Microbiote : la révolution de l'individu

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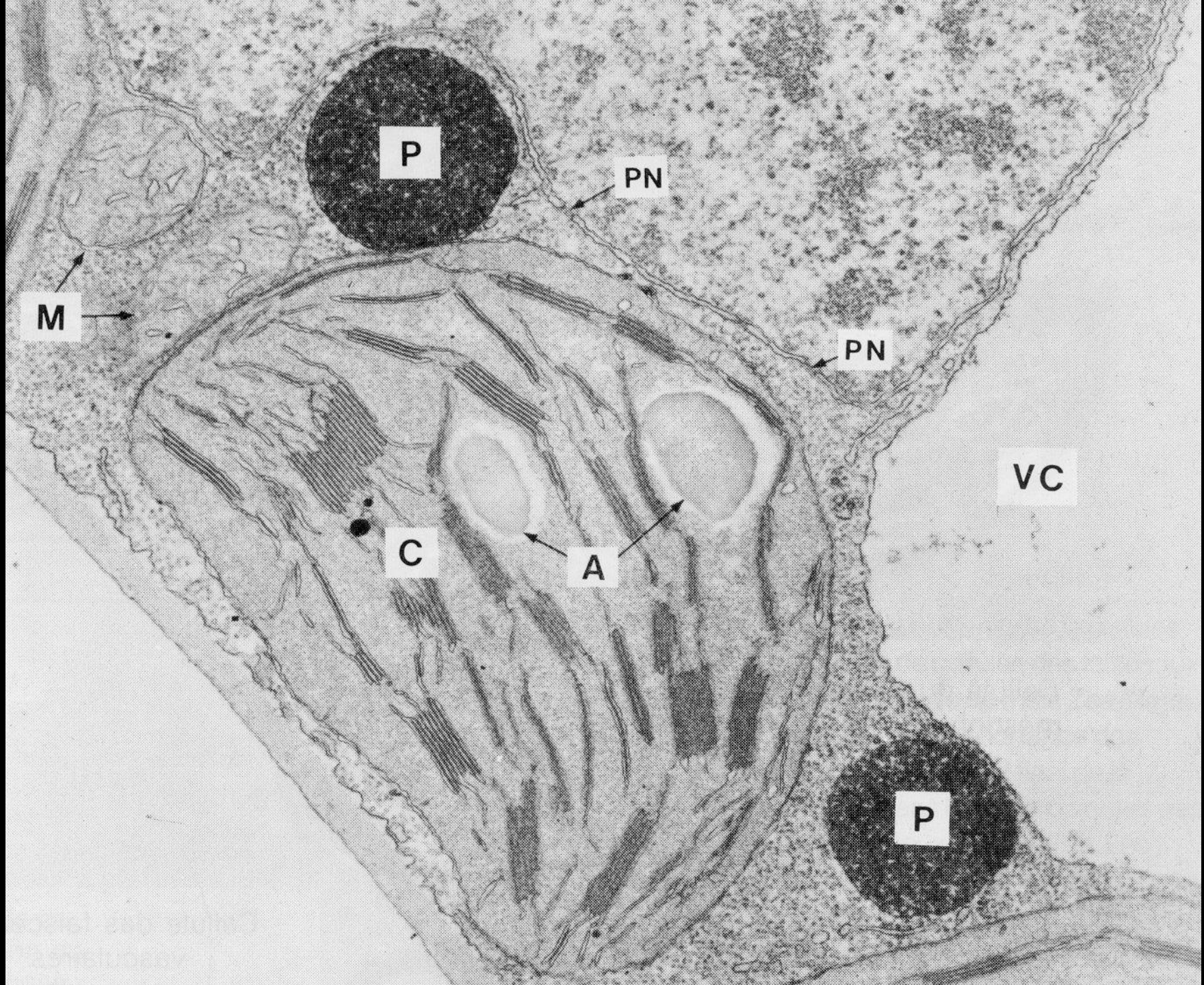
Muséum nat. d'Histoire naturelle, Paris
Universités de Gdansk (Pologne) & Kunming (Chine)

1

métabolisme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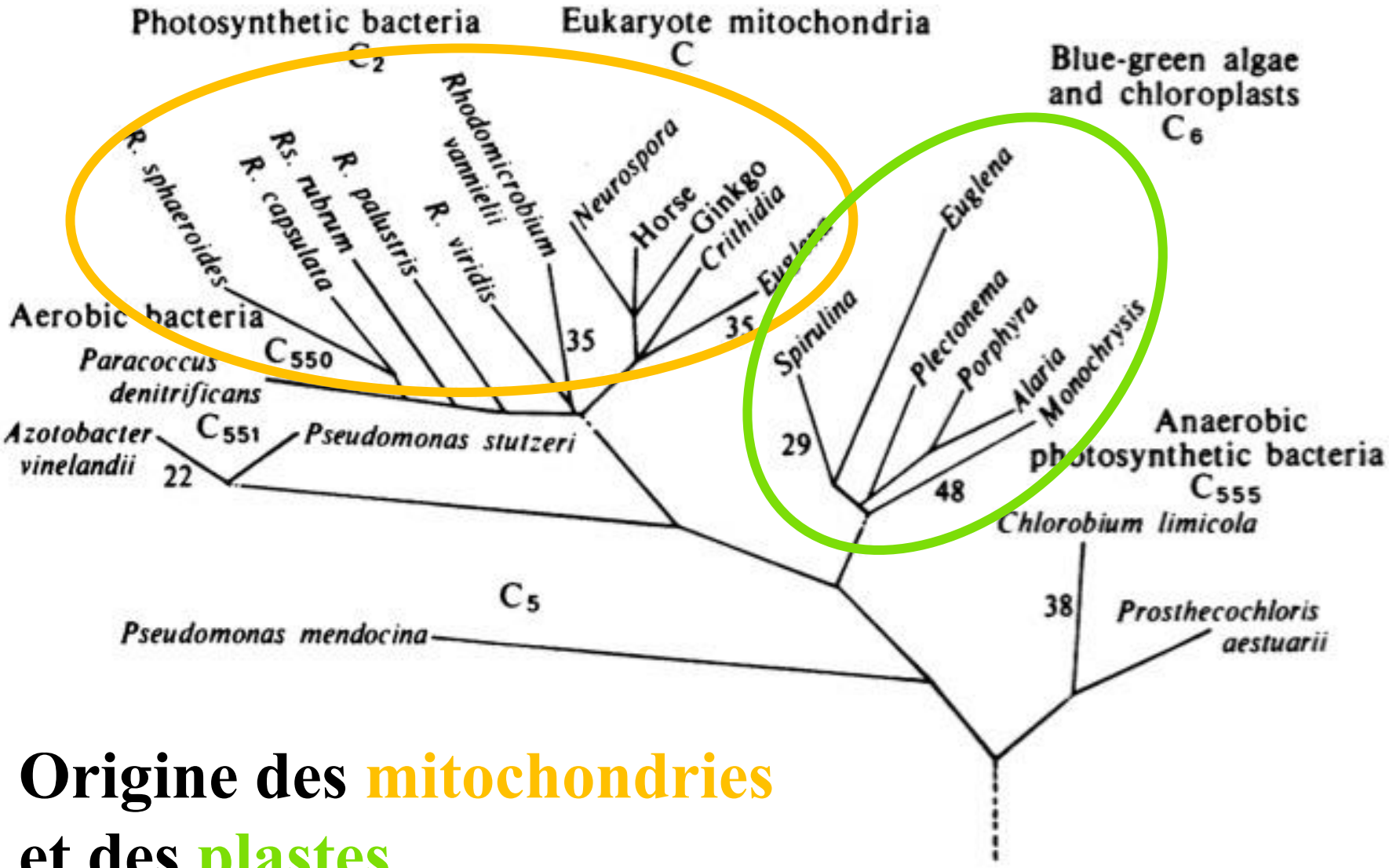
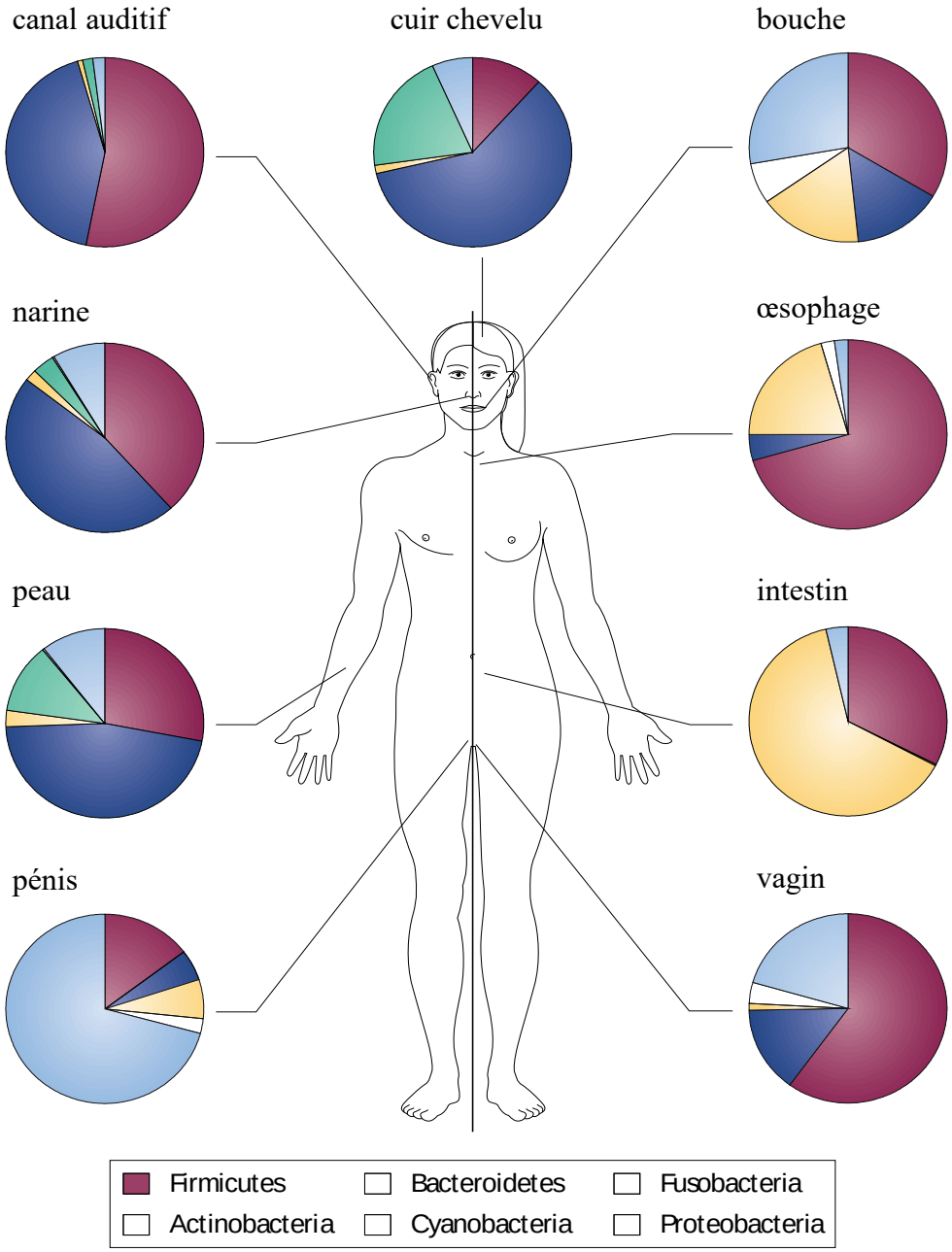


Origine des mitochondries et des plastes

Schwartz & Dayhoff, 1978

2

microbiotes

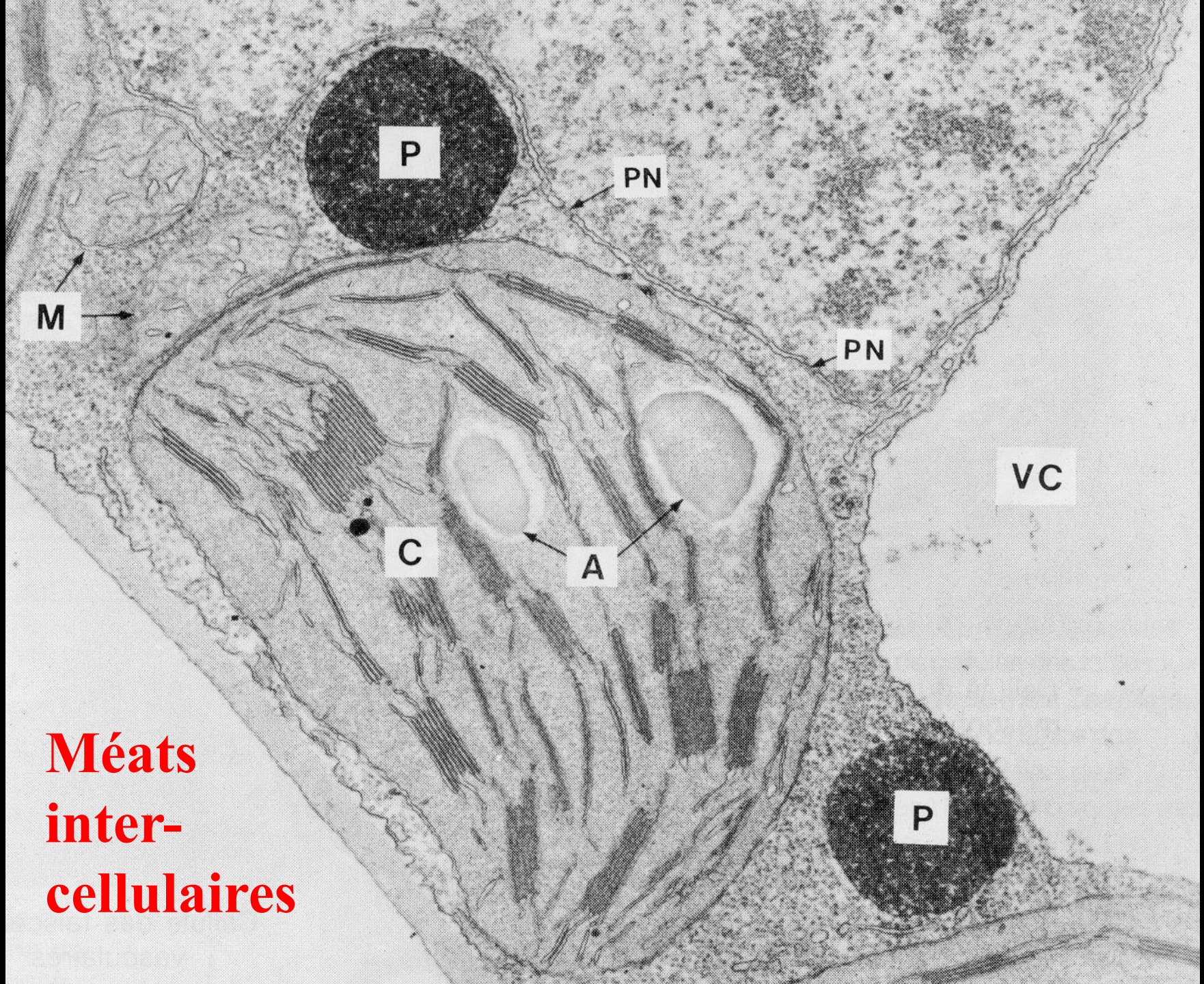


10 000 milliards de cellules humaines

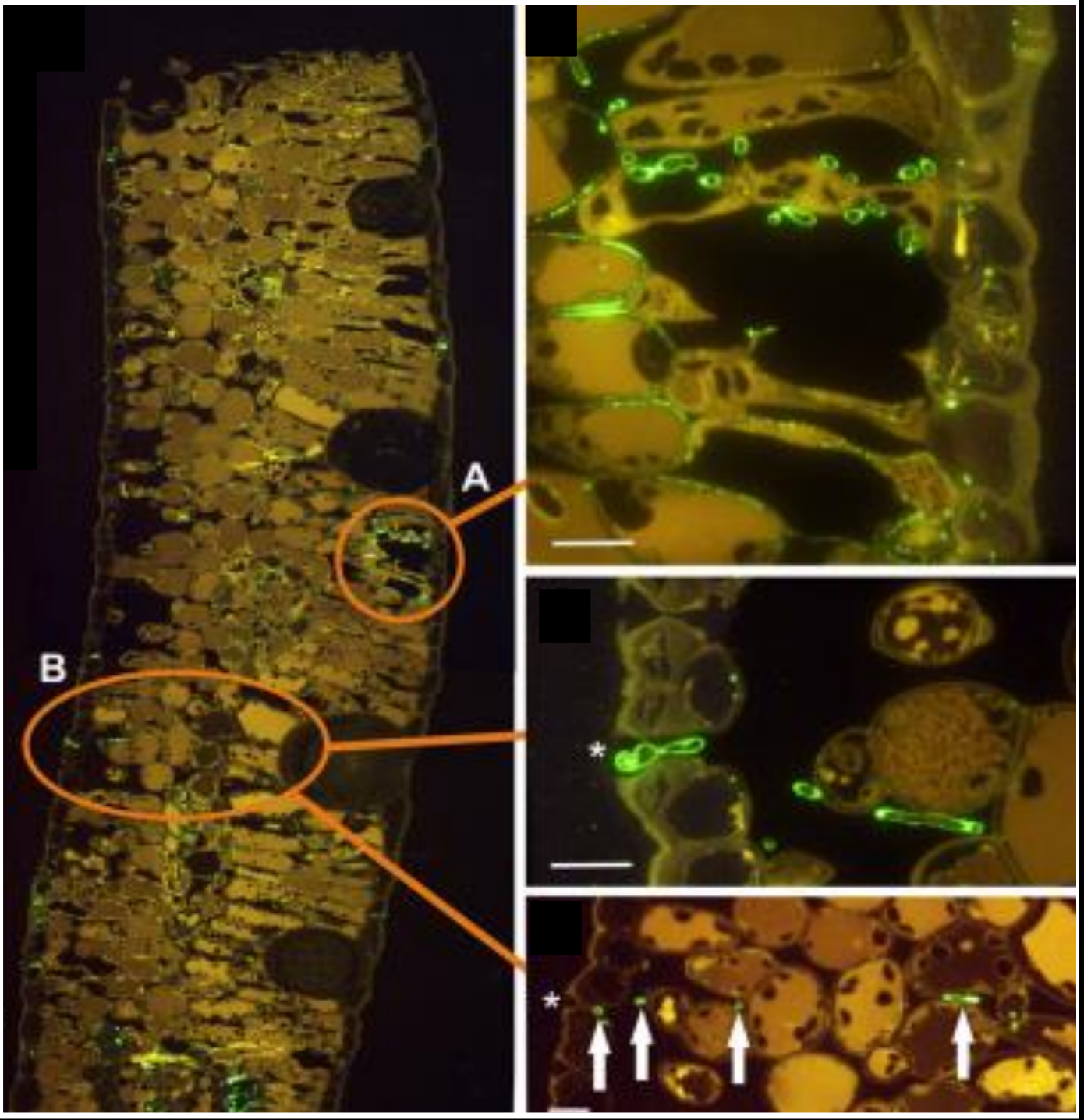
10 000 milliards de microbes intestinaux

1 000 milliards de microbes sur la peau

100 milliards de microbes par ailleurs

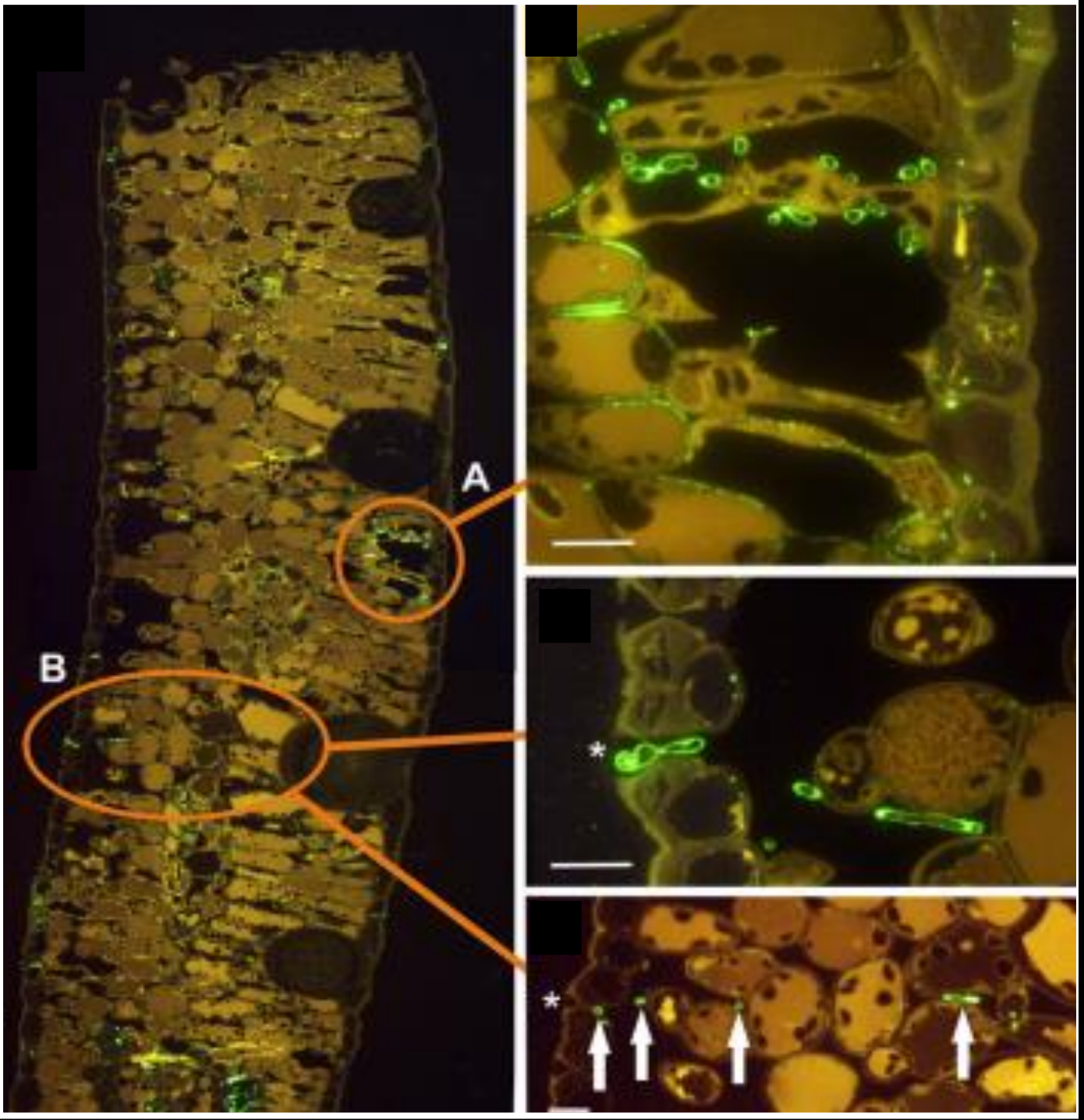


Méats inter-cellulaires



Une hyper-diversité foliaire ignorée…

jusqu'à 100 espèces de champignons endophytes dans une feuille tropicale !



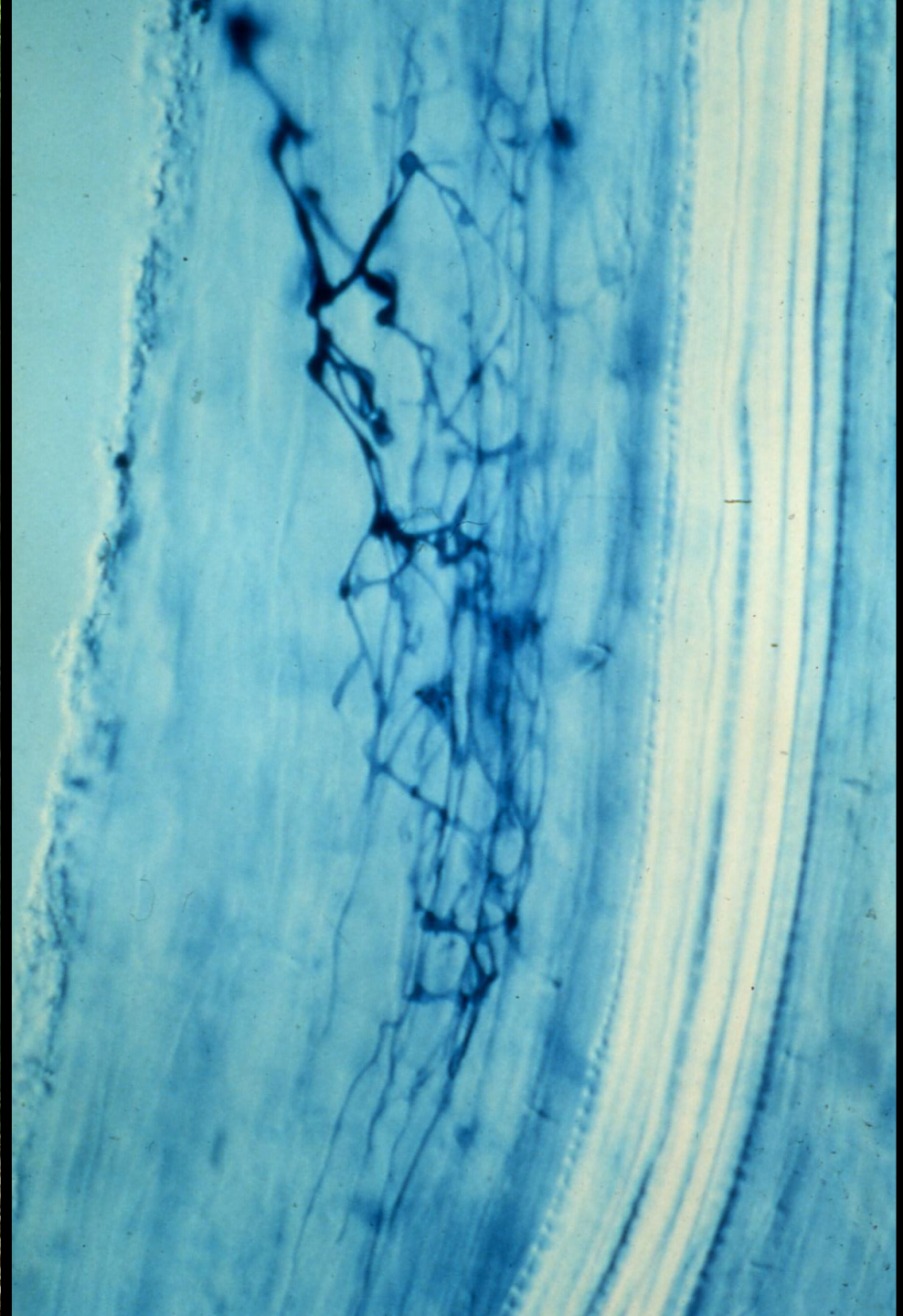
Une hyper-diversité foliaire ignorée…

jusqu'à 100 espèces de champignons endophytes dans une feuille tropicale !

10^8 bactéries/g de feuille

3

nutrition



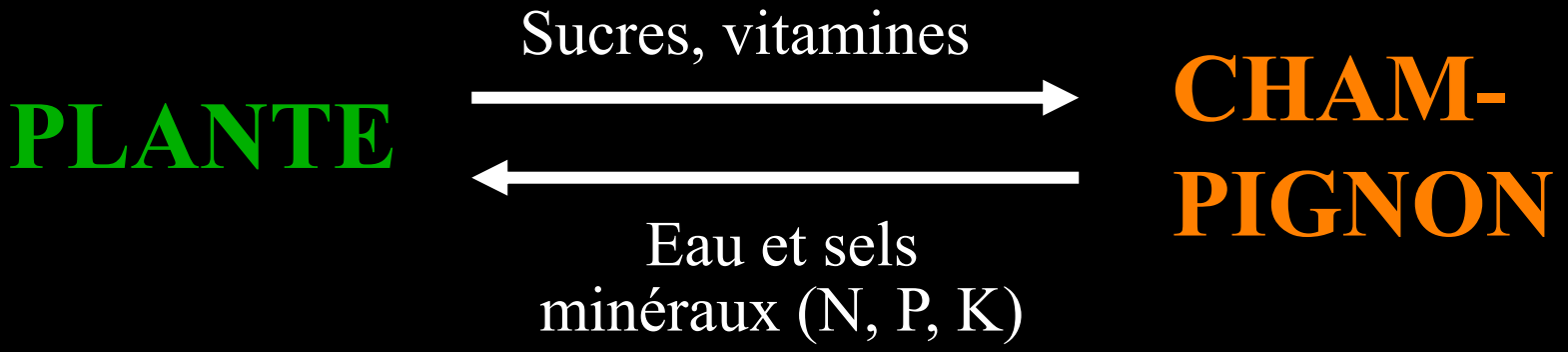
MYCORHIZES

Mycélium et spores de Gloméromycètes

MYCORHIZES

Sans (stérile) ou avec champignons

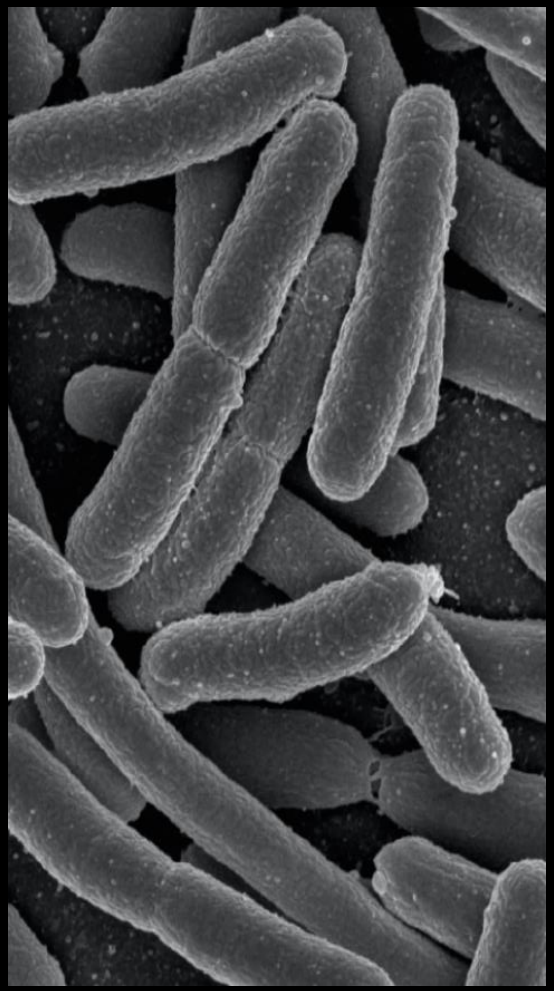
MYCORHIZES, 80% des plantes



MICROBIOTE INTESTINAL

Aliments complexes

Aliments assimilables



MICROBIOTE INTESTINAL

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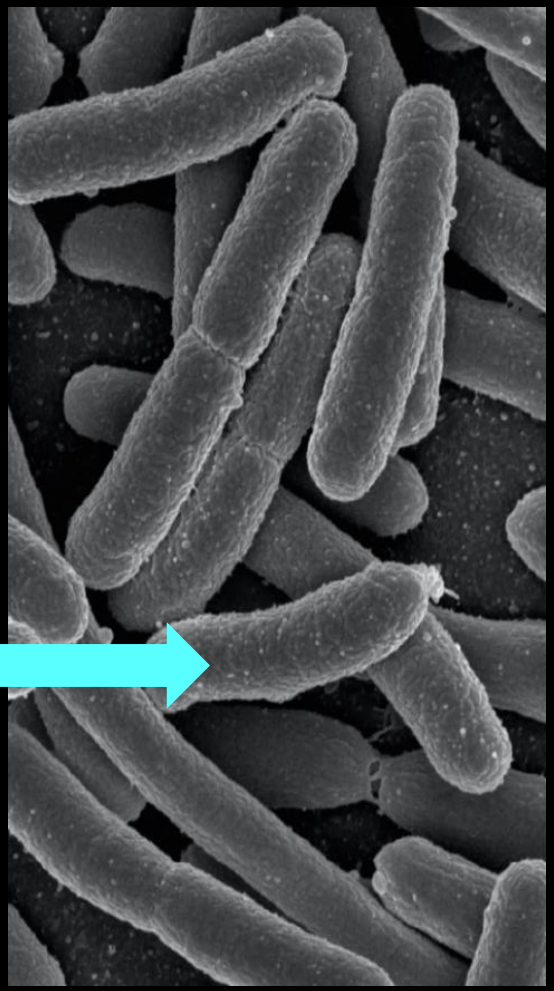
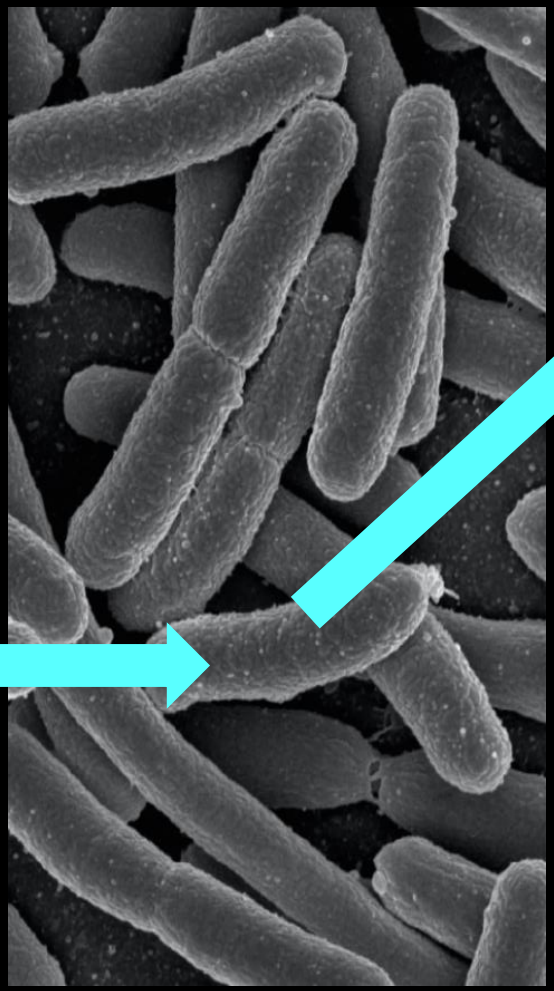
Aliments assimilables



MICROBIOTE INTESTINAL

Aliments complexes

Aliments assimilables

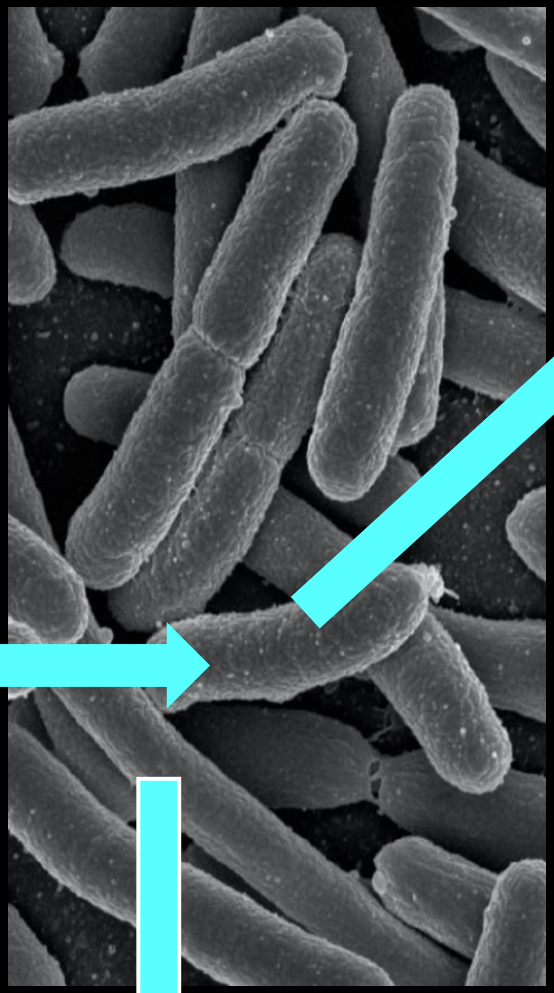


Déchets de fermentation : butyrate, acétate…

MICROBIOTE INTESTINAL

Aliments complexes

Aliments assimilables



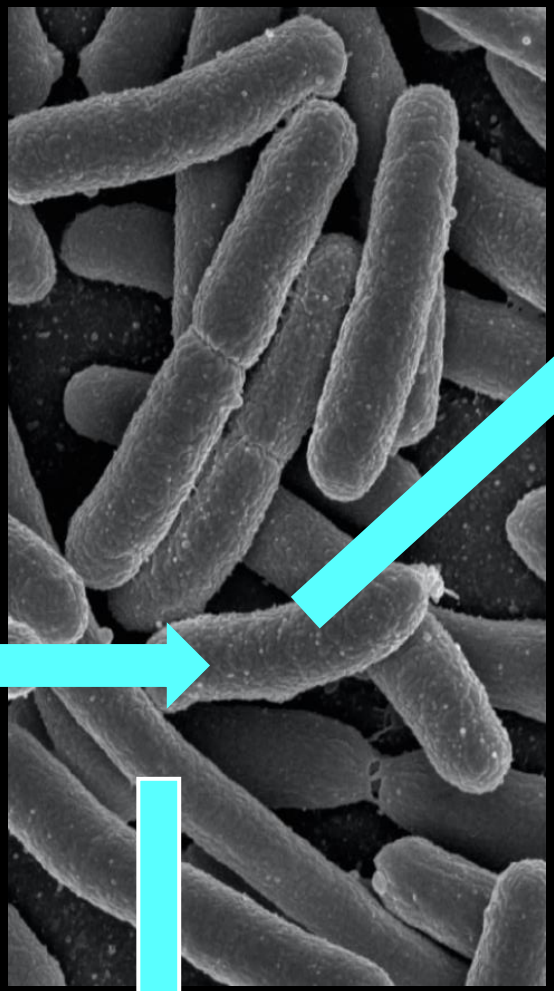
Déchets de fermentation : butyrate, acétate…

Cell. mortes

MICROBIOTE INTESTINAL

Aliments complexes

Aliments assimilables



Déchets de fermentation : butyrate, acétate…

Cell. mortes

EPITHELIUM INTESTINAL

Action enzymatique

Bacteroidetes plebeius
et le nori (algue rouge)

Production de produits assimilables

vitamines
acides gras volatiles (couvant 10% de nos besoins)

4

protection

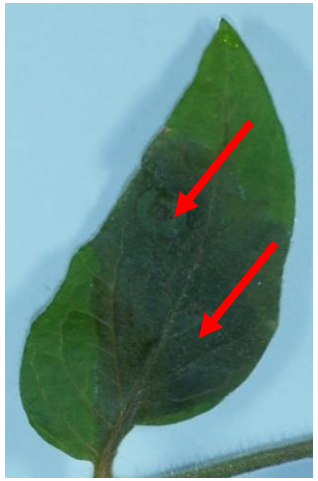
Protection foliaire

Non mycorhizé

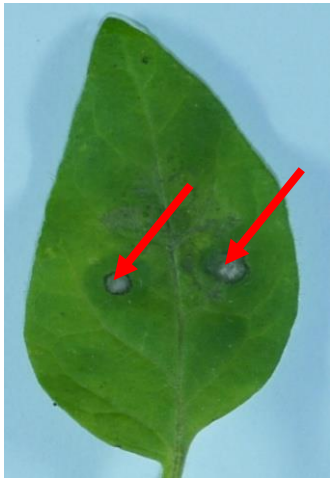
Myco-rhizé

Jung, S.C. *et al.* (2012)
J. Chem. Ecol. 38, 651

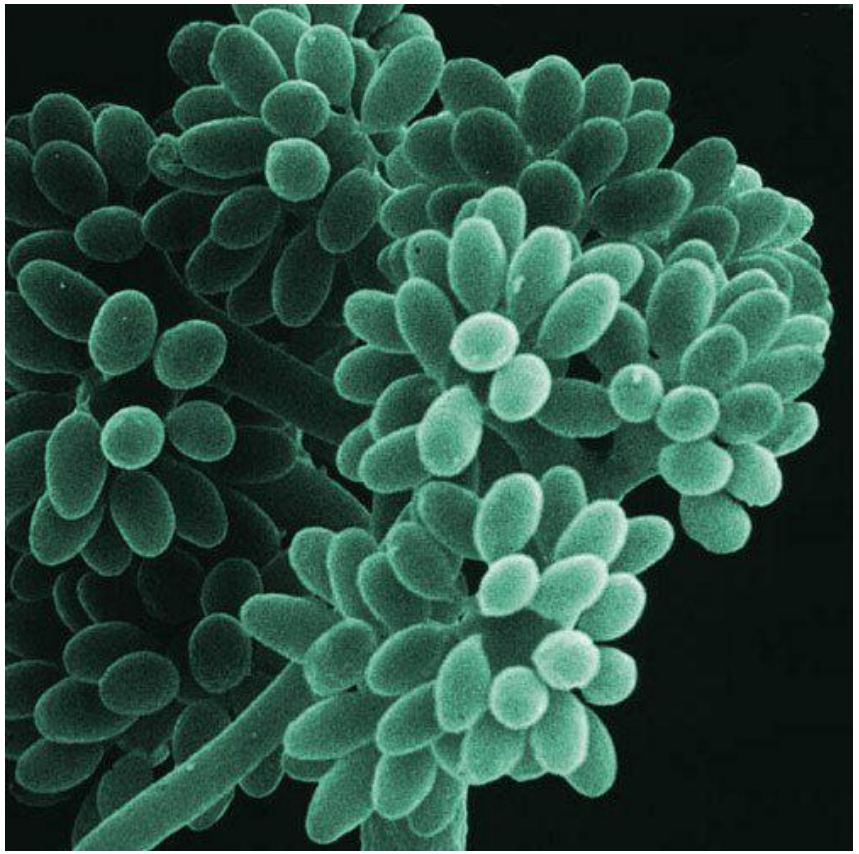
Protection foliaire contre *Botrytis cinerea*



Non mycorhizé



Myco-rhizé



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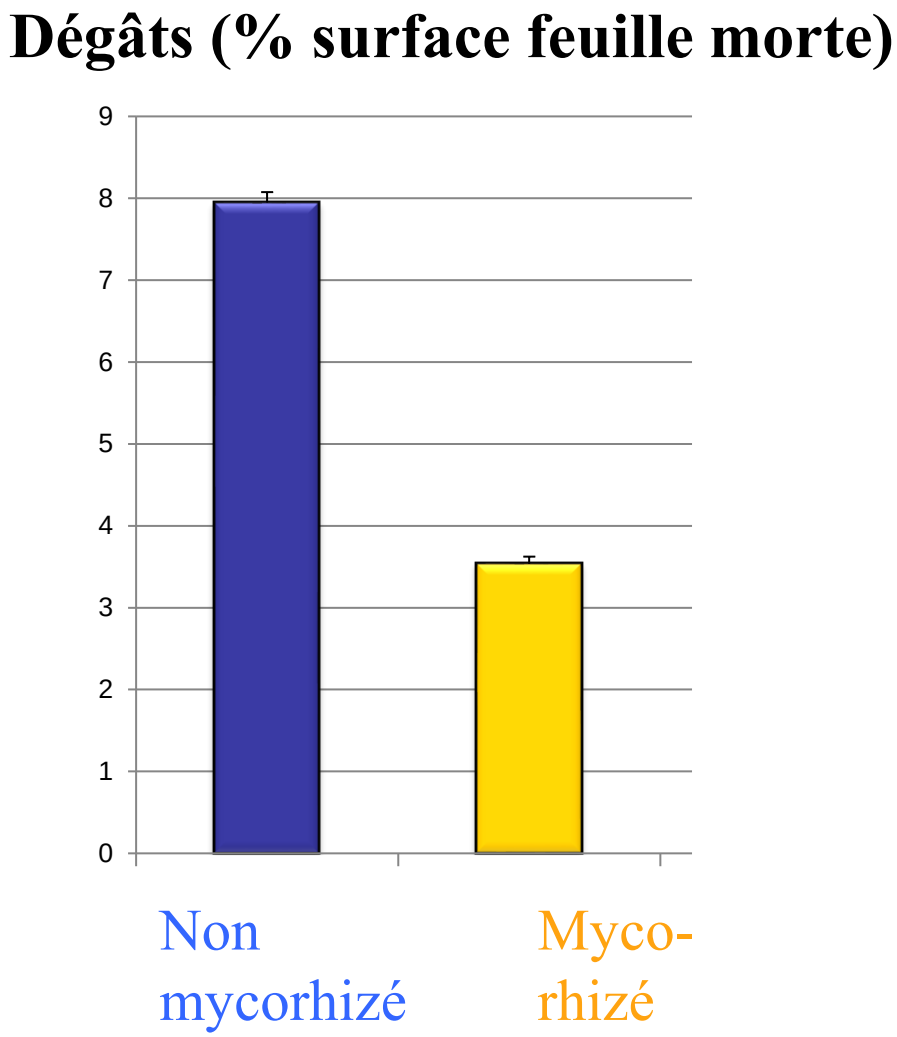


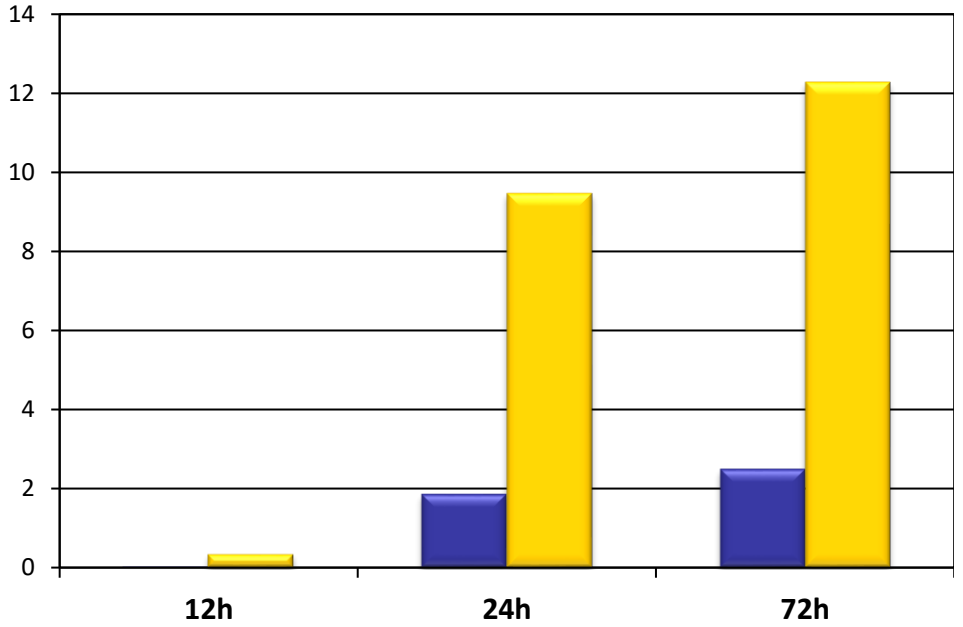
Jung, S.C. *et al.* (2012)
J. Chem. Ecol. 38, 651

Protection foliaire contre *Botrytis cinerea*

Non mycorhizé

Myco-rhizé

Accumulation des composés de défense (*pin II*)



Non mycorhizé

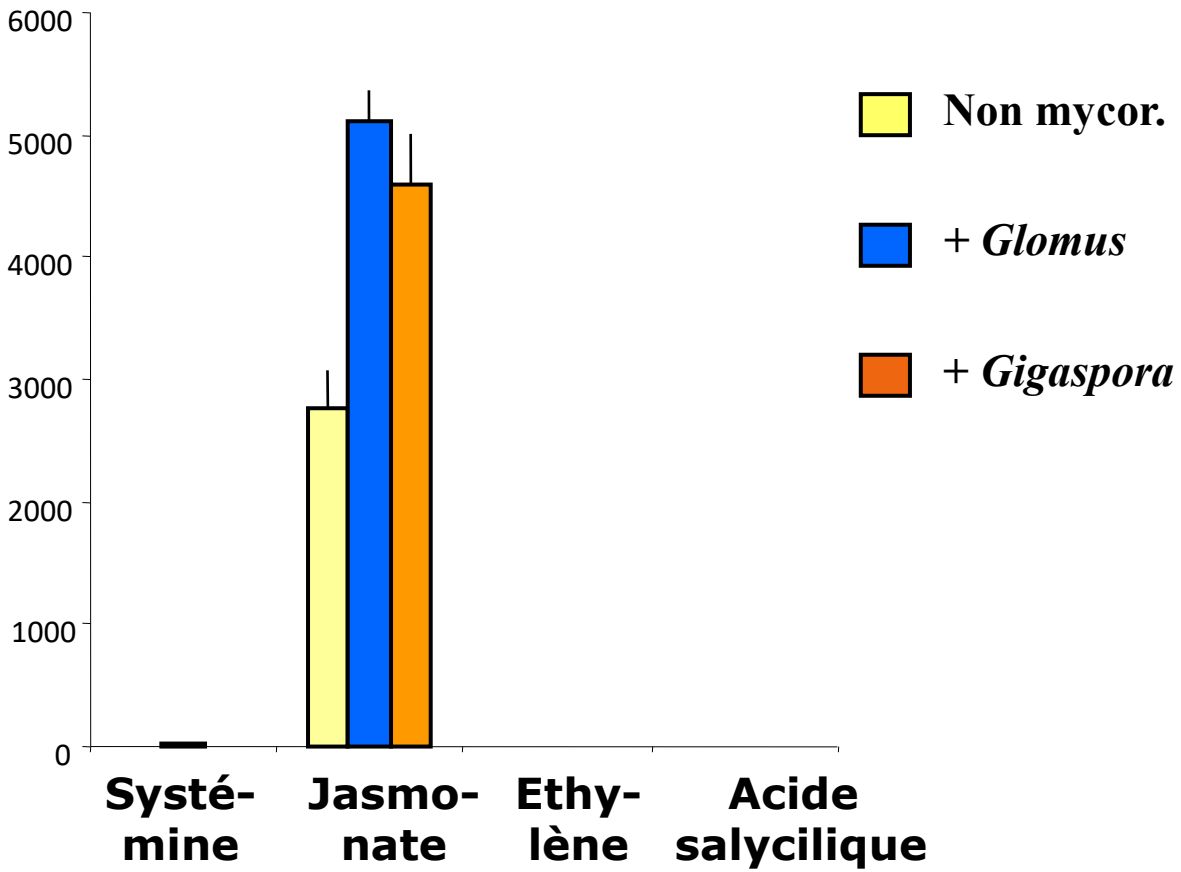
Myco-rhizé

Jung, S.C. *et al.* (2012)
J. Chem. Ecol. 38, 651

Protection foliaire contre *Botrytis cinerea*

qPCR: expression de *PinII*

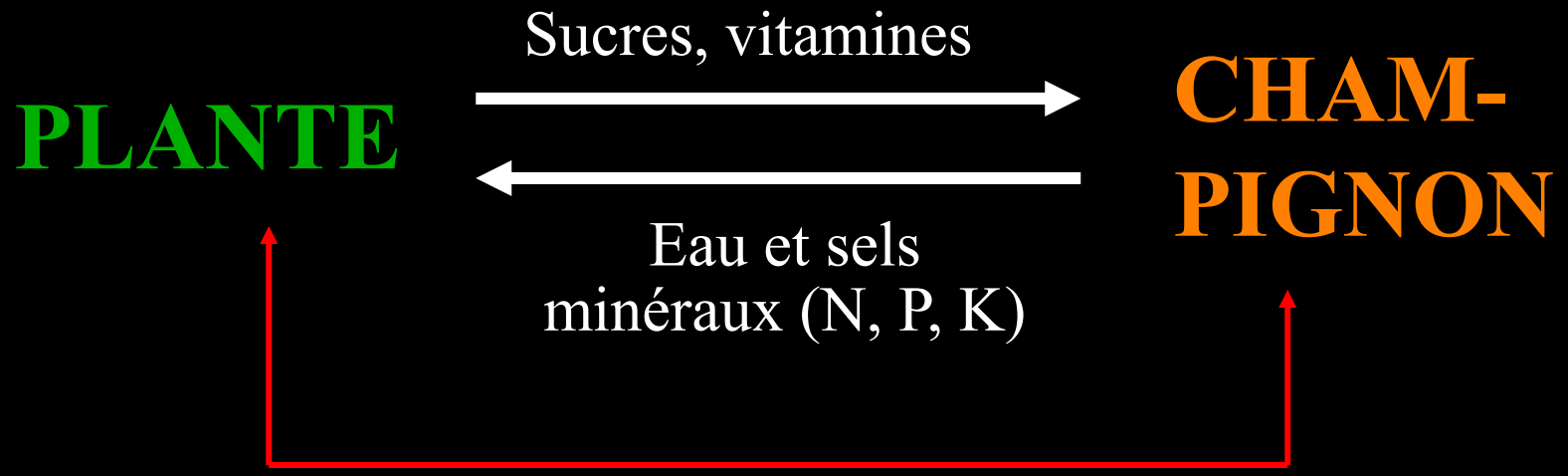
Facteur d'induction après application d'hormone exogène



>> la colonisation endomycorhizienne

potentialise la perception du jasmonate

MYCORHIZES, 80% des plantes



Protection contre les agressions
physiques et biologiques

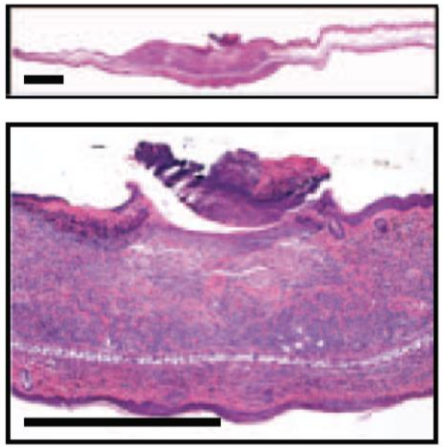
MICROBIOTE ANIMAL

Leishmania major

MICROBIOTE ANIMAL

Leishmania major

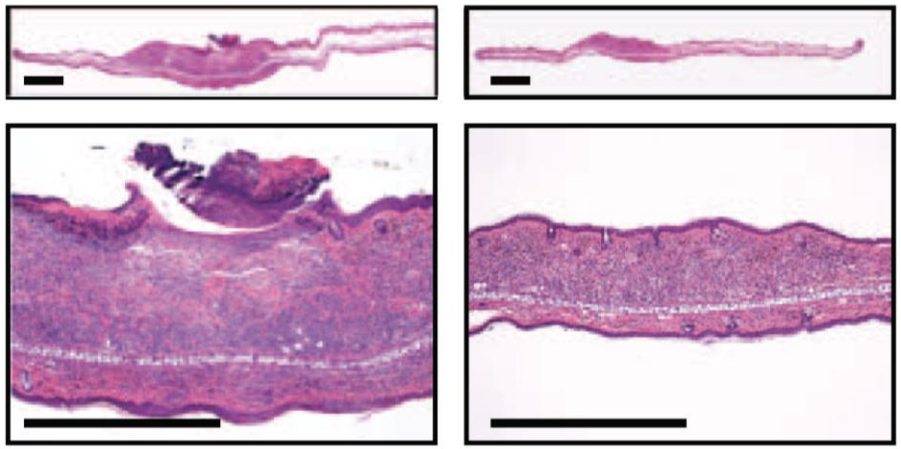
Contrôle



MICROBIOTE ANIMAL

Leishmania major

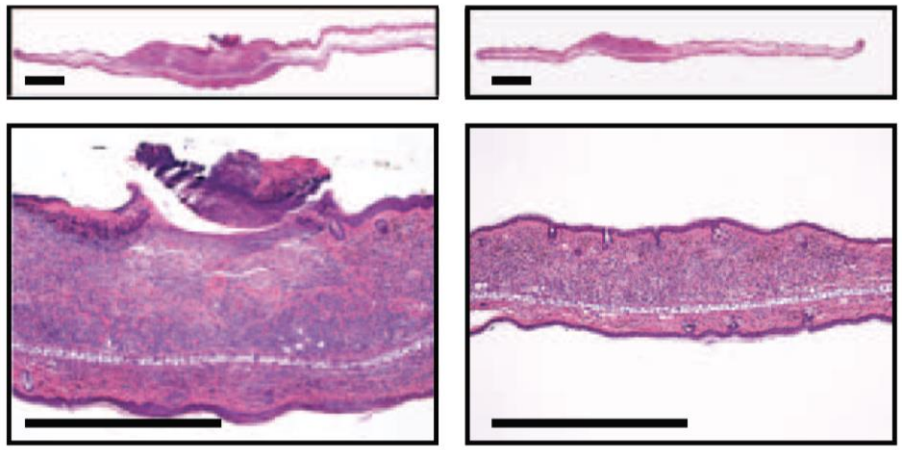
Contrôle Axénique

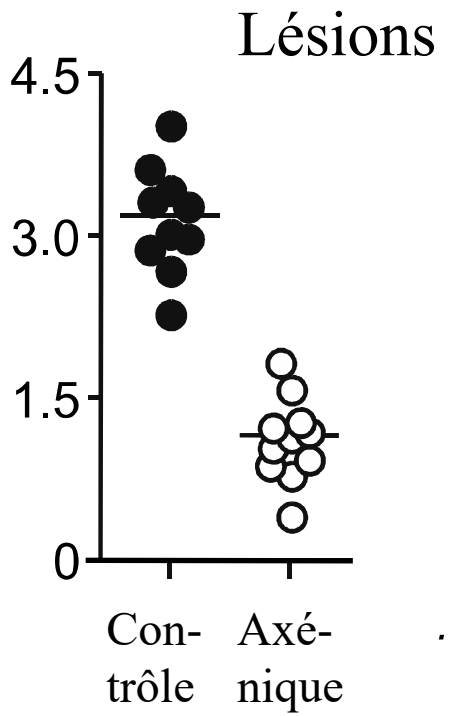


MICROBIOTE ANIMAL

Leishmania major

Contrôle Axénique

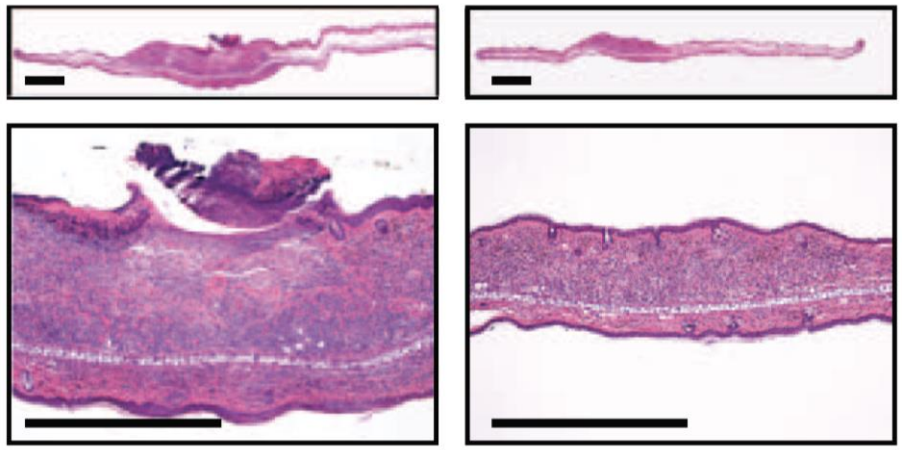


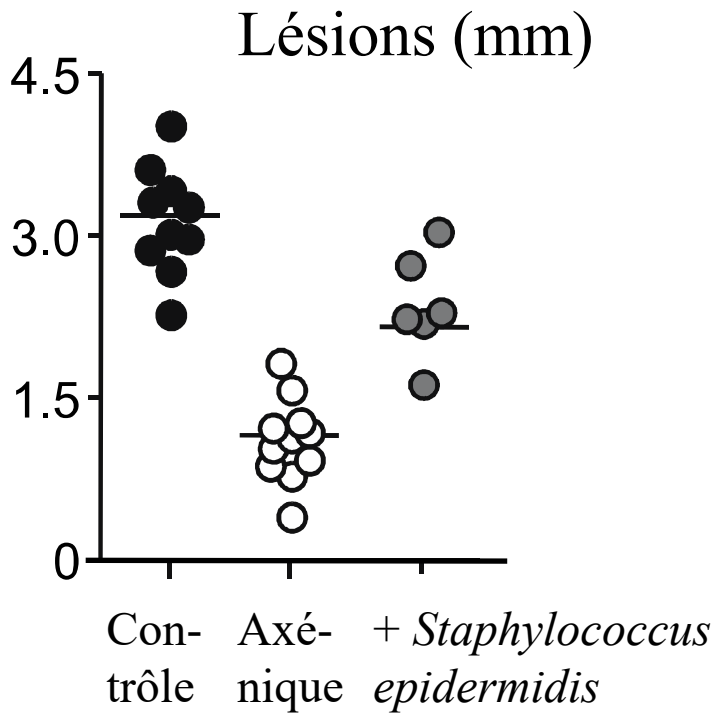


MICROBIOTE ANIMAL

Leishmania major

Contrôle Axénique

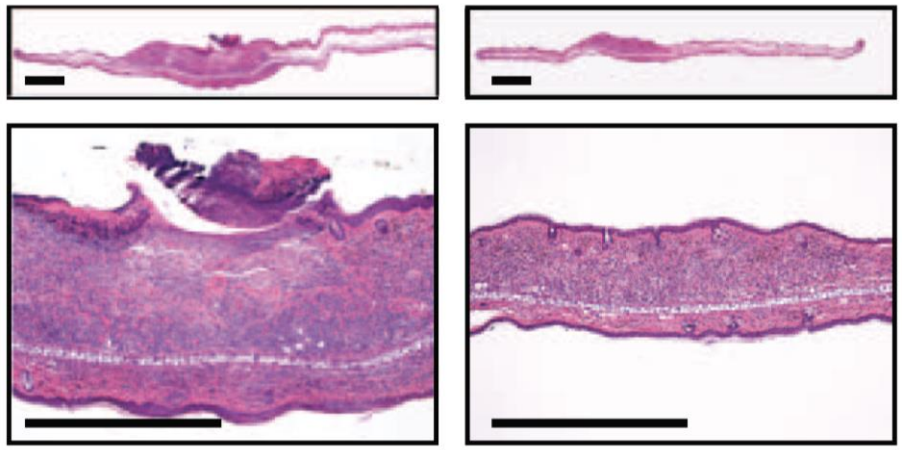




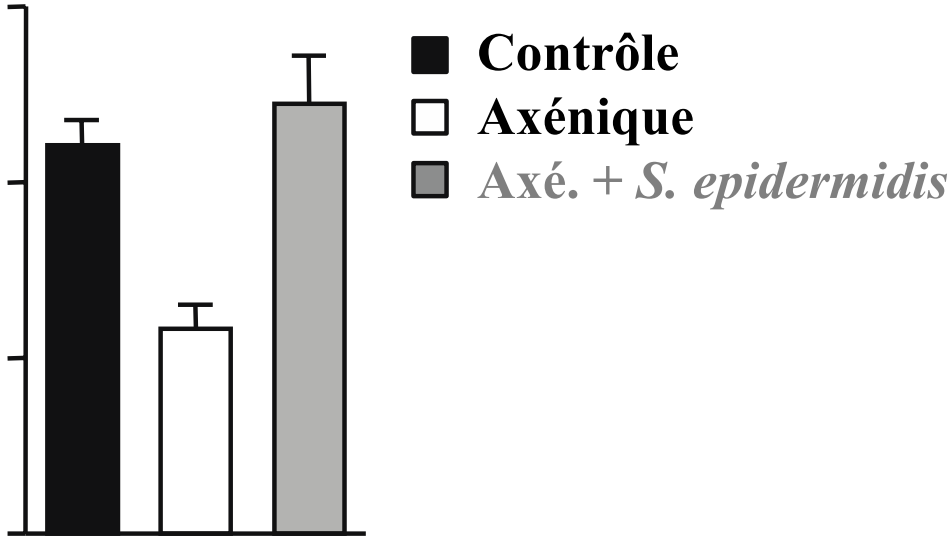
MICROBIOTE ANIMAL

Leishmania major

Contrôle Axénique



Nombre de lymphocytes TCRß+



5

partout

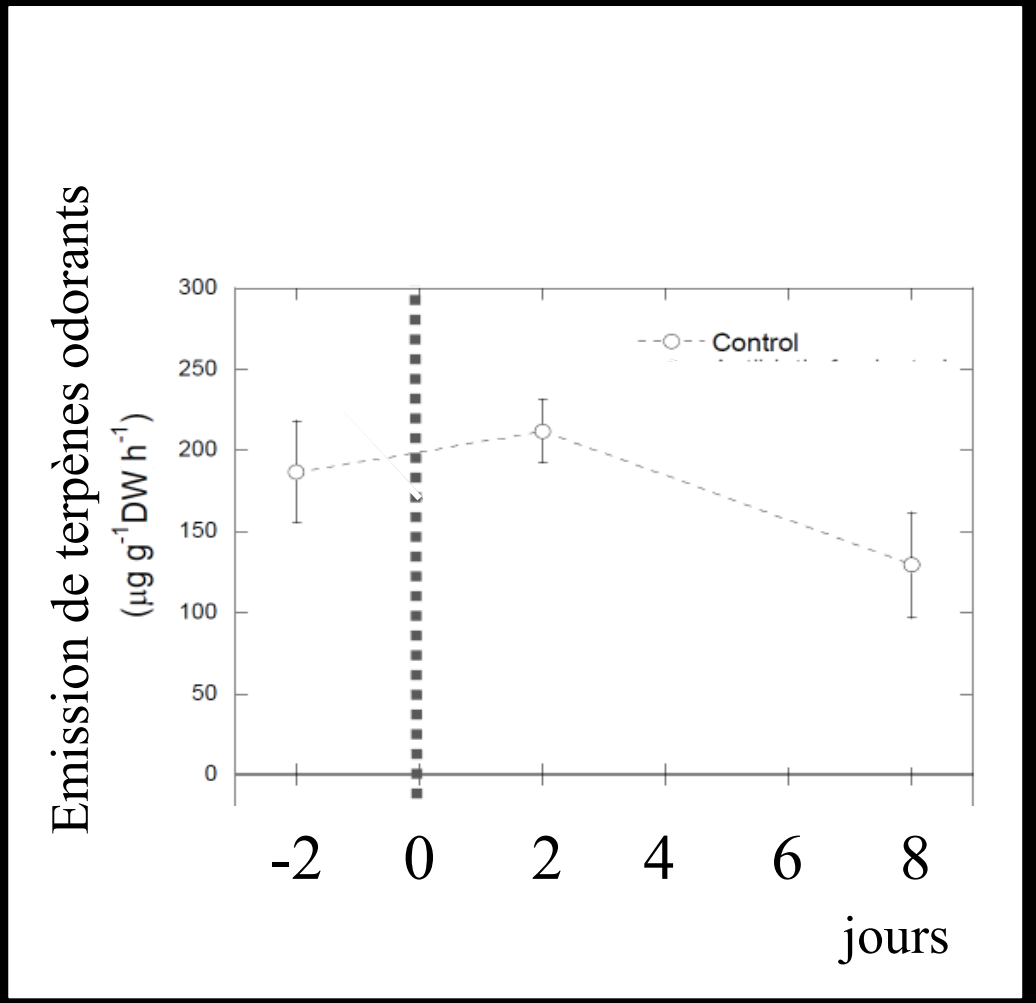
JUSQUE DANS LE PARFUM FLORAL

Sambucus nigra

sureau noir

***Scientific Report* (2014) 4 : 6727**

JUSQUE DANS LE PARFUM FLORAL



Scientific Report (2014) 4 : 6727

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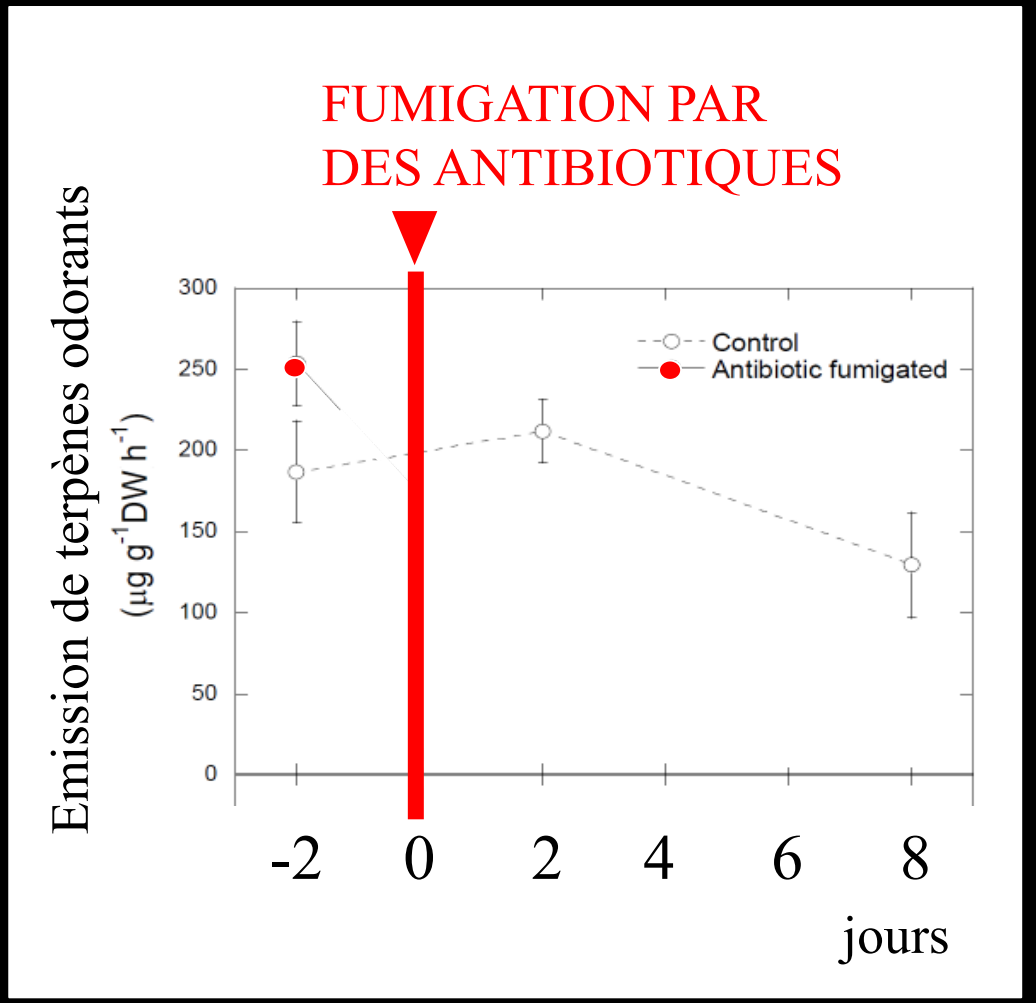

Scientific Report (2014) 4 : 6727

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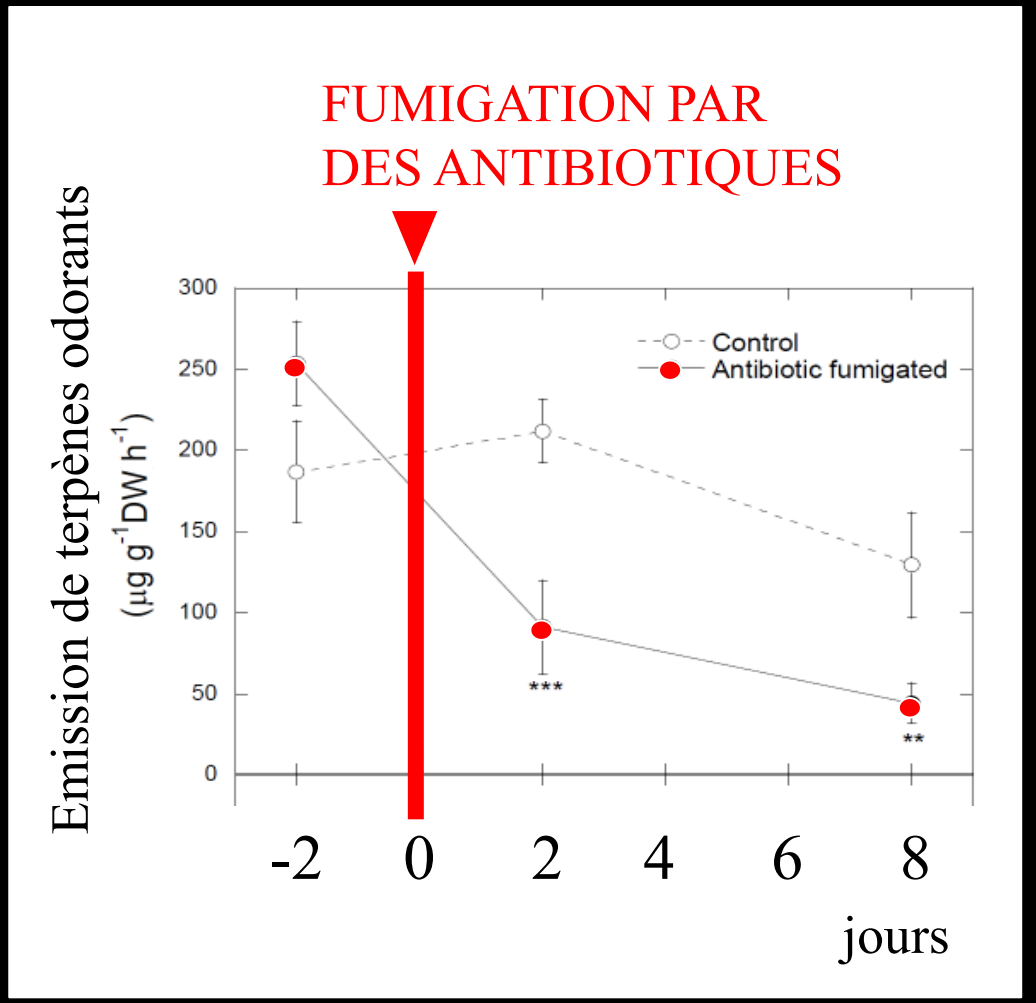

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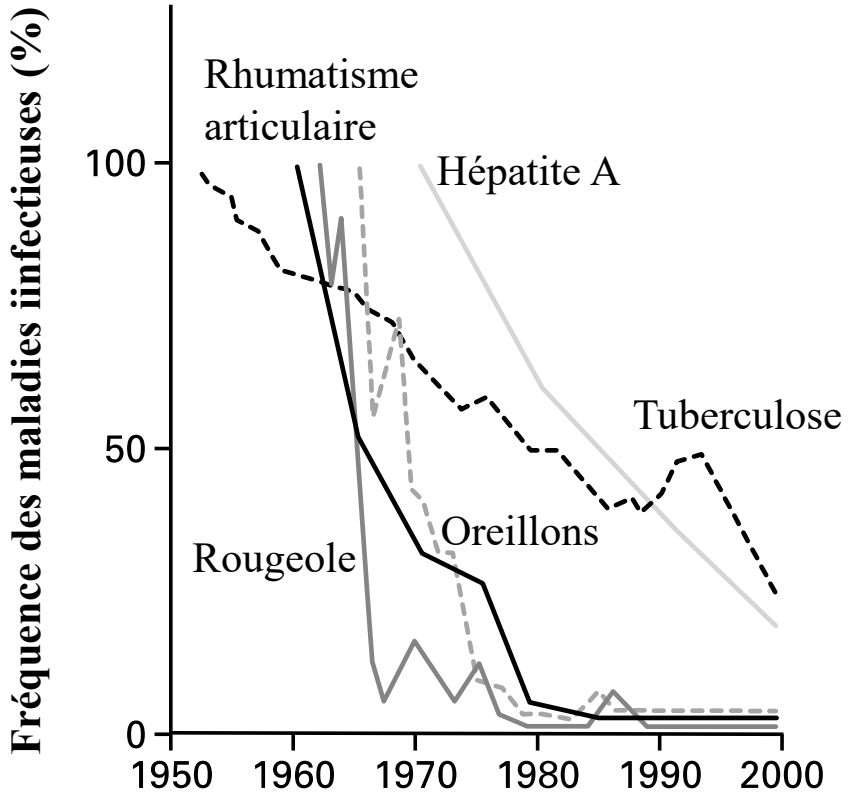
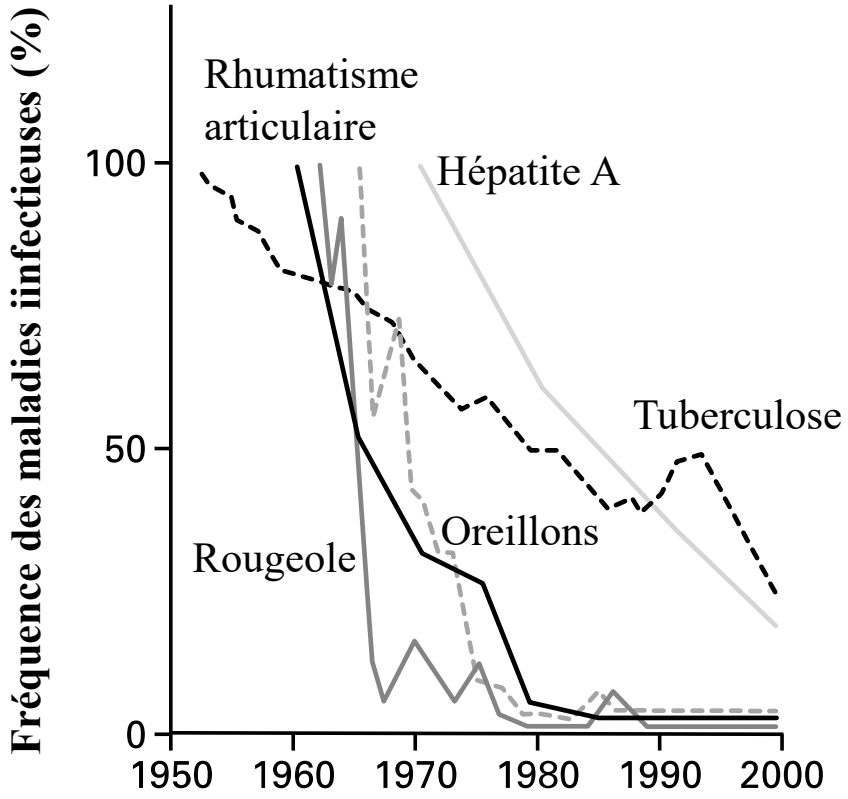
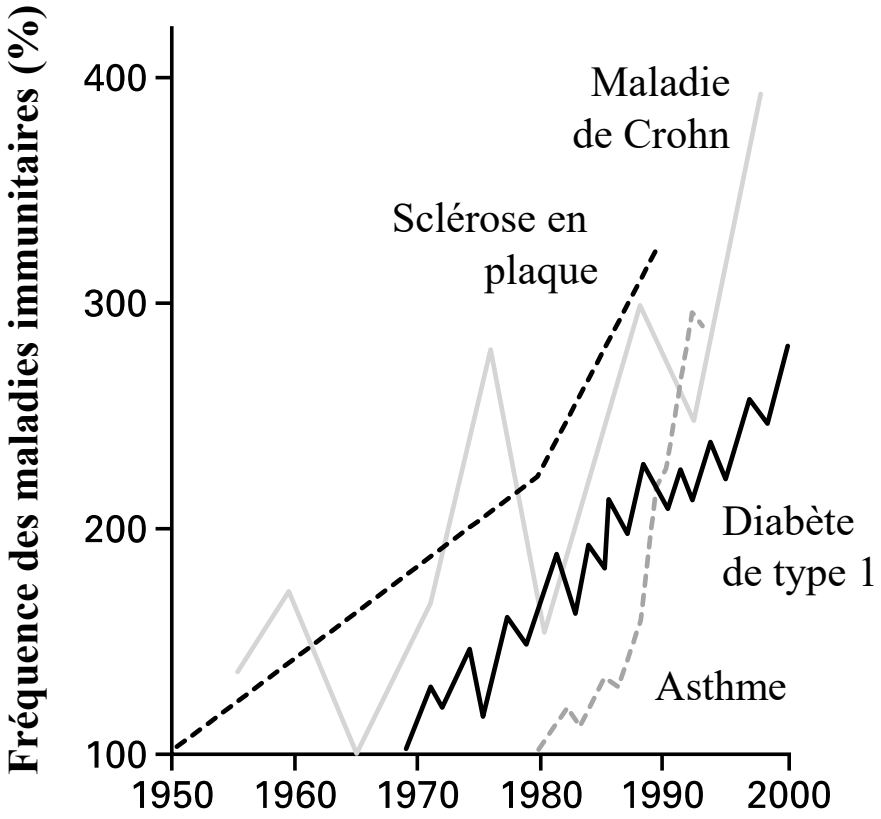
MICROBIOTE ET IMMUNITE



D'après J.-F. Bach

MICROBIOTE ET IMMUNITE





D'après J.-F. Bach

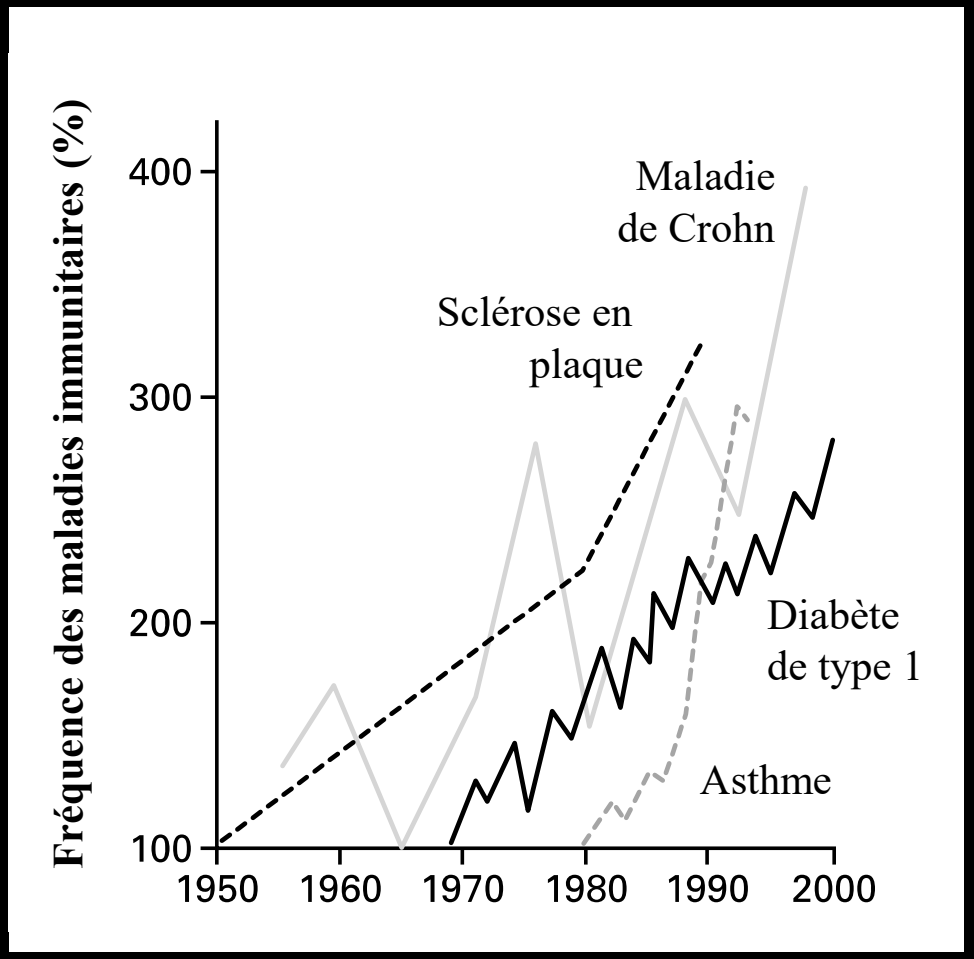
MICROBIOTE ET IMMUNITE

Maladies :

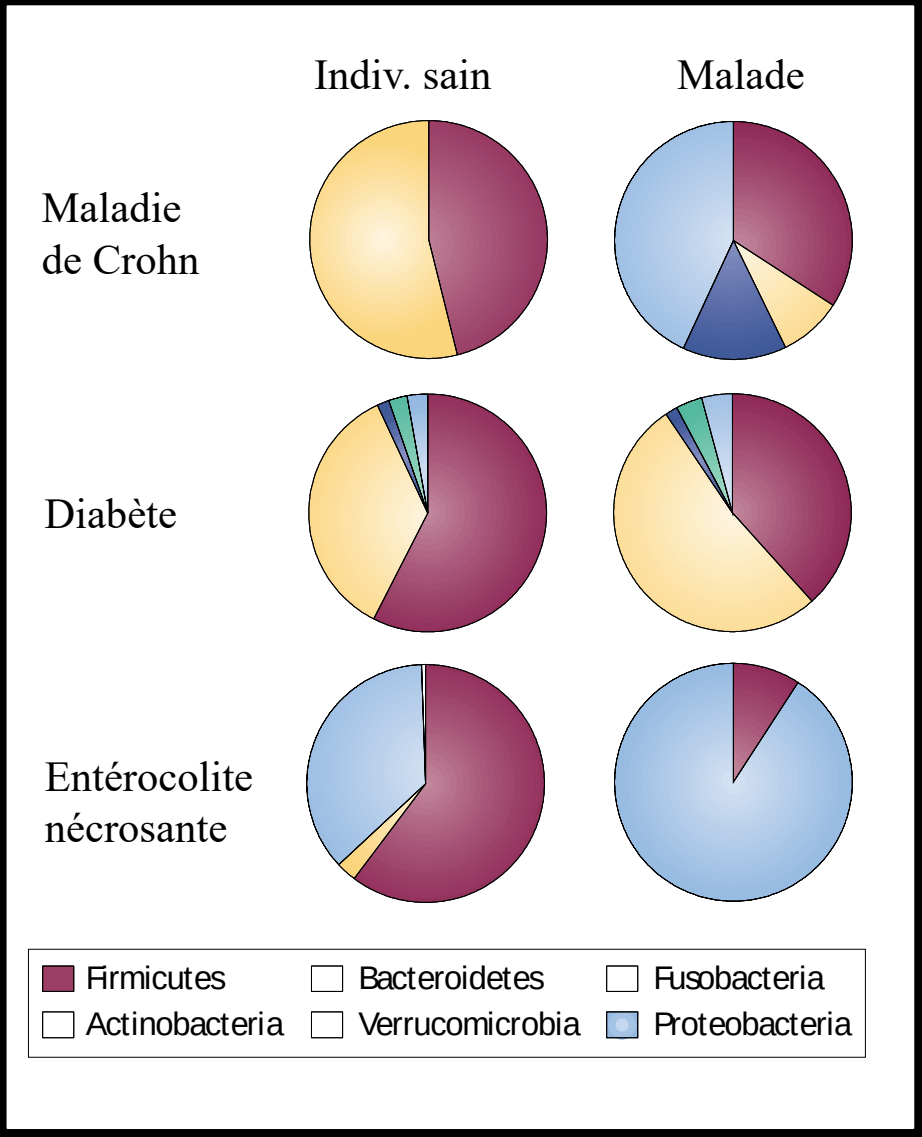
- du **métabolisme** (diabètes, obésité…)

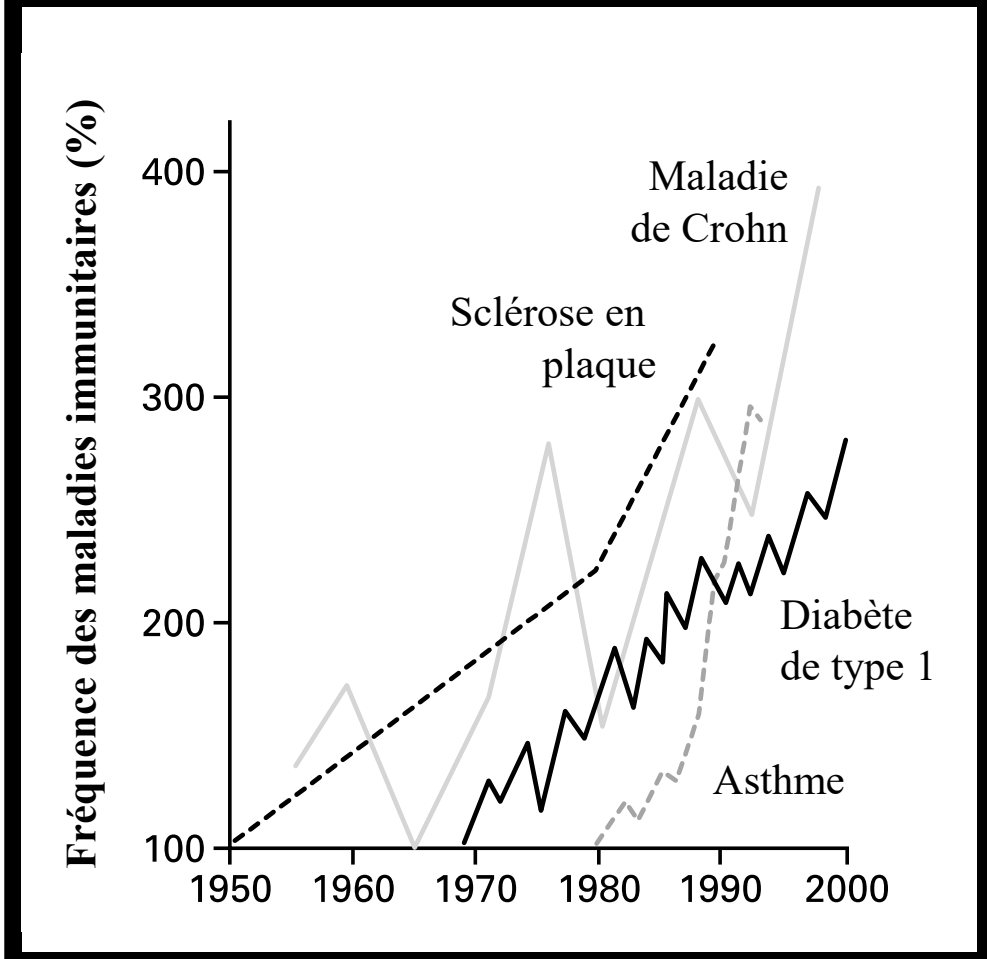
- du **système immunitaire** (asthme, allergie, maladies auto-immunes…)

- du **système nerveux** (autisme, Parkinson, Alzheimer…)



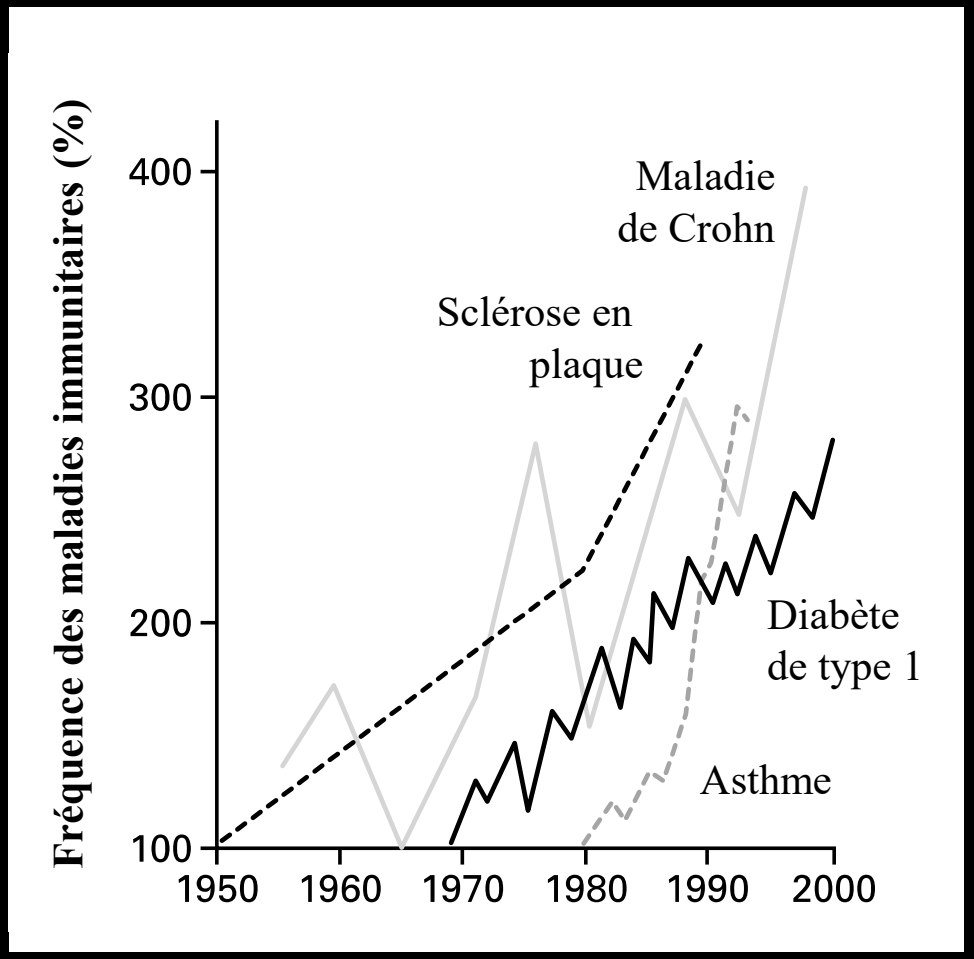
MICROBIOTE ET IMMUNITE





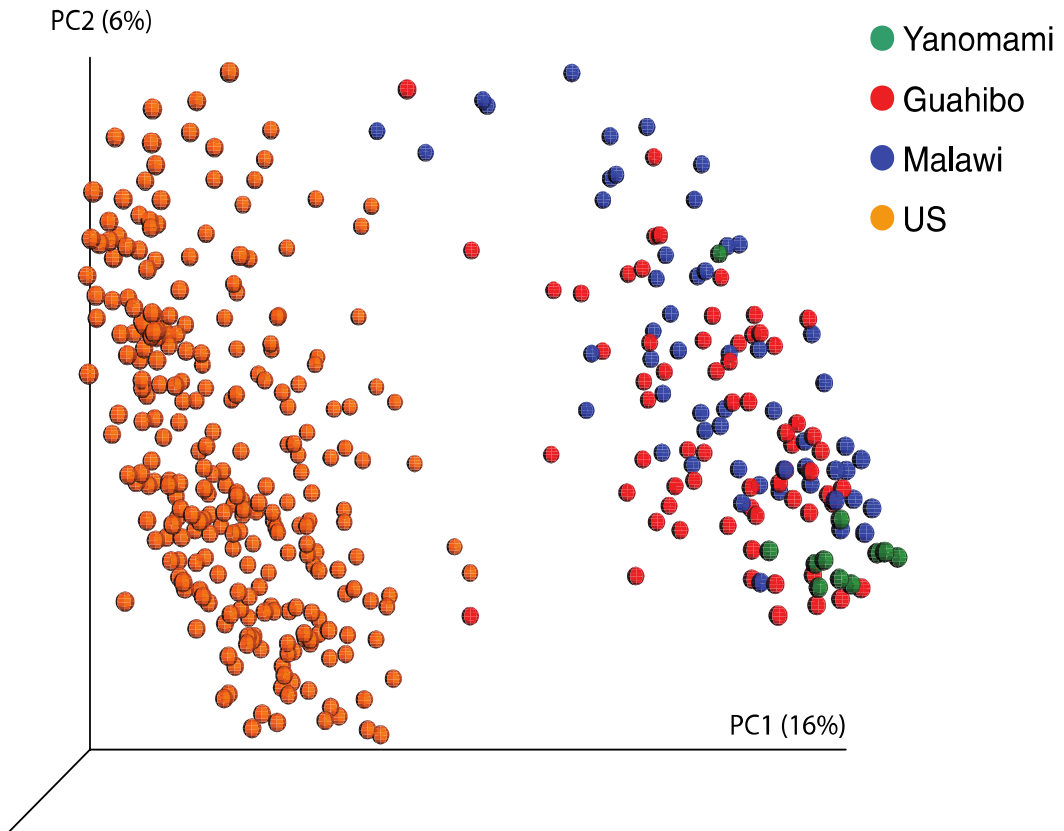
MICROBIOTE ET IMMUNITE

25% des occidentaux auront un problème de maladies ‘de la modernité’ en 2025



Yanomami, « non-contactés »
Guahibo & Malawi, peu contactés
… et les Etats-Uniens

1,5 à 3 x moins d'espèces dans les microbiotes occidentaux

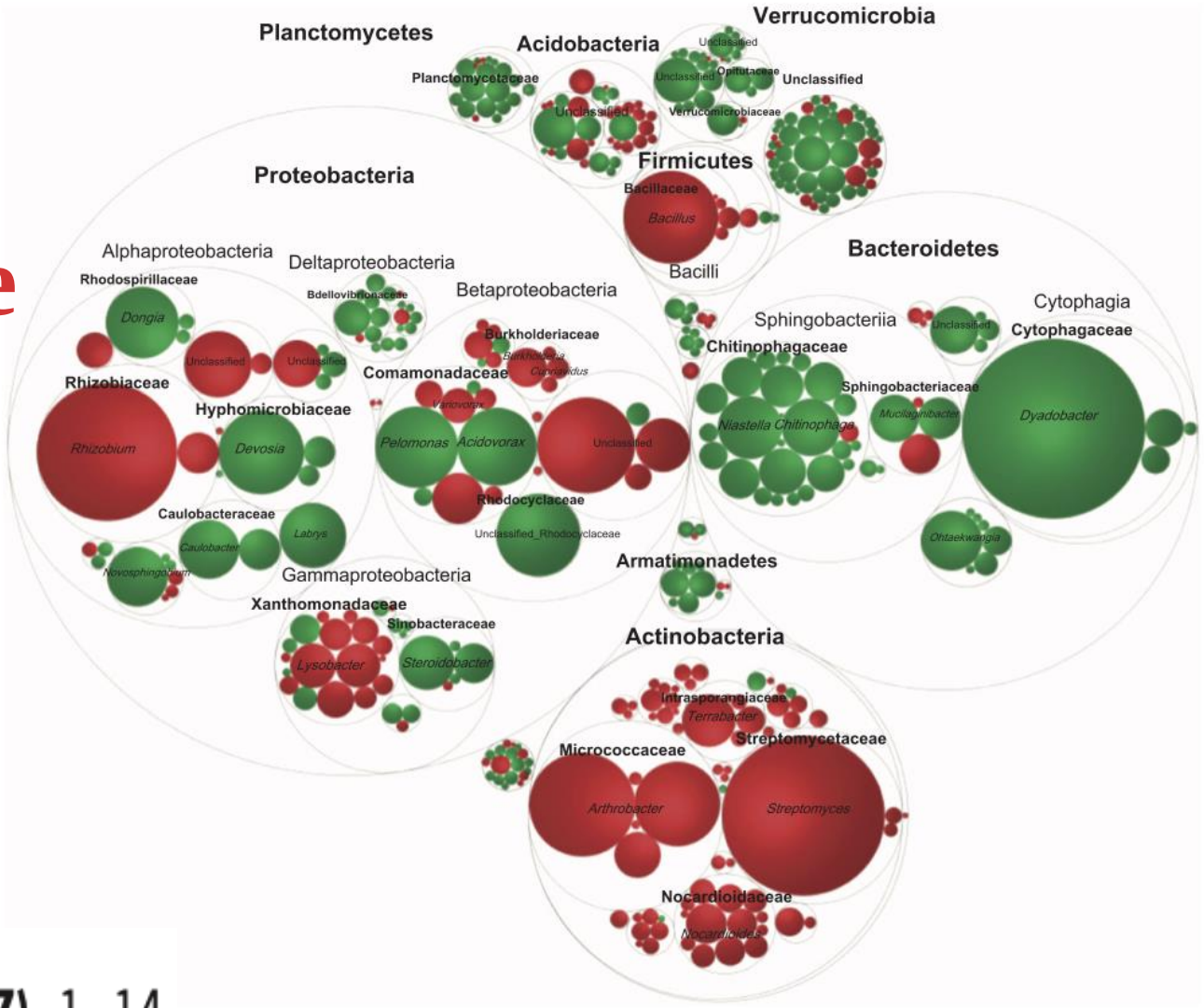


Linking rhizosphere microbiome composition of wild and domesticated *Phaseolus vulgaris* to genotypic and root phenotypic traits

Domestique

versus

Sauvage



The ISME Journal (2017), 1–14

6

pourquoi ?

Symbiosis as a dependence

Selosse, Bessis & Pozo, *Trends in Microbiology* 2014 (**22**: 607-613)

Symbiosis as a dependence

Selosse, Bessis & Pozo, *Trends in Microbiology* 2014 (**22**: 607-613)

Symbiosis as a dependenceb

Selosse, Bessis & Pozo, *Trends in Microbiology* 2014 (**22**: 607-613)

Symbiosis as a dependenceb

No positive selection

Selosse, Bessis & Pozo, *Trends in Microbiology* 2014 (**22**: 607-613)

Symbiosis as a dependence

Contingent, neutral

Selosse, Bessis & Pozo, *Trends in Microbiology* 2014 (**22**: 607-613)

Symbiosis as a dependence

Contingent,
neutral
and often
irreversible

Selosse, Bessis & Pozo, *Trends in Microbiology* 2014 (**22**: 607-613)

Symbiosis as a dependence

Contingent,
neutral
and often
symmetrical

Selosse, Bessis & Pozo, *Trends in Microbiology* 2014 (**22**: 607-613)

Symbiosis as a dependence

Symbiosis as a dependence

… a ratchet mechanism

Selosse, Bessis & Pozo, *Trends in Microbiology* 2014 (**22**: 607-613)

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C. R. Biologies 327 (2004) 639–648
COMPTES RENDUS BIOLOGIES

Plant biology and pathology / Biologie et pathologie végétales

Symbiotic microorganisms, a key for ecological success and protection of plants

Marc-André Selosse [a,*], Ezékiel Baudoin [b], Philippe Vandenkoornhuyse [c]

Abstract

Plant-associated microbial diversity encompasses symbionts, protecting their host against various aggressions. Mycorrhizal and rhizospheric microorganisms buffer effects of soil toxic compounds and soil-borne pathogens. Endophytic bacteria and fungi, some of which are vertically inherited through seeds, take part in plant protection by acting directly on aggressive factors (mainly pathogens and herbivores) or by enhancing plant responses. Plant protective microbial symbionts determine the ecological success of plants; they drastically modify plant communities and related trophic webs. This review suggests approaches to improve the inventory of diversity and functions of in situ plant-associated microorganisms. ***To cite this article: M.-A. Selosse et al., C. R. Biologies 327 (2004).***

MARC-ANDRÉ
SELOSSE

JAMAIS SEUL

Ces microbes qui construisent les plantes, les animaux et les civilisations

postface de Francis Hallé

ACTES SUD