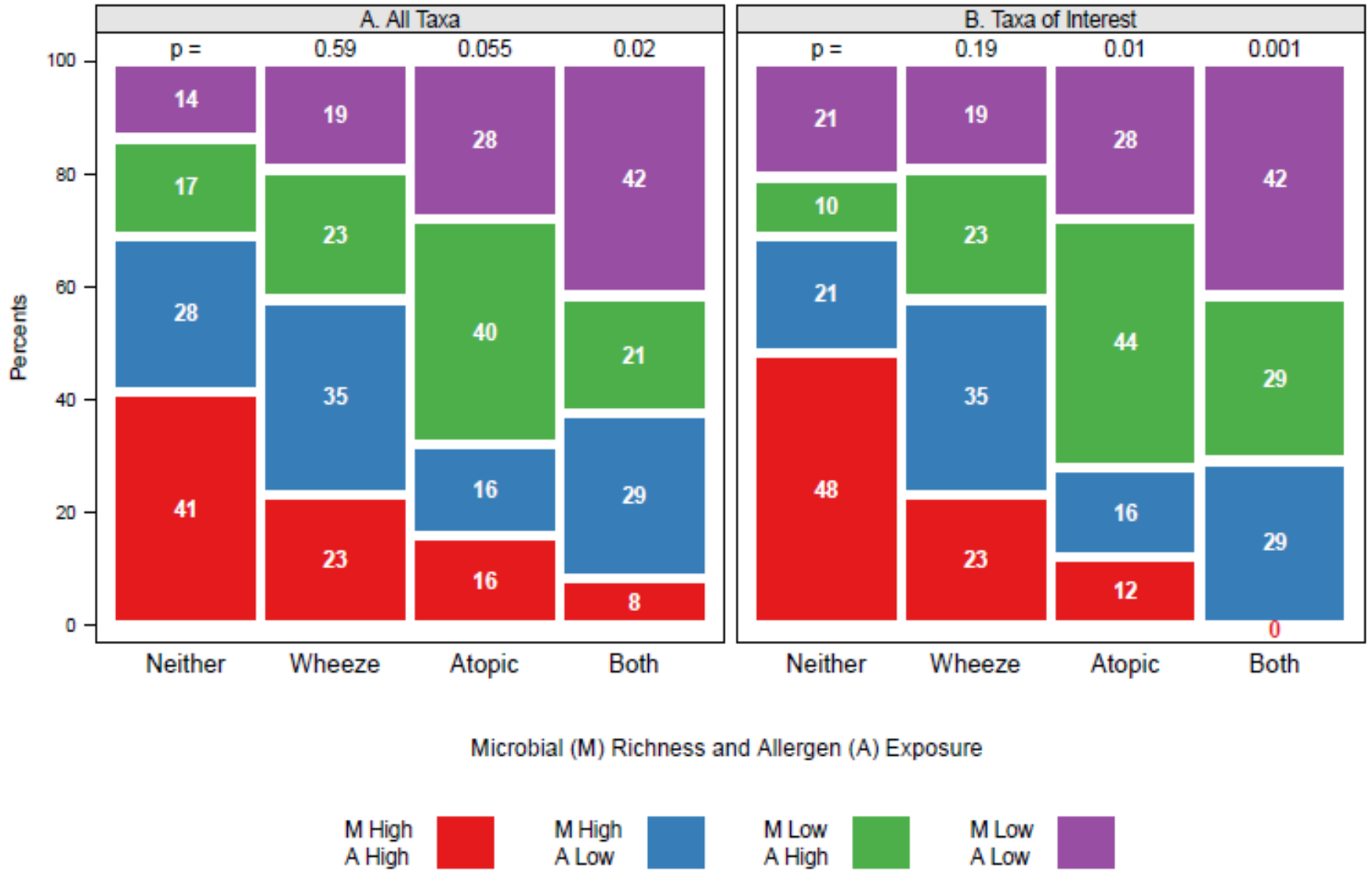
Background: Wheezing illnesses cause major morbidity in infants and are frequent precursors to asthma.
Objective: We sought to examine environmental factors associated with recurrent wheezing in inner-city environments.
Methods: The Urban Environment and Childhood Asthma study examined a birth cohort at high risk for asthma (n = 560) in Baltimore, Boston, New York, and St Louis. Environmental assessments included allergen exposure and, in a nested case-control study of 104 children, the bacterial content of house dust collected in the first year of life. Associations were determined among environmental factors, aeroallergen sensitization, and recurrent wheezing at age 3 years.
Results: Cumulative allergen exposure over the first 3 years was associated with allergic sensitization, and sensitization at age 3 years was related to recurrent wheeze. In contrast, first-year exposure to cockroach, mouse, and cat allergens was negatively associated with recurrent wheeze (odds ratio, 0.60, 0.65, and 0.75, respectively; $P \leq .01$). Differences in house dust bacterial content in the first year, especially reduced exposure to specific Firmicutes and Bacteriodetes, was associated with atopy and atopic wheeze. Exposure to high levels of both allergens and this subset of bacteria in the first year of life was most common among children without atopy or wheeze.
Conclusions: In inner-city environments children with the highest exposure to specific allergens and bacteria during their first year were least likely to have recurrent wheeze and allergic sensitization. These findings suggest that concomitant exposure to high levels of certain allergens and bacteria in early life might be beneficial and suggest new preventive strategies for wheezing and allergic diseases. (J Allergy Clin Immunol 2014;134:593-601.)

Key words: *Asthma, atopy, allergen exposure, microbial exposure, inner city*

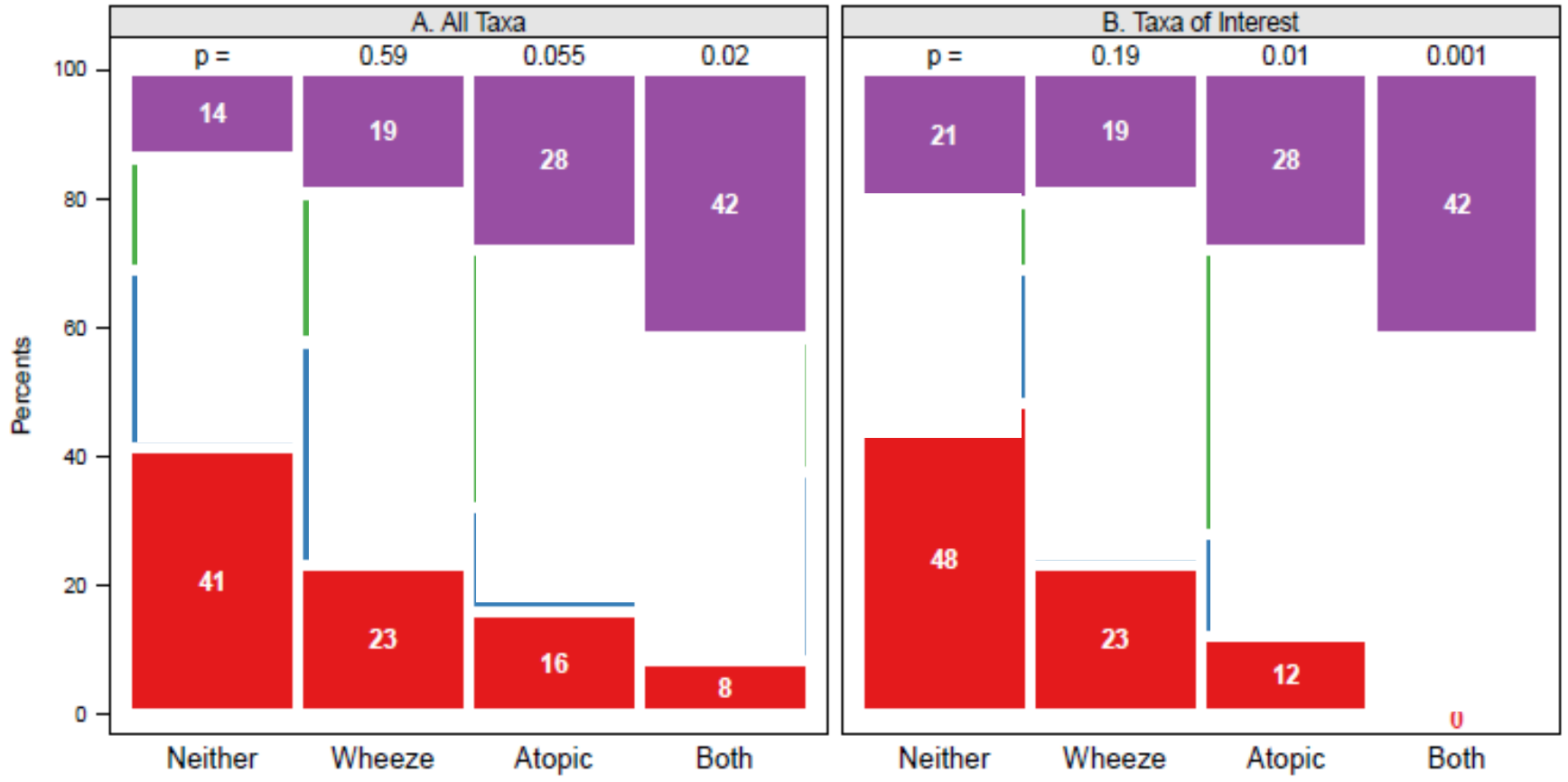
Wheezing illnesses affect 35% to 50% of children by the age of 3 years[1,2] and are a leading cause for outpatient visits and hospitalizations.[3,4] Wheezing in nonatopic children is often transient, but recurrent wheezing in children with early allergic sensitization or other signs of atopy during the preschool years

Complex interplay of allergens and microbes (and presumably genotype) may explain inconsistent findings

Lynch SV, Wood RA, et al. Effects of early-life exposure to allergens and bacteria on recurrent wheeze and atopy in urban children. J Allergy Clin Immunol. 2014 134(3):593-601 e12.



Complex interplay of allergens and microbes (and presumably genotype) may explain inconsistent findings



Complex interplay of allergens and microbes (and presumably genotype) may explain inconsistent findings

Amish vs Mennonites

Amish – lite - back to the future…….

Trials of domestic and dietary ‘biomic’ intervention in pregnancy and first year of life

Should be co-ordinated and multi-national
rural and urban
developed and developing

Amish Lite

Pre-industrial microbiota and allergens in a post industrial environment

MATERNAL

- City farm environment
- Pets + close contact
- Feather bedding
- Internal compost
- No disinfectants
- Yoghurt/probiotics
- Allergenic foods
- Reduced cleaning

INFANT

- City farm environment
- Animal contact
- Pets + close contact
- Yoghurt - early
- Early allergenic foods
- Saliva transfer – pre-mastication/pacifier
- +++

New friends……..

- Microbes really rule Earth
- We need to re-connect with them
  - Diet
  - Probiotics (fermented food)
  - Urban jungles and the psyche needs natural environments
  - Need care – “Keep your friends close and your enemies closer (Nicolo Machieavelli)
- City farms, City fields, Throw away your bleach
- ??????????????