5e Journée Cap de Rouen
« La vitamine D au cœur de tous les systèmes »

Microbiote intestinal et vitamine D : une relation en pleine lumière

Dr Julie Rodriguez

Chargée de projet sur le Microbiome

Inserm
La science pour la santé
From science to health

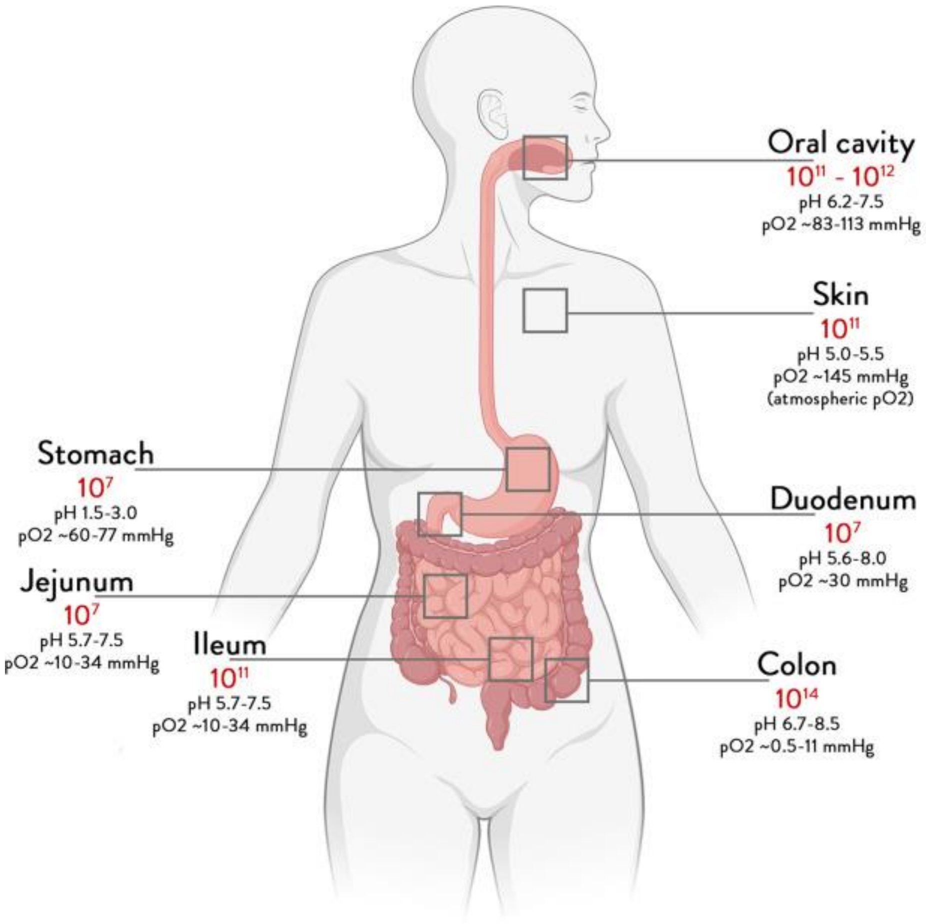
C2VN
Centre de Recherche en
CardioVasculaire et Nutrition

Pharmabiotic
Research Institute

Candidate CRCN Inserm CSS3 2025

Equipe « Micronutriments et Maladies Métaboliques »

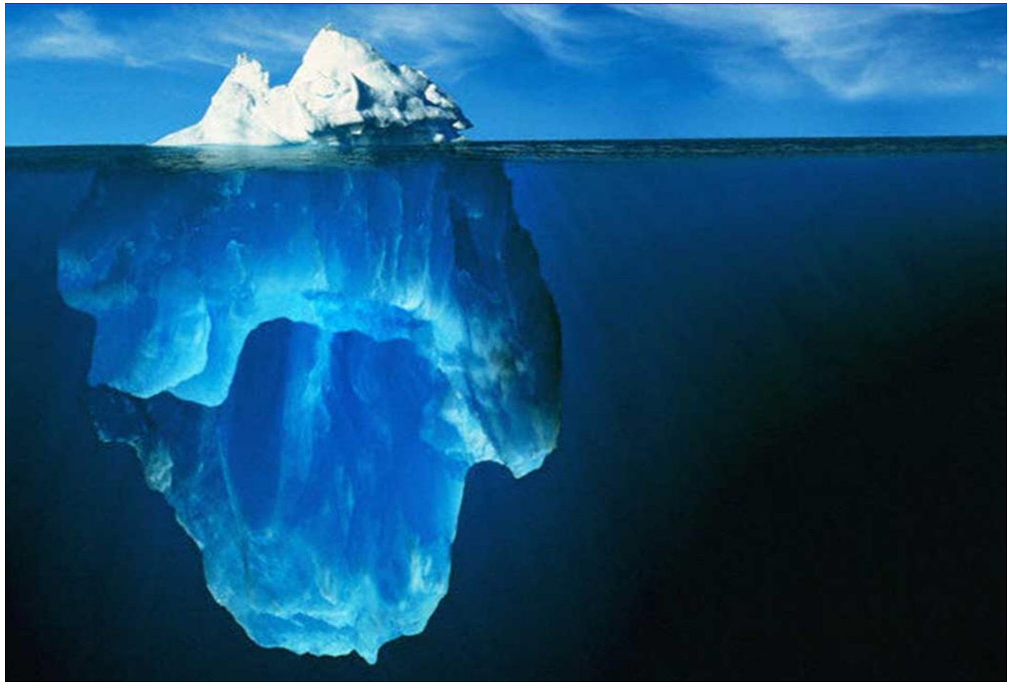
Le Microbiome intestinal: un intérêt croissant pour la santé humaine



- Poids total ~1,5 kg
- Ratio bactéries/ cellules eucaryotes = 1,3
- Nombre de gènes dans le microbiome > nombre de gènes dans le génome humain

- Plus de 1000 espèces bactériennes différentes
- Des milliers de métabolites produits, peu sont décrit
- Certains composants peuvent être délétères pour la santé de l'hôte (LPS)

Le Microbiome intestinal: un intérêt croissant pour la santé humaine

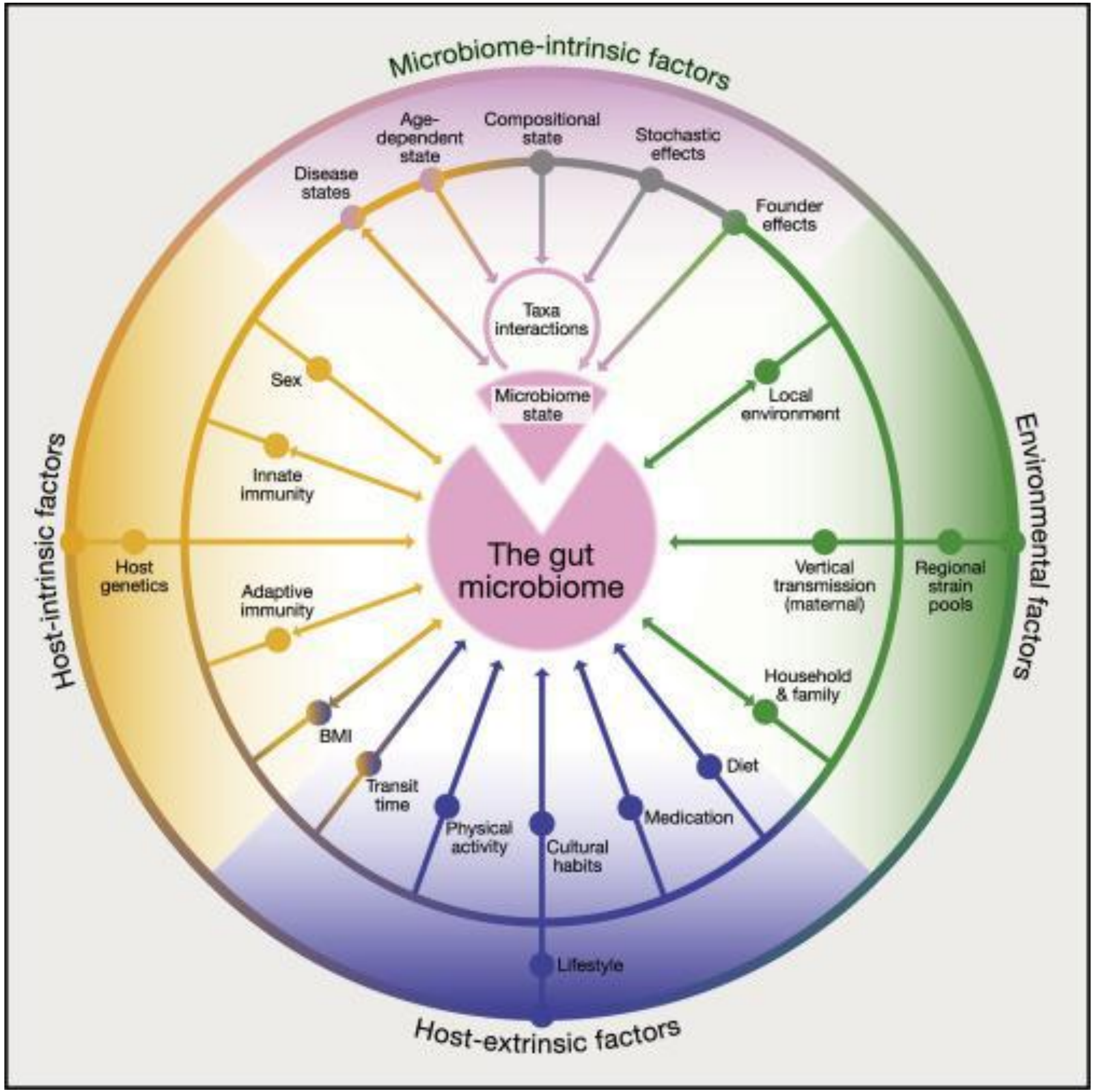


La métagénomique a donné un nouvel élan à la recherche sur le microbiome.

L'impact du microbiome sur notre santé est de plus en plus décrit, à travers sa participation sur la régulation de:

- L'immunité
- Le métabolisme
- La barrière intestinale
- Les fonctions digestives et l'absorption des nutriments
- Les fonctions neurologiques
- La synthèse de certains micronutriments et de métabolites bioactifs

De nombreux facteurs modulent la composition et/ou la fonction du MI



Schmidt et al. Cell. 2018

Nutrition & microbiome : prédominance des études sur les macronutriments

Les interactions entre micronutriments et microbiome intestinal sont encore peu documentées.

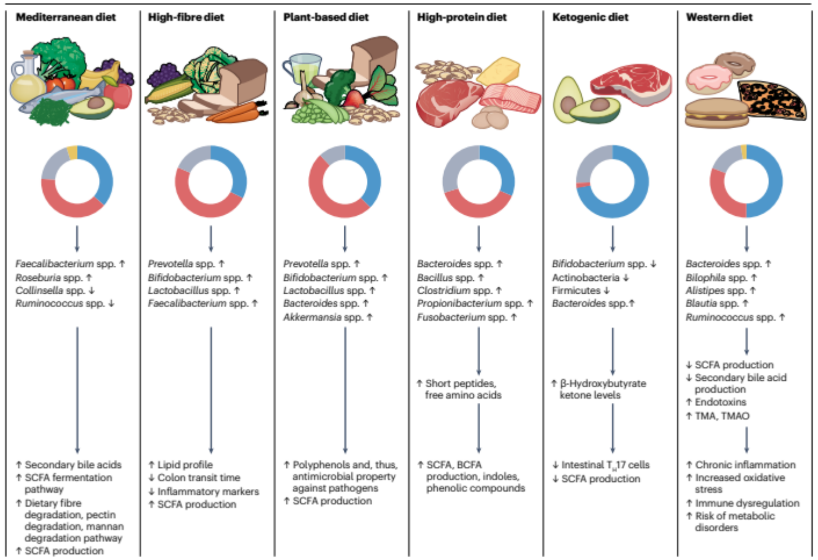
nature reviews microbiology
https://doi.org/10.1038/s41579-024-01068-4

Review article

Check for updates

The interplay between diet and the gut microbiome: implications for health and disease

Review article



Contents lists available at ScienceDirect
Best Practice & Research Clinical Gastroenterology
journal homepage: www.elsevier.com/locate/bpg
ELSEVIER

The role of diet in shaping human gut microbiota

Emanuele Rinninella [a,b,1], Ege Tohumcu [b,c,1], Pauline Raoul [a,b], Marcello Fiorani [b,c], Marco Cintoni [a,b], Maria Cristina Mele [a,b], Giovanni Cammarota [b,c], Antonio Gasbarrini [b,c,2], Gianluca Ianiro [b,c,*,2]

GUT MICROBES
2024, VOL. 16, NO. 1, 2350785
https://doi.org/10.1080/19490976.2024.2350785
Taylor & Francis
Taylor & Francis Group

OPEN ACCESS Check for updates

Diet-microbiota associations in gastrointestinal research: a systematic review

Kerith Duncanson [a,b,c], Georgina Williams [a,b,c], Emily C. Hoedt [a,b,d], Clare E. Collins [b,c], Simon Keely [a,b,d], and Nicholas J. Talley [a,b,c]

nature communications

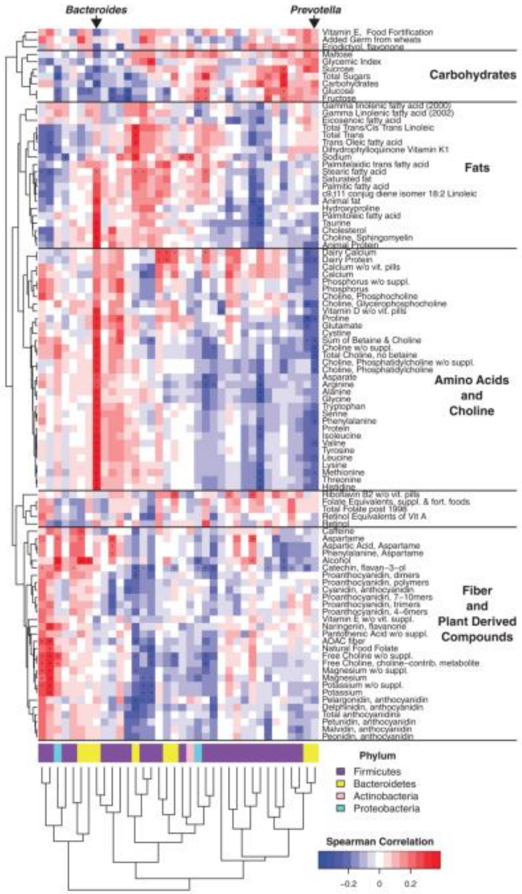
Article

https://doi.org/10.1038/s41467-023-38778-x

Host-diet-gut microbiome interactions influence human energy balance: a randomized clinical trial

NIH Public Access
Author Manuscript
Science. Author manuscript; available in PMC 2012 June 06.
Published in final edited form as:
Science. 2011 October 7; 334(6052): 105–108. doi:10.1126/science.1208344.

Linking Long-Term Dietary Patterns with Gut Microbial Enterotypes



Les vitamines ne sont pas considérées comme des prébiotiques (selon la définition de *Gibson et al*)

"***Substrates that affect composition of the microbiota through mechanisms not involving selective utilization*** *by host microorganisms* ***are not prebiotics.*** *These substrates would include antibiotics, minerals,* ***vitamins*** *and bacteriophages, which are not growth substrates, even though their intake might alter microbiota and metabolic composition.*"

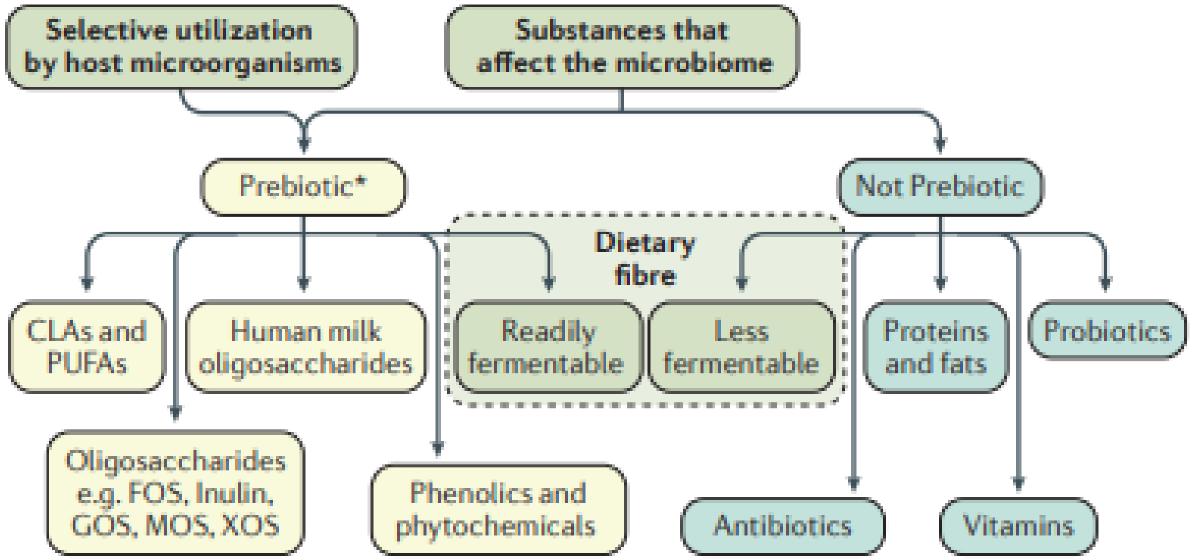
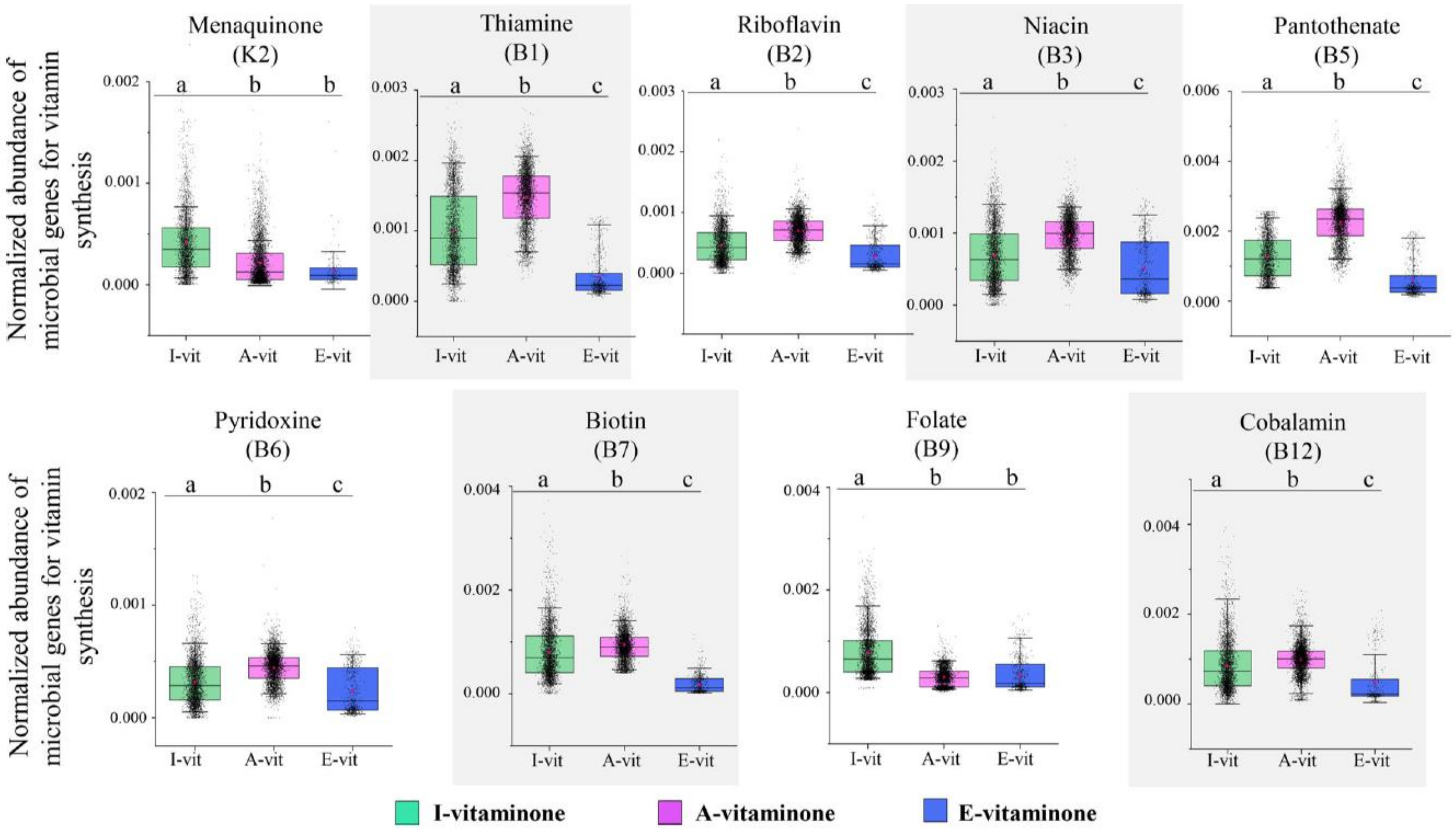


Figure 1 | **Distinguishing what is considered a prebiotic with the proposed definition.** Prebiotics must be selectively utilized and have adequate evidence of health benefit for the target host. Dietary prebiotics must not be degraded by the target host enzymes. *The figure shows candidate as well as accepted prebiotics in that levels of evidence currently vary, with FOS and GOS being the most researched prebiotics.CLA, conjugated linoleic acid; PUFA, polyunsaturated fatty acid; FOS, fructooligosaccharides; GOS, galactooligosaccharides; MOS, mannanoligosaccharide; XOS, xylooligosaccharide.

Gibson et al. Nat Rev Gastroenterol Hepatol. 2017

Le Microbiome Intestinal synthétise des vitamines

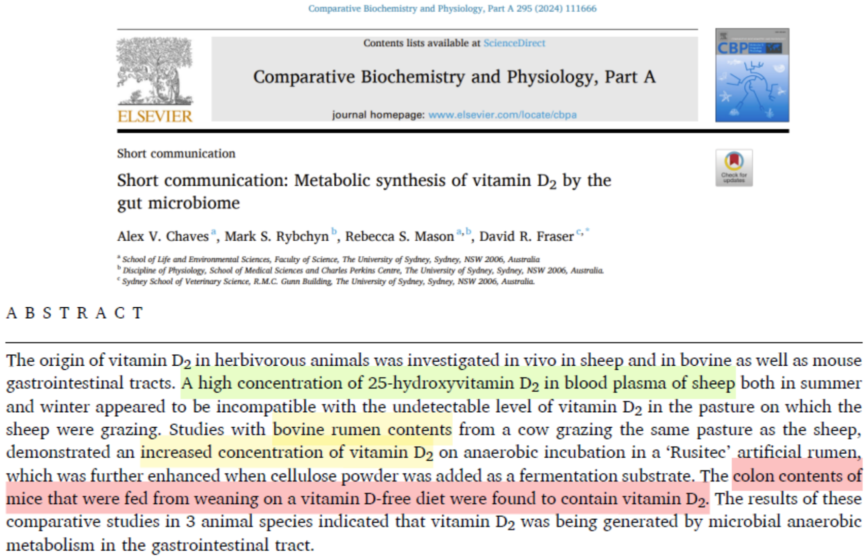


Enfants (n=3340)

Adultes (n=4091)

Personnes âgées (n=645)

Et la vitamine D ?



Comparative Biochemistry and Physiology, Part A 295 (2024) 111666

Contents lists available at ScienceDirect

Comparative Biochemistry and Physiology, Part A

journal homepage: www.elsevier.com/locate/cbpa

Short communication

Short communication: Metabolic synthesis of vitamin D_2 by the gut microbiome

Alex V. Chaves [a], Mark S. Rybchyn [b], Rebecca S. Mason [a,b], David R. Fraser [c,*]

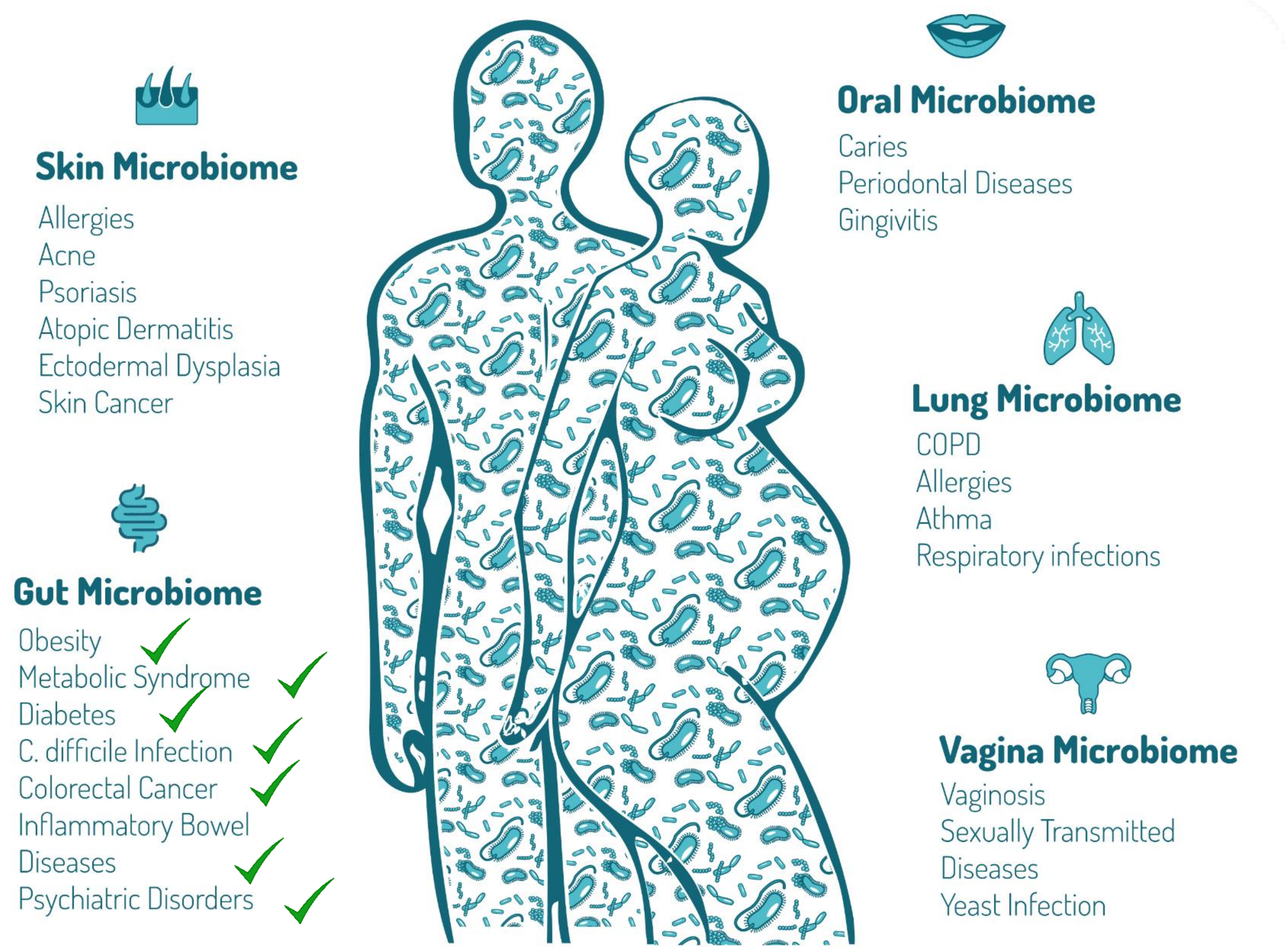
[a] School of Life and Environmental Sciences, Faculty of Science, The University of Sydney, Sydney, NSW 2006, Australia
[b] Discipline of Physiology, School of Medical Sciences and Charles Perkins Centre, The University of Sydney, Sydney, NSW 2006, Australia.
[c] Sydney School of Veterinary Science, R.M.C. Gunn Building, The University of Sydney, Sydney, NSW 2006, Australia.

A B S T R A C T

The origin of vitamin D_2 in herbivorous animals was investigated in vivo in sheep and in bovine as well as mouse gastrointestinal tracts. A high concentration of 25-hydroxyvitamin D_2 in blood plasma of sheep both in summer and winter appeared to be incompatible with the undetectable level of vitamin D_2 in the pasture on which the sheep were grazing. Studies with bovine rumen contents from a cow grazing the same pasture as the sheep, demonstrated an increased concentration of vitamin D_2 on anaerobic incubation in a 'Rusitec' artificial rumen, which was further enhanced when cellulose powder was added as a fermentation substrate. The colon contents of mice that were fed from weaning on a vitamin D-free diet were found to contain vitamin D_2. The results of these comparative studies in 3 animal species indicated that vitamin D_2 was being generated by microbial anaerobic metabolism in the gastrointestinal tract.

Tarracchini et al.mSystems. 2025

De nombreuses pathologies sont associées à un déséquilibre du MI…



Adapted from, Belizário JE, Napolitano M. Human microbiomes and their roles in dysbiosis, common diseases, and novel therapeutic approaches. Front Microbiol. 2015;6:1050.

…et une déficience en VitD

Ye *et al*. Lancet Diabetes Endocrinol. 2015

Association between circulating 25-hydroxyvitamin D and incident type 2 diabetes: a mendelian randomisation study

Zheng Ye, Stephen J Sharp, Stephen Burgess, Robert A Scott, Fumiaki Imamura, InterAct Consortium, Claudia Langenberg, Nicholas J Wareham, Nita G Forouhi

Pereira-Santos *et al*. Obes Rev. 2015

OBESITY Reviews — WORLD OBESITY

Etiology and Pathophysiology

Obesity and vitamin D deficiency: a systematic review and meta-analysis

M. Pereira-Santos, P. R. F. Costa, A. M. O. Assis, C. A. S. T. Santos, D. B. Santos

Zhou *et al*. Int J Cancer. 2021

IJC INTERNATIONAL JOURNAL of CANCER — UICC

Cancer Epidemiology

Associations of vitamin D status with colorectal cancer risk and survival

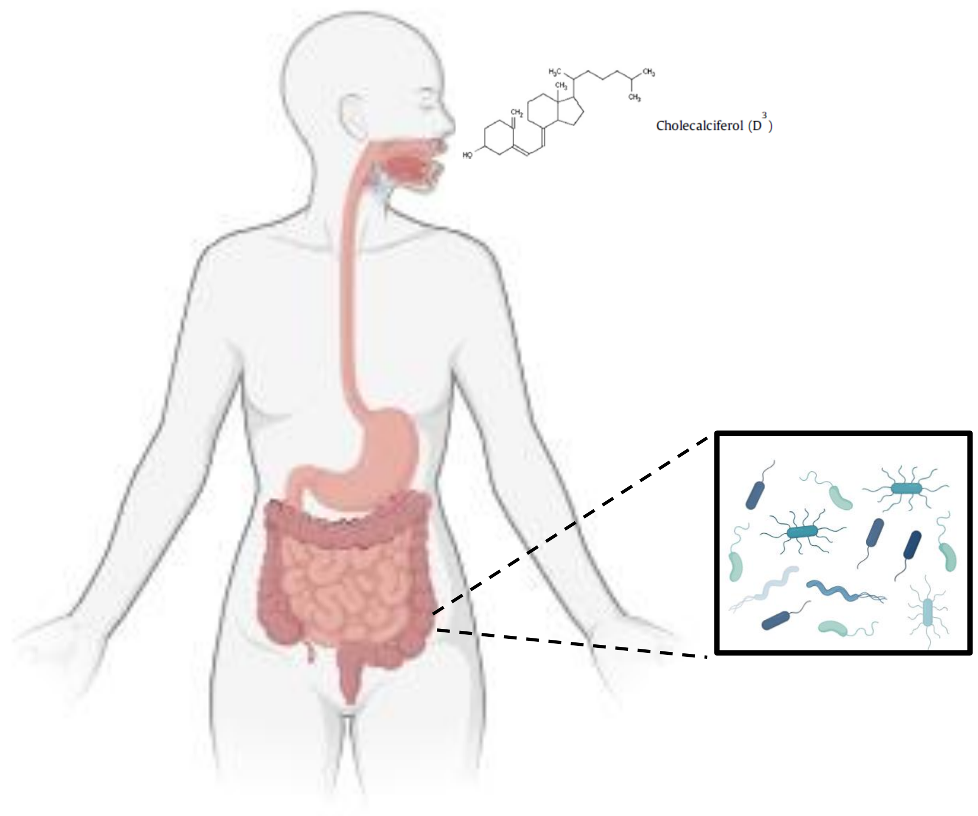
Jian Zhou, Xianxiu Ge, Xikang Fan, Jiayu Wang, Lin Miao, Dong Hang

Furuya-Kanamori *et al*. JPEN J Parenter Enteral Nutr. 2017

25-Hydroxyvitamin D Concentrations and Clostridium difficile Infection: A Meta-Analysis

Luis Furuya-Kanamori [1], Kinley Wangdi [1], Laith Yakob [2], Samantha J McKenzie [3], Suhail A R Doi [1], Justin Clark [4], David L Paterson [5], Thomas V Riley [6], Archie C A Clements [1]

La vitamine D peut être en contact avec le microbiome du colon



1-50% de VitD non absorbée dans la partie haute de l'intestin

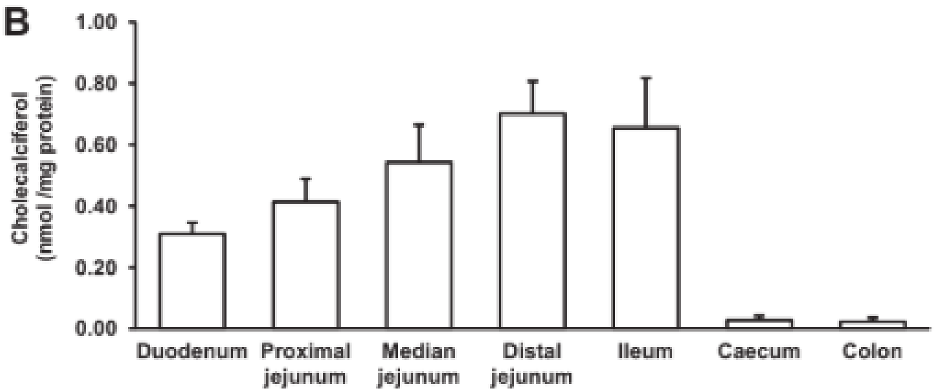
SRB1 (Scavenger Receptor class B type I)
Cd36 (Cluster differentiation 36)
NPC1L1 (Niemann-Pick C1 Like 1)

Mol. Nutr. Food Res. 2011, 55, 691–702 DOI 10.1002/mnfr.201000553 691

RESEARCH ARTICLE

Vitamin D intestinal absorption is not a simple passive diffusion: Evidences for involvement of cholesterol transporters

Emmanuelle Reboul[1,2,3], Aurélie Goncalves[1,2,3], Christine Comera[4,5], Romain Bott[1,2,3], Marion Nowicki[1,2,3], Jean-François Landrier[1,2,3], Dominique Jourdheuil-Rahmani[1,2,3], Claire Dufour[6,7], Xavier Collet[4] and Patrick Borel[1,2,3]



Goncalves *et al*. Food chemistry. 2015

THE FASEB JOURNAL • RESEARCH • www.fasebj.org

ABCB1 (P-glycoprotein) regulates vitamin D absorption and contributes to its transintestinal efflux

Marielle Margier,* Xavier Collet,†,1 Cédric le May,‡,1 Charles Desmarchelier,* François André,§ Chantal Lebrun,¶ Catherine Defoort,*,|| Alice Bluteau,¶ Patrick Borel,* Anne Lespine,¶,2 and Emmanuelle Reboul*,3

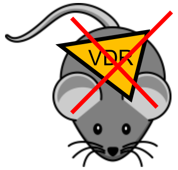
Degraeve et al. Microbiome (2023) 11:138
https://doi.org/10.1186/s40168-023-01578-y
Microbiome

RESEARCH Open Access

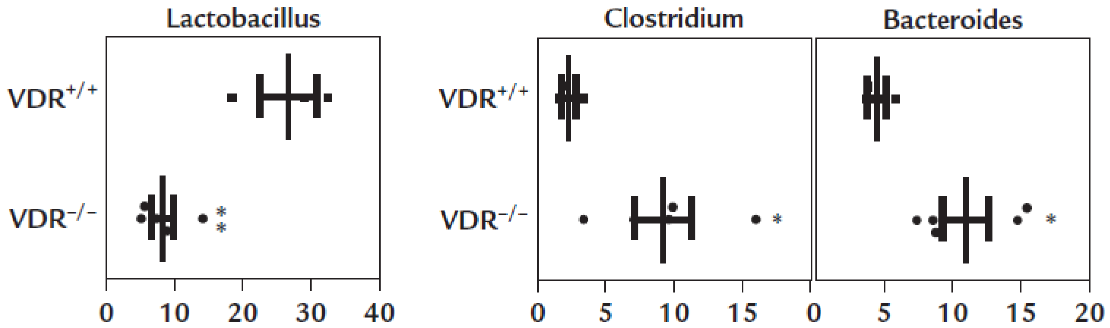
Gut microbiome modulates tacrolimus pharmacokinetics through the transcriptional regulation of ABCB1

Alexandra L. Degraeve[1,2], Vincent Haufroid[3,4], Axelle Loriot[5], Laurent Gatto[5], Vanessa Andries[6,7,8], Lars Vereecke[6,7,8], Laure Elens[1,3†] and Laure B. Bindels[2,9*†]

Le récepteur nucléaire de la vitamine D (VDR) est exprimé tout le long du tractus gastrointestinal

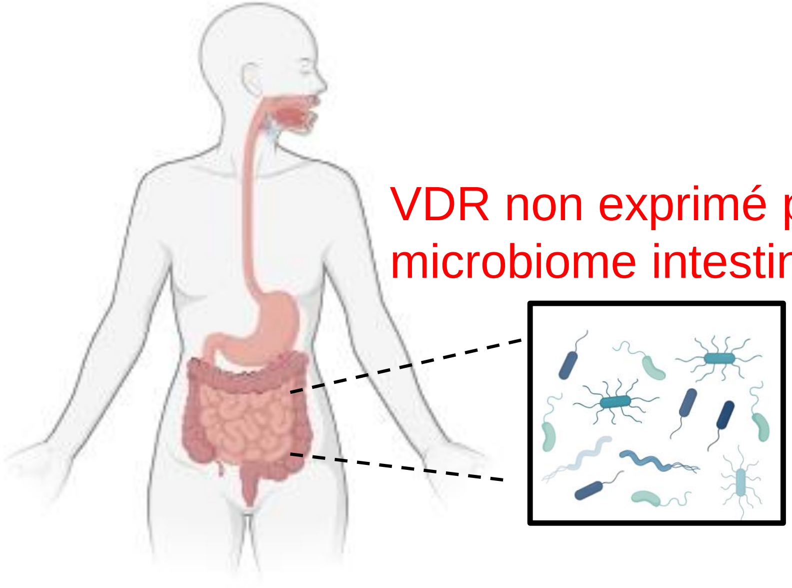


KO VDR

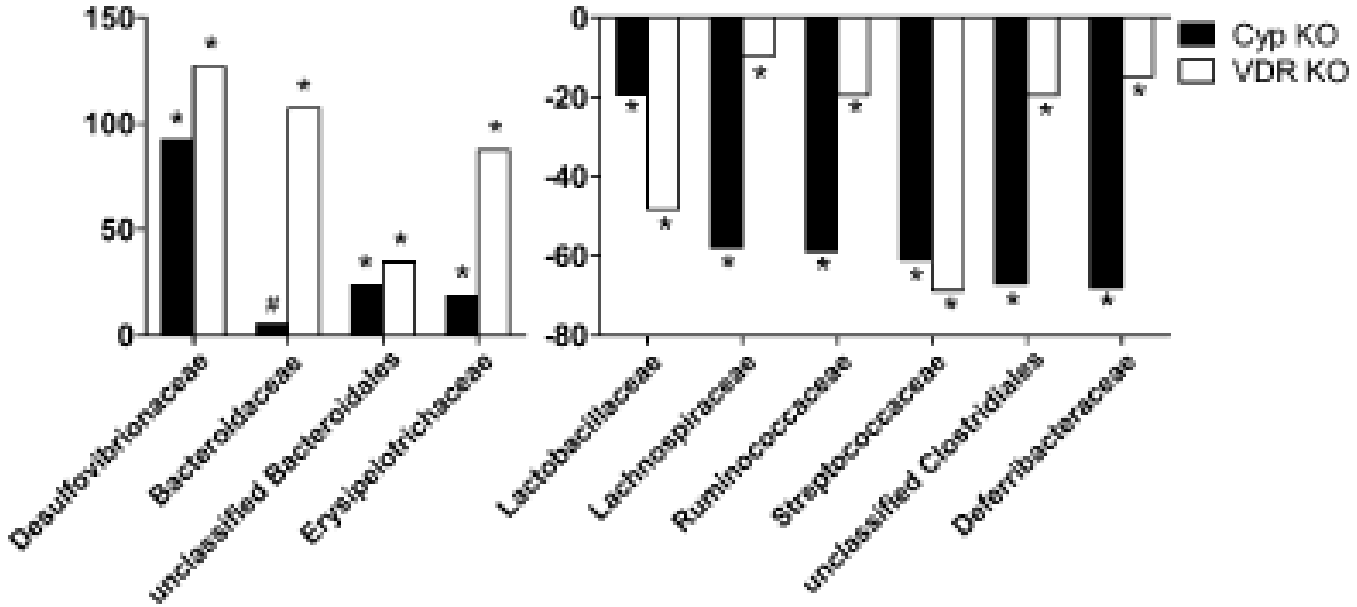


↓ *Lactobacillus*, ↑ *Clostridium* et *Bacteroides* (Jin *et al. Clin Ther.* 2015)

VDR non exprimé par le microbiome intestinal



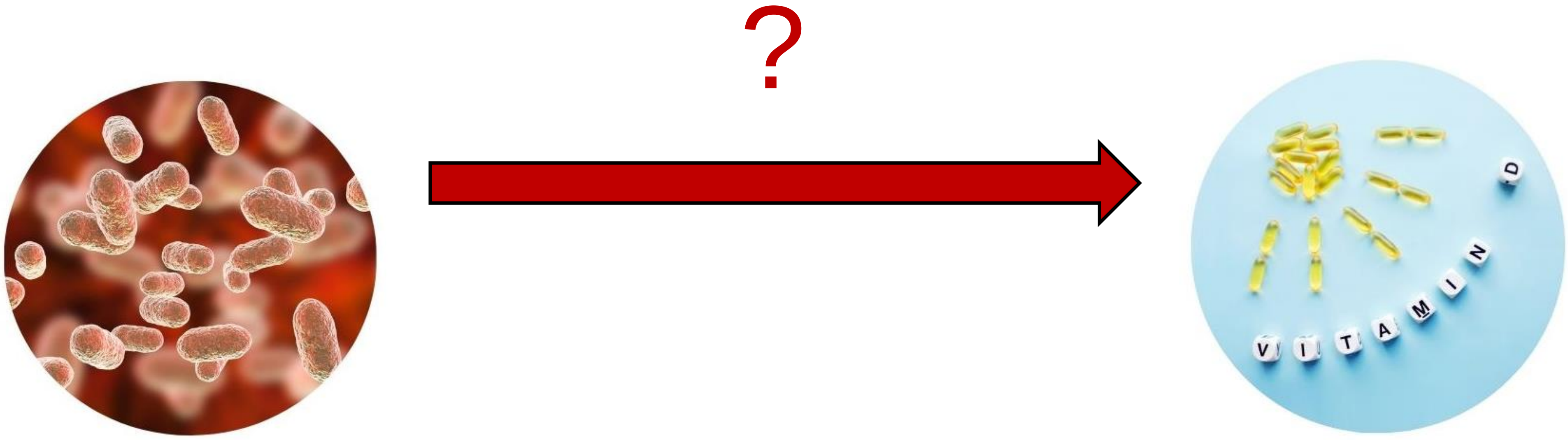
✓ VDR très exprimé dans le tractus gastro-intestinal



↓ bactéries qui produisent des acides gras à chaine courte

(Ooi et al. J Nutr. 2013; Wu *et al.* Gut. 2015)

Est-ce que le microbiome intestinal régule le métabolisme et/ou l’activité de la VitD ?



Les antibiotiques régulent les niveaux de 25(OH)D, 24·25(OH)$_2$D et FGF23

Cocktail d'antibiotiques (2 semaines): ampicillin (1g/L), metronidazole (1g/L), neomycin (1g/L), and vancomycin (0.5g/L).

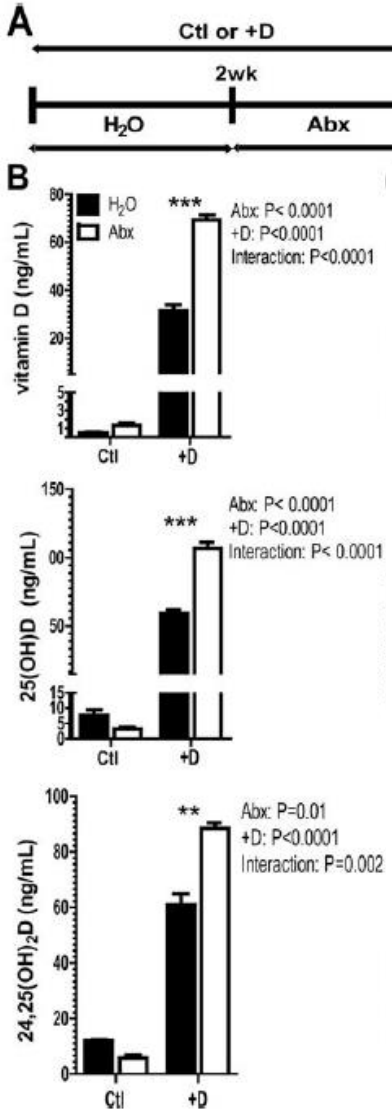
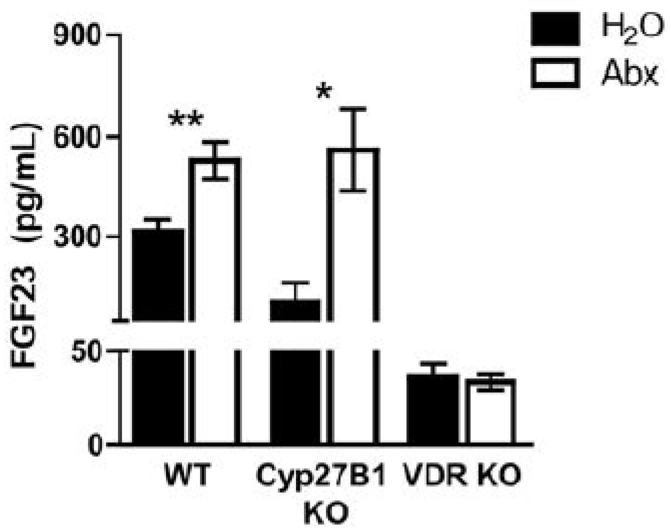
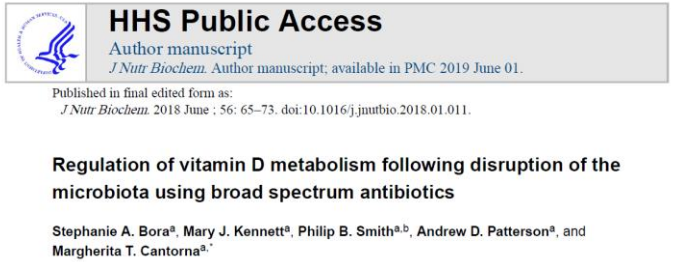


Figure 1. Abx treatments induced vitamin D metabolism





HHS Public Access

Author manuscript

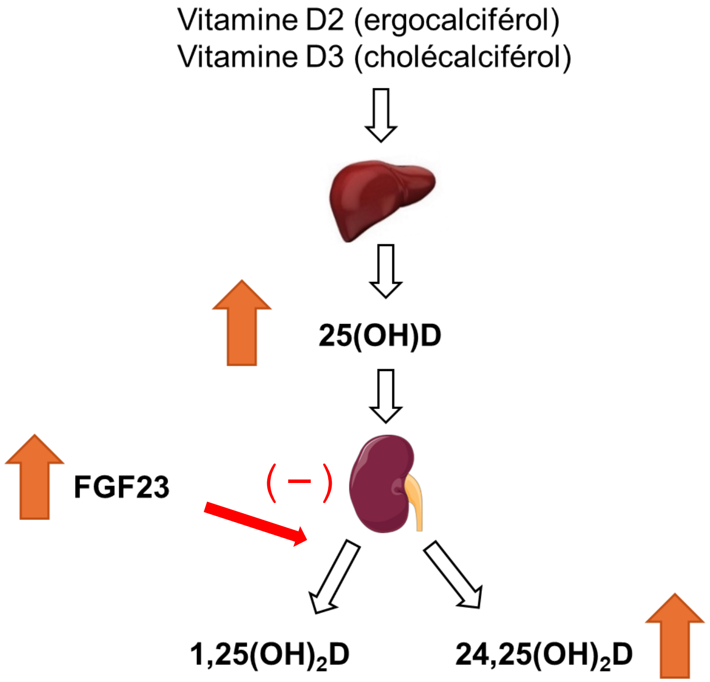
J Nutr Biochem. Author manuscript; available in PMC 2019 June 01.

Published in final edited form as:

J Nutr Biochem. 2018 June ; 56: 65–73. doi:10.1016/j.jnutbio.2018.01.011.

Regulation of vitamin D metabolism following disruption of the microbiota using broad spectrum antibiotics

Stephanie A. Bora[a], Mary J. Kennett[a], Philip B. Smith[a,b], Andrew D. Patterson[a], and Margherita T. Cantorna[a,*]



Certaines bactéries peuvent réguler les niveaux de 25(OH)D

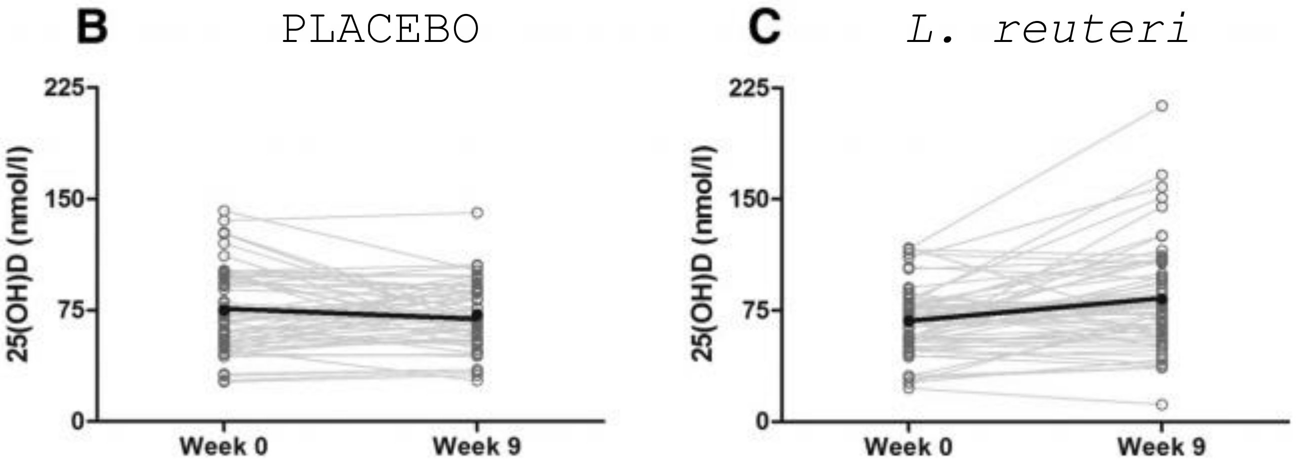
	Placebo (n 61)	*L. reuteri* (n 66)	
	Mean (SD)	Mean (SD)	*P*
Vitamin A (µmol/l)			
Week 0	1.96 (0.53)	1.90 (0.47)	0.360[a]
Week 9	2.01 (0.53)	1.91 (0.39)	
25(OH)D (nmol/l)			
Week 0	75.12 (27.68)	67.91 (22.14)	0.003[a]
Week 9	71.93 (22.05)	82.64 (35.52)	
Vitamin E (µmol/l)			
Week 0	32.24 (4.90)	33.15 (2.89)	0.852[b]
Week 9	33.96 (5.61)	34.63 (6.39)	
β-carotene (µmol/l)			
Week 0	0.55 (0.40)	0.60 (0.49)	0.790[a]
Week 9	0.55 (0.37)	0.59 (0.46)	
Calcium (mmol/l)			
Week 0	2.35 (0.09)	2.34 (0.07)	0.100[a]
Week 9	2.36 (0.11)	2.33 (0.07)	
Phosphate (mmol/l)			
Week 0	1.18 (0.22)	1.19 (0.18)	0.312[a]
Week 9	1.17 (0.18)	1.16 (0.18)	

[a] Two-factor repeated measures ANOVA on log-transformed values
[b] Two-factor repeated measures ANOVA
25(OH)D, 25-hydroxyvitamin D

RCT healthy hypercholesterolemic adult men and women between the ages of 20 and 75 years old
L. reuteri (2.9 x 10^9 colony-forming units per capsule)
13 weeks

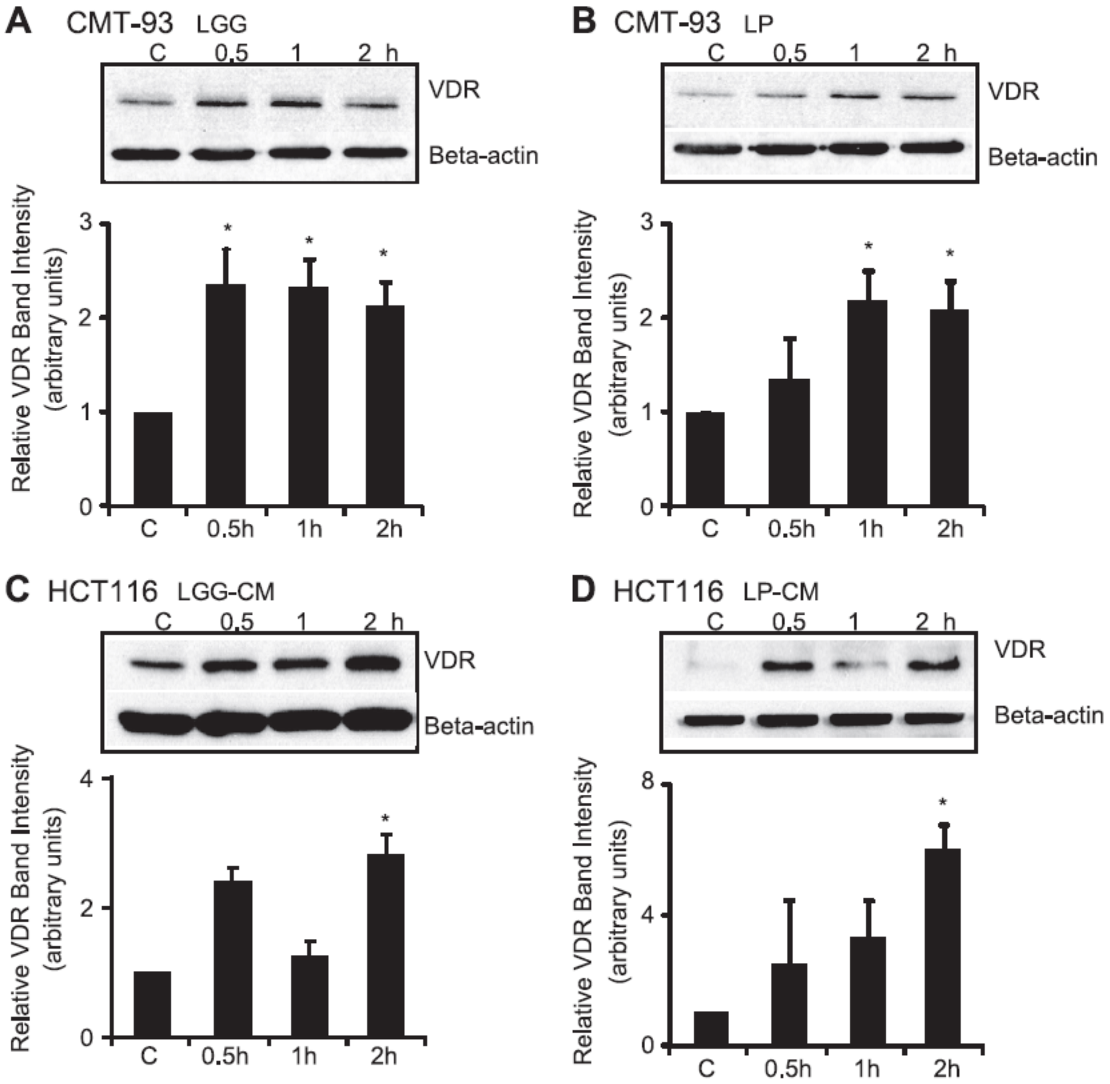
2. Dietary Total Energy and Nutrient Intake

	Mean (SD)		
	Placebo (n = 61)	*L. reuteri* (n = 66)	*P*
Energy, kcal/d			
wk 0	2033.1 (642.5)	2074.8 (690.0)	.85[b]
wk 9	1999.7 (621.0)	2024.6 (586.5)	
Lipids, kcal/d			
wk 0	710.0 (258.5)	770.5 (333.5)	.22[b]
wk 9	744.8 (301.7)	741.0 (276.5)	
Proteins, kcal/d			
wk 0	345.6 (115.5)	351.3 (116.4)	.87[b]
wk 9	339.7 (104.3)	345.8 (100.1)	
Carbohydrates, kcal/d			
wk 0	977.5 (343.6)	953.0 (361.2)	.44[b]
wk 9	915.2 (321.8)	937.8 (295.7)	
Vitamin A, µg/d[a]			
wk 0	554.5 (401.7–843.4)	575.1 (450.9–834.3)	.70[c]
wk 9	540.8 (394.7–832.0)	542.9 (413.4–772.4)	
Retinol, µg/d[a]			
wk 0	308.5 (206.6–595.3)	345.2 (243.6–484.0)	.68[c]
wk 9	348.8 (224.2–522.4)	339.4 (241.9–477.7)	
Carotenoids, mg/d[a]			
wk 0	2.51 (1.05–3.81)	1.86 (0.96–4.27)	.90[c]
wk 9	2.20 (0.96–3.21)	2.13 (0.83–3.61)	
Vitamin D, µg/d[a]			
wk 0	1.26 (0.52–2.25)	1.31 (0.72–2.29)	.26[c]
wk 9	1.10 (0.57–2.07)	1.09 (0.69–1.70)	
Vitamin E, mg/d[a]			
wk 0	9.96 (7.17–11.72)	10.12 (7.62–13.27)	.51[c]
wk 9	9.59 (6.71–12.66)	9.90 (7.53–12.78)	



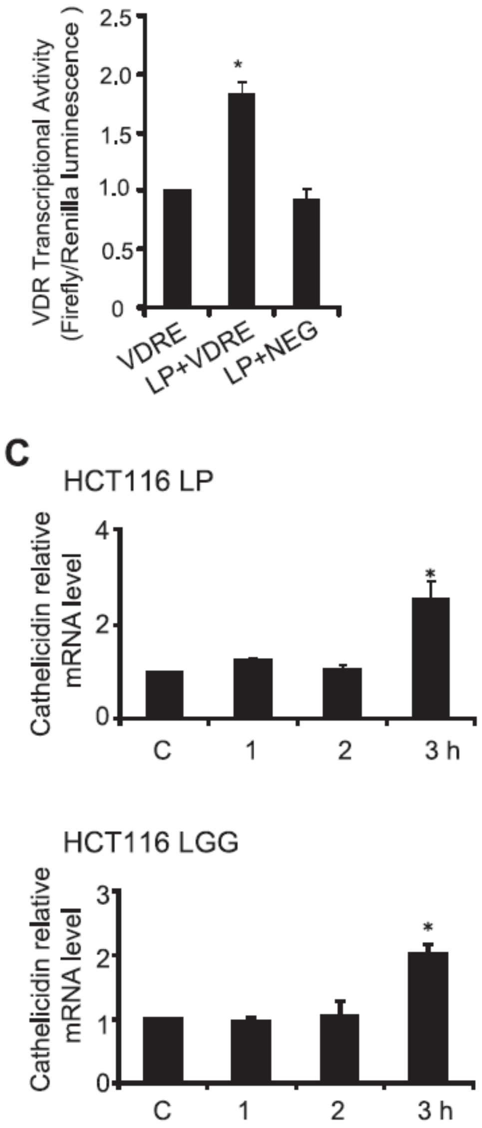
Jones et al. J Clin Endocrinol Metab. 2013

Certaines bactéries peuvent réguler l'expression et l'activité du VDR dans la cellule intestinale



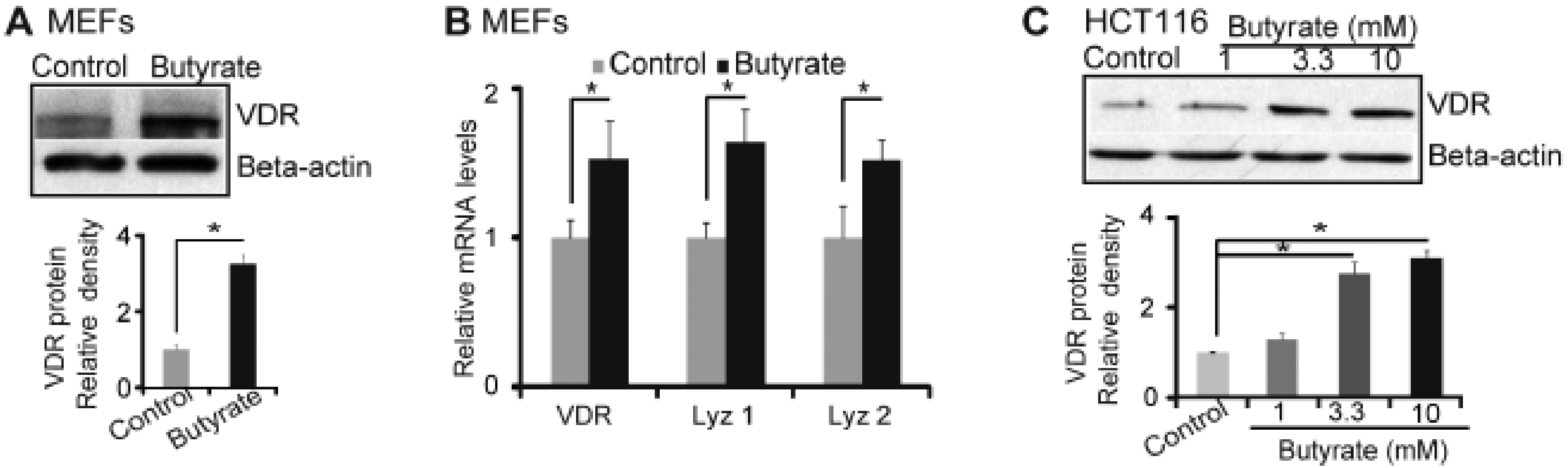
Lactobacillus rhamnosus strain GG (LGG)
Lactobacillus plantarum (LP)

Fig. 1. Probiotics *Lactobacillus rhamnosus* strain GG (LGG) and *Lactobacillus plantarum* (LP) increased vitamin D receptor (VDR) protein expression in vitro. *A*: LGG increases VDR protein expression in mouse epithelia CMT-93 cells. *B*: LP increases VDR protein expression in CMT-93 cells. *C*: LGG conditioned medium (CM) increases VDR protein expression in human epithelial HCT116 cells. *D*: LP CM increases VDR protein expression in HCT116 cells. Cells were treated with indicated time course. Three separate experiments with 3 replicates each, $*P < 0.05$, compared with control (C).



Wu et al. AJP-Gastrointest Liver Physiol. 2015

Des métabolites bactériens peuvent réguler l'expression du VDR dans la cellule intestinale

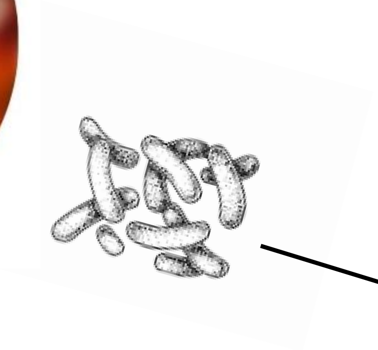


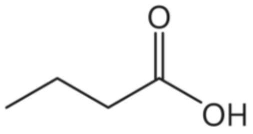
Mouse embryonic fibroblasts (MEFs)

Wu et al. Gut. 2015

Est-ce que le microbiome intestinal régule le métabolisme et/ ou l’activité de la VitD ?

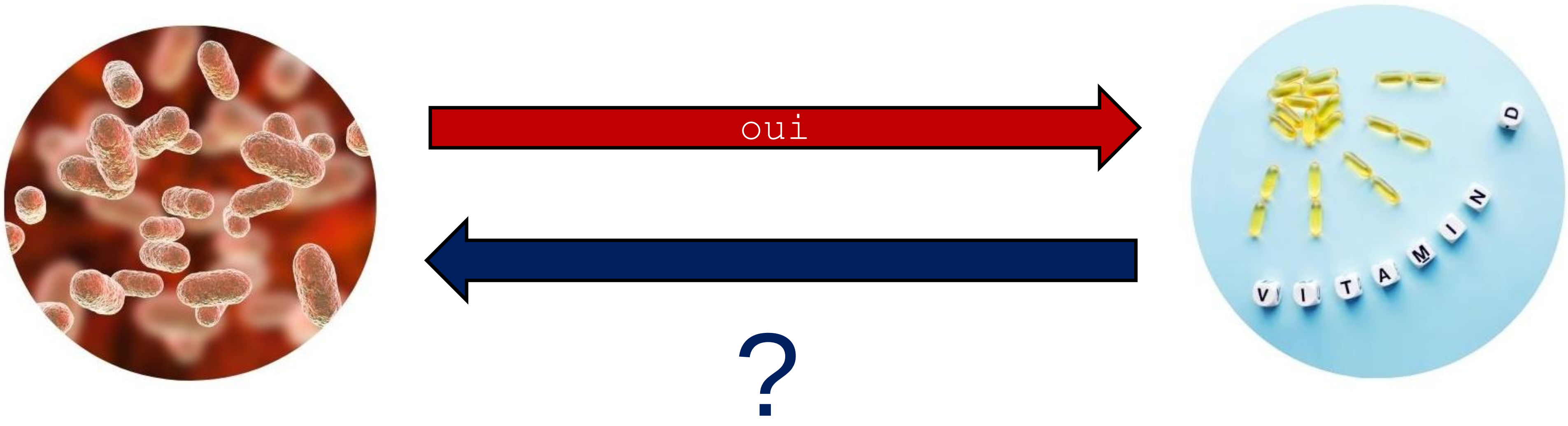
OUI





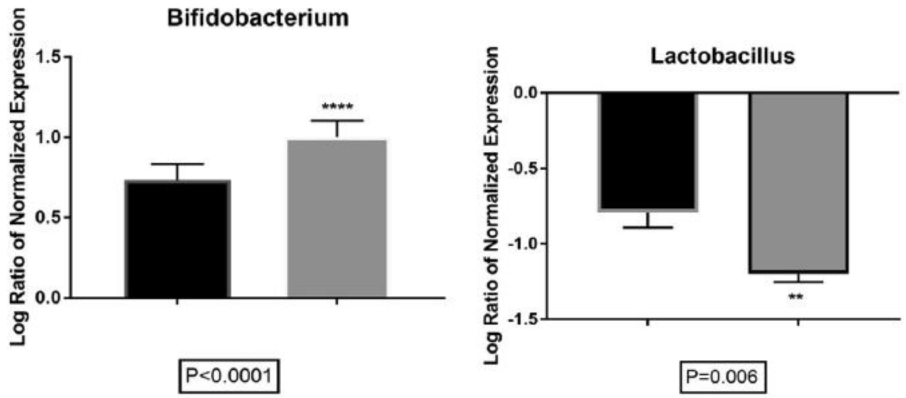
- ✓ 25(OH)D
- ✓ $24,25(OH)_2D$
- ✓ FGF23
- ✓ VDR

Est-ce que la VitD régule la composition et/ou fonction du microbiome intestinal ?



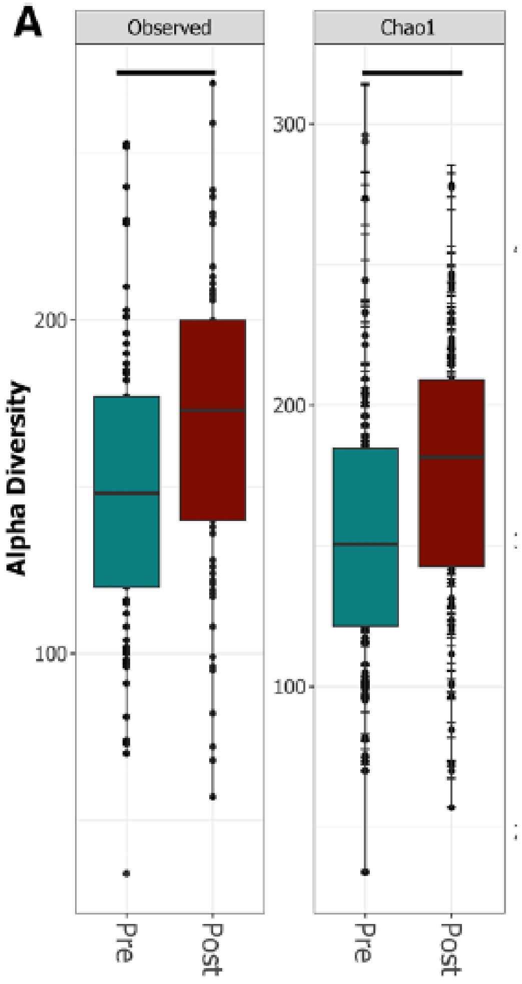
La supplementation en VitD augmente l’abondance relative des bifidobactéries

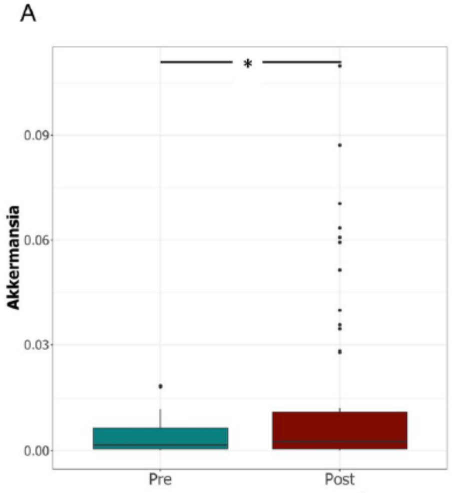
50 adolescentes en bonne santé,
50 000IU/ wk, 9 semaines
6% > 30ng/mL avant,
versus 68% après

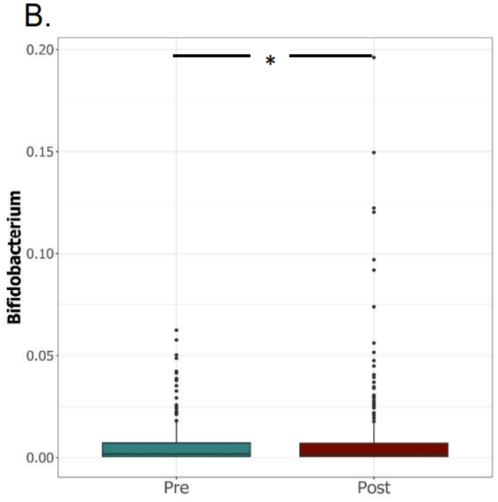


Tabatabaeizadeh *et al*. Clin Nutr ESPEN. 2020

50 femmes en bonne santé (VitD déficience),
50 000IU/ wk, 12 semaines
69% > 30 … vention

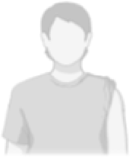






Singh *et al*. Sci Rep. 2020

Des associations retrouvées entre des métabolites de VitD et le microbiome intestinal



↓ 25(OH)D

Adultes en bonne santé

↔

(Luthold *et al.* Metabolism. 2017)

↑ LPS
↓ *Coprococcus*
↑ *Bifidobacterium*

↑ $1,25(OH)_2D$

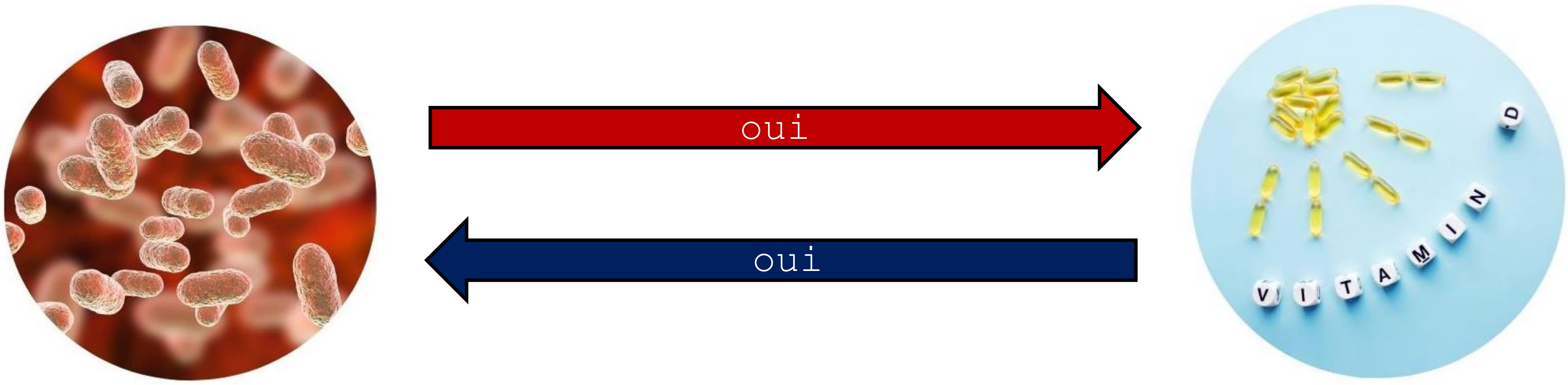
Hommes (n=567)

↔

(Thomas *et al.* Nat. Comm 2020)

↑ diversité bactérienne
↑ bactéries produisant du butyrate (genres appartenant aux familles Lachnospiraceae et Ruminococcaceae)

Est-ce que la VitD régule la composition et/ou fonction du microbiome intestinal ?



Bifidobacterium ?
Akkermansia ?
Producteurs d’acides gras à chaîne courte ?

Est-ce que la VitD régule la composition et/ou fonction du microbiome intestinal ?

oui →

← oui

?

Récepteur nucléaire de la vitD non exprimé

- ❑ **Via un effet direct ?**

Est-ce que la VitD régule la composition et/ou fonction du microbiome intestinal ?

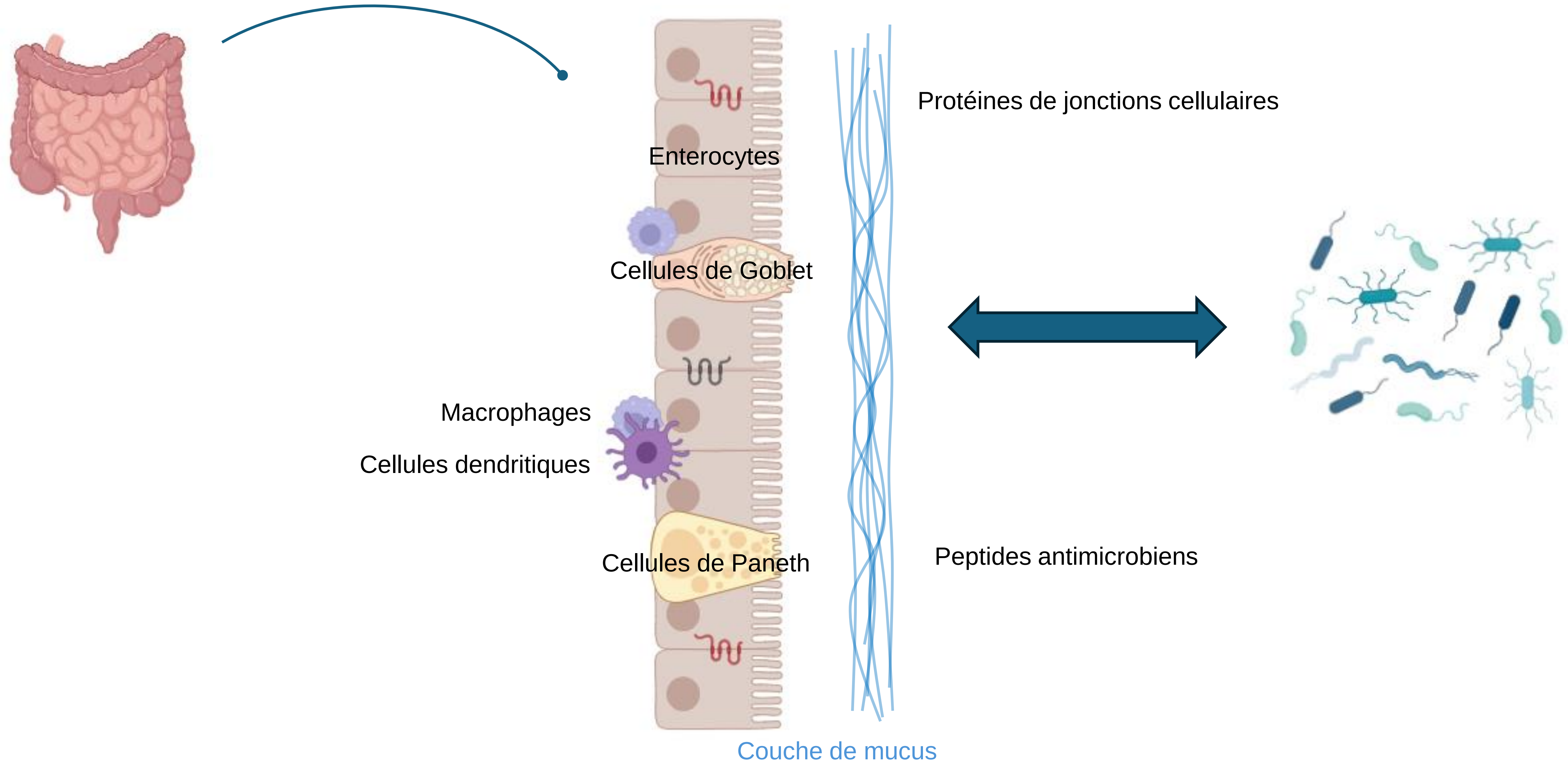
oui

oui

?

- Via un effet indirect ?

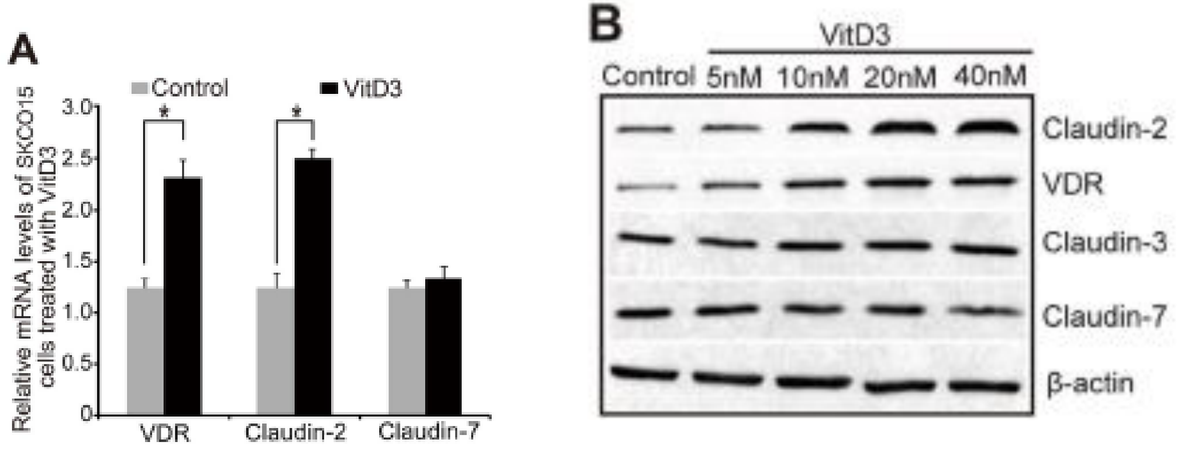
Est-ce que la VitD influence la communication entre la barrière de l'intestin et le MI ?



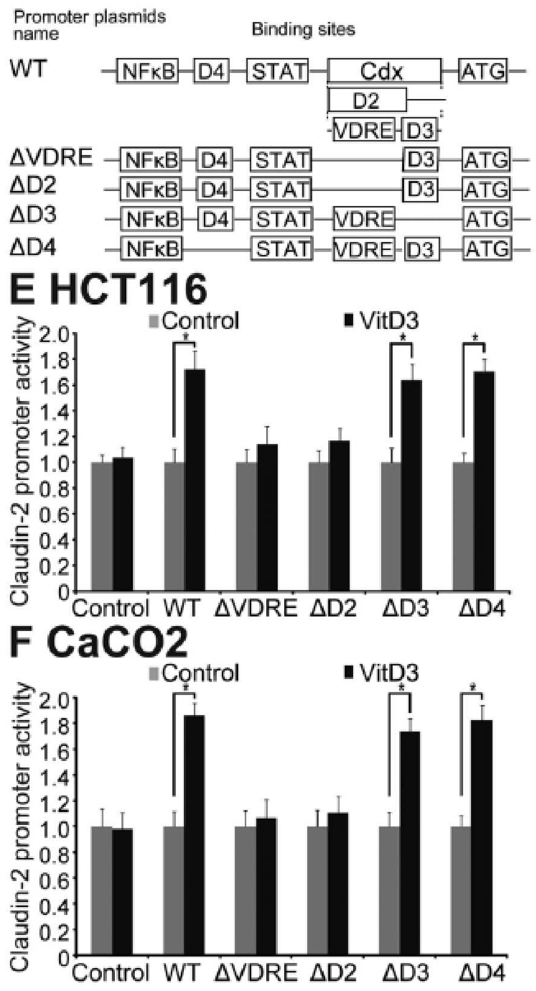
Kayama *et al*. Annu Rev Immunol. 2020

La VitD régule certaines protéines de jonctions serrées

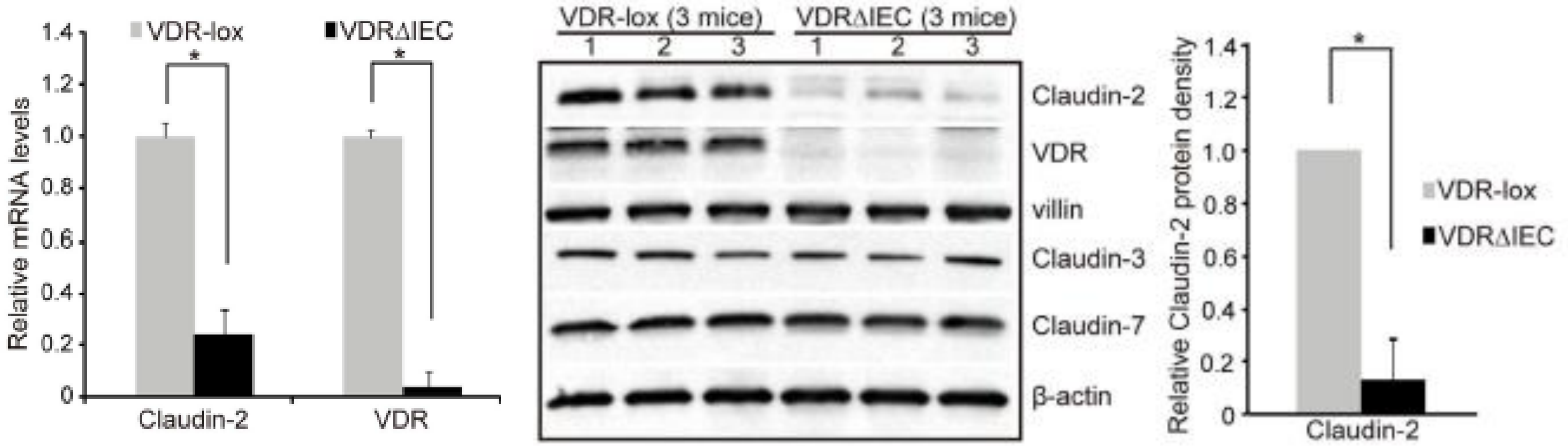
- Traitement de cellules épithéliales du colon avec la vitD3



- VDRE présent sur le promoteur de claudin-2



- Inactivation constitutive du récepteur nucléaire de la VitD dans l’intestin

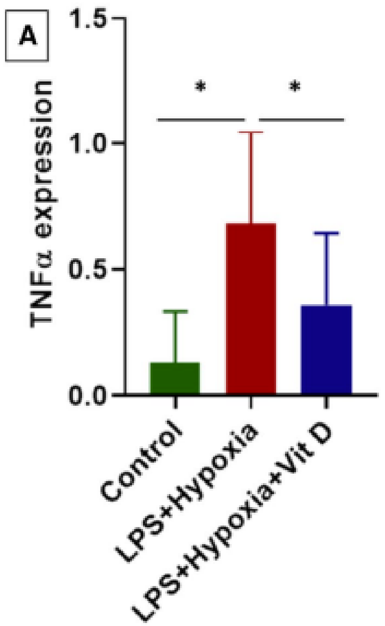


Zhang et al. Sci Rep. 2015

La VitD régule certaines protéines de jonctions serrées

- Traitement des organoides avec du LPS et de la VitD.

- Effets sur la protéine de jonction cellulaire zo1



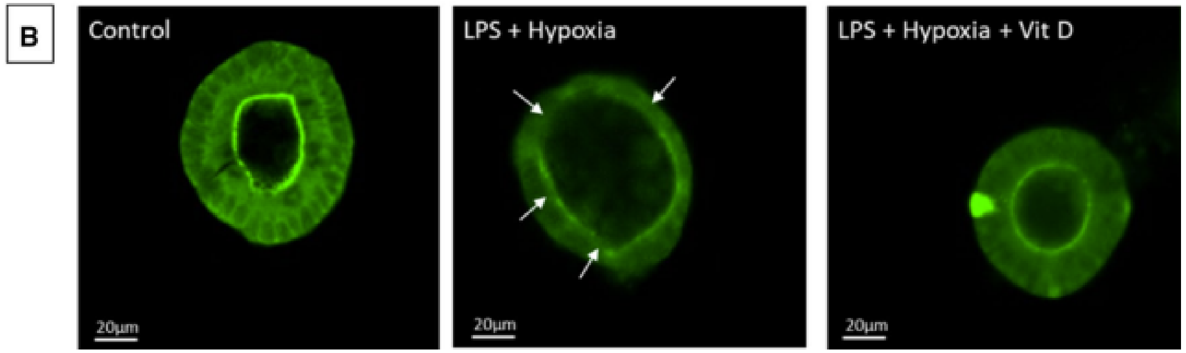
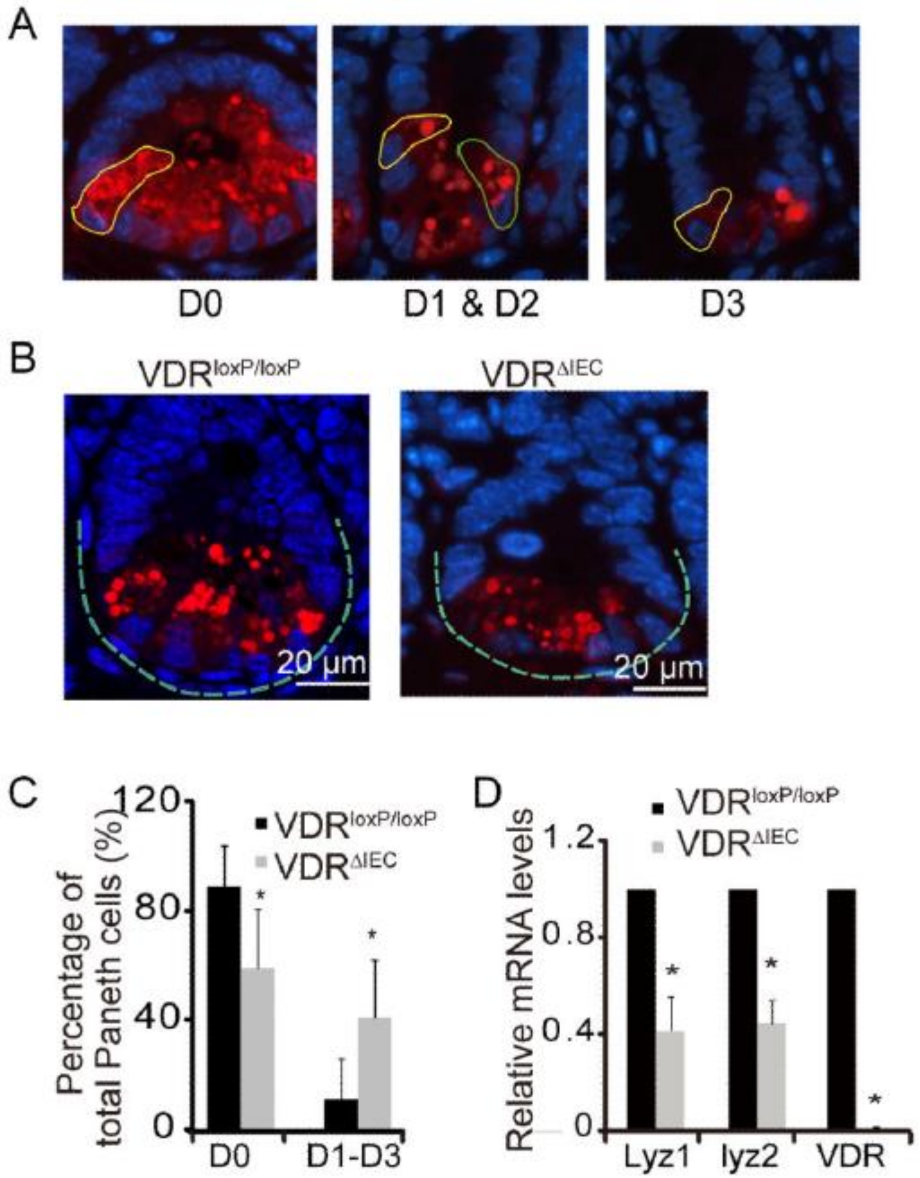


Fig.3 Organoid inflammation and tight junction disruption were prevented by vitamin D. **a** Gene expression of inflammation marker TNFα in intestinal organoids Real-time polymerase chain reaction for inflammation markers TNFα in control intestinal organoids and organoids subjected to LPS + Hypoxia and LPS + Hypoxia + Vit D. **b** Immunofluorescence staining micrographs of tight junction protein in intestinal organoids Immunofluorescence staining micrographs of tight junction ZO-1. ZO-1 protein formed a distinct ring in the control organoid and it was disrupted in LPS and hypoxia-treated organoids as indicated by white arrows. Organoids treated with vitamin D showed similar ring structure as control organoids. Experiments were independently repeated three times. $p < 0.05$ was considered significant

Lee et al. Pediatric Surgery International (2019)

L’absence de VDR induit des cellules de Paneth anormales



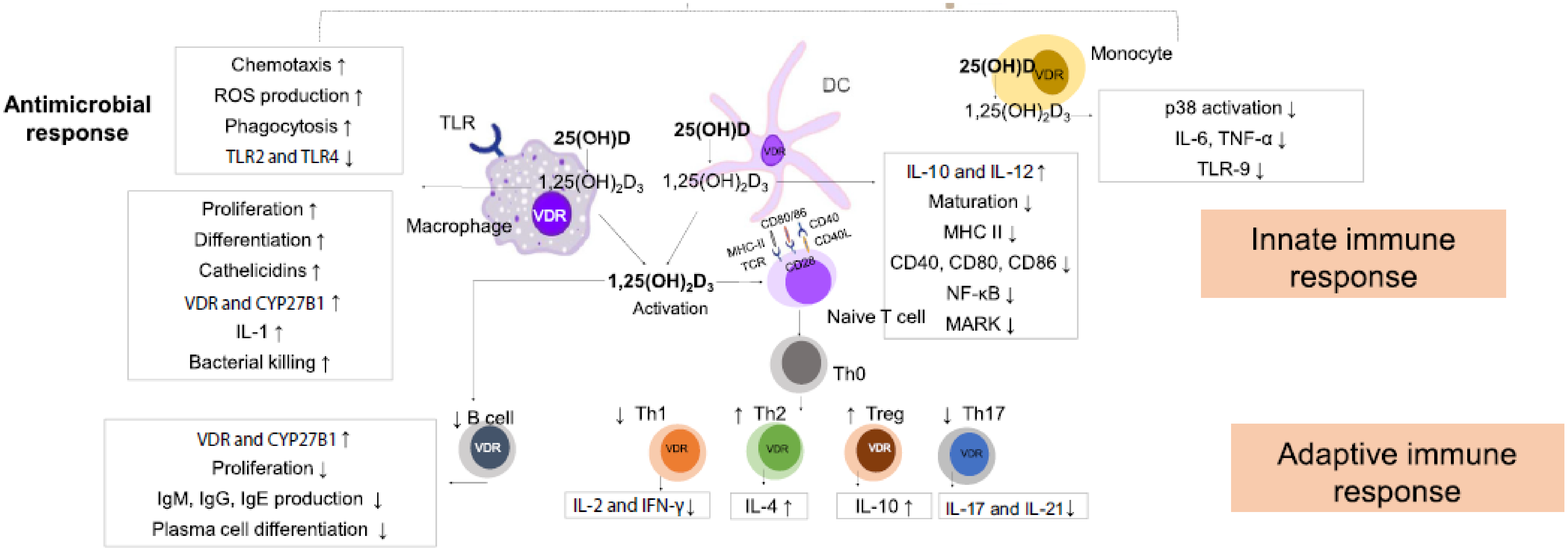
1/ Le nombre de cellules de Paneth diminue dans l’iléon des souris n’exprimant pas le VDR dans l’intestin (comparées aux souris contrôles)

2/ L’absence de VDR dans l’épithélium intestinal induit des cellules de Paneth anormales.

3/ Les capacités antimicrobiennes des cellules de Paneth sont altérées en absence de VDR

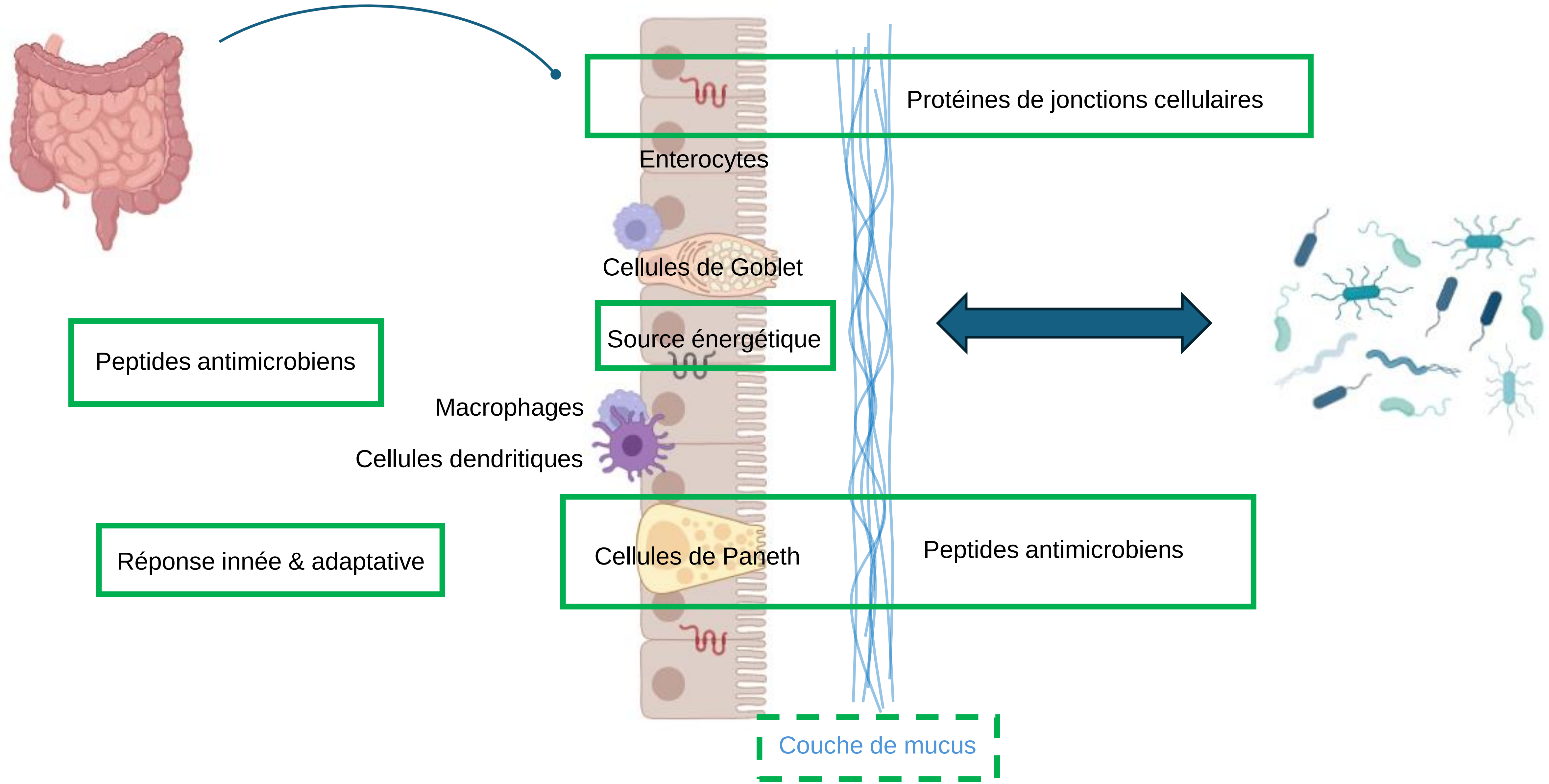
Wu et al. Gut. 2015

La VitD régule les réponses immunitaires innées et adaptatives

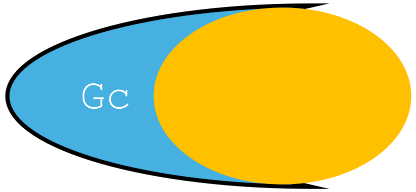


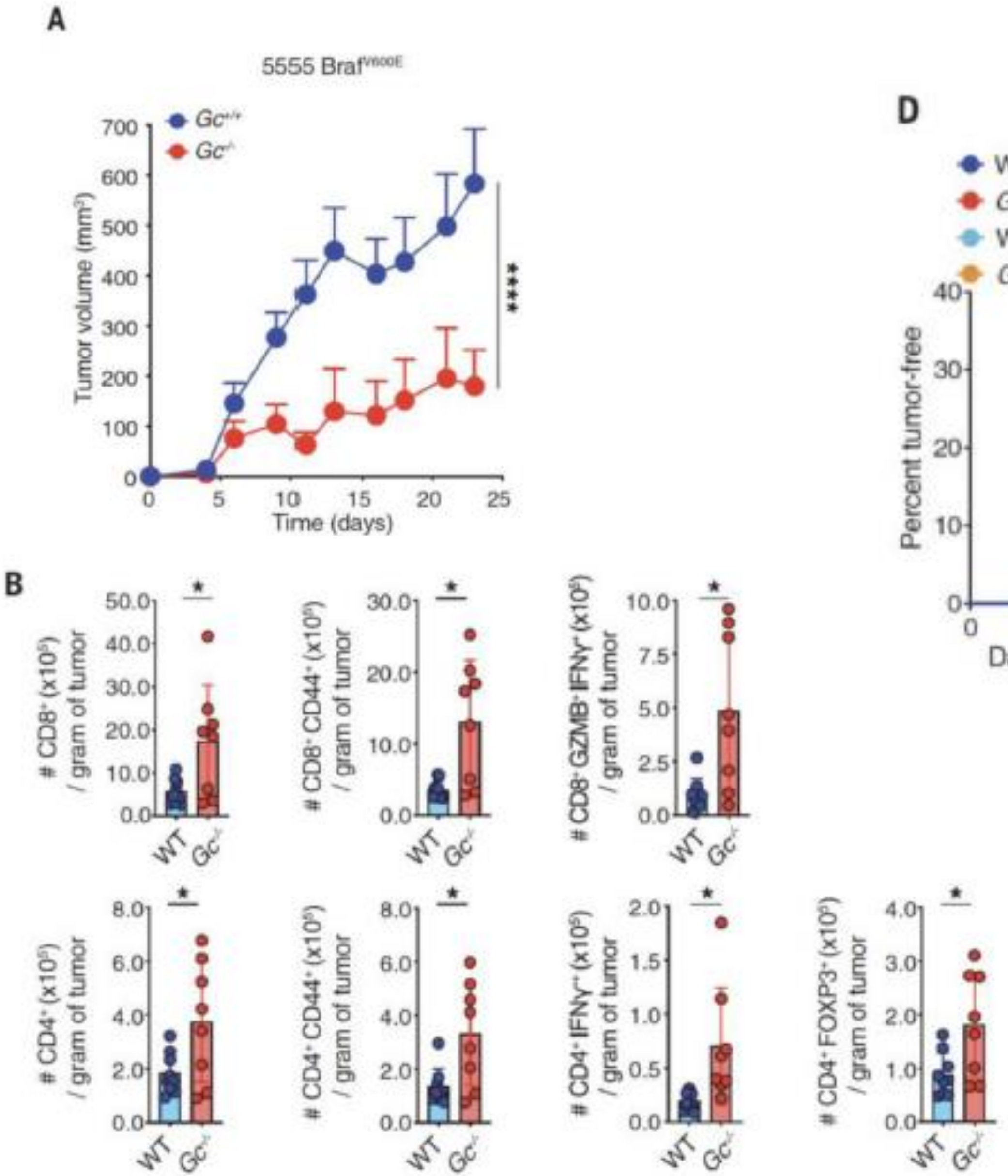
Aggeletopoulou et al. Am J Pathol. 2023

La VitD influence la communication bidirectionnelle entre la barrière de l'intestin et le MI



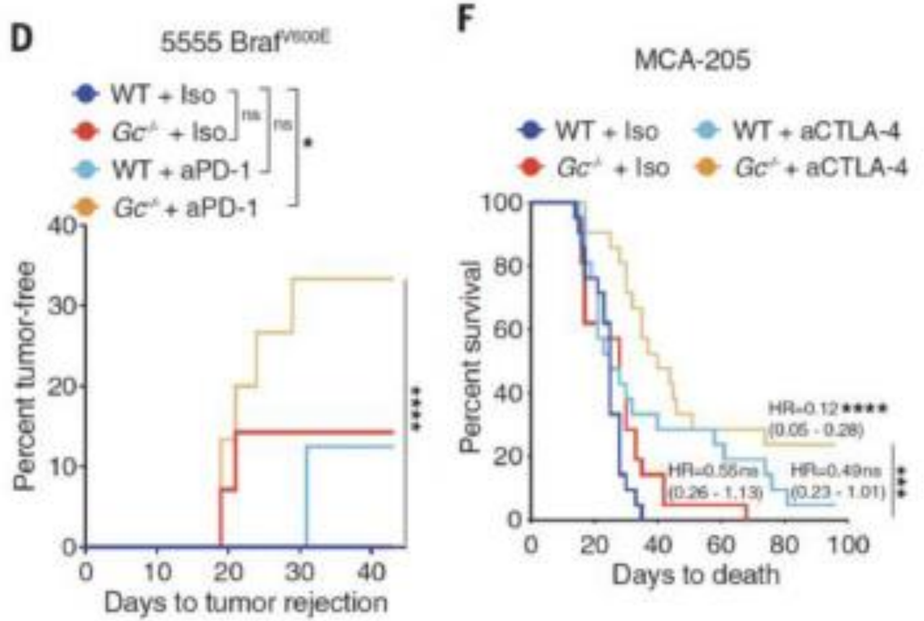
Un exemple récent de l'effet indirect de la VitD sur le microbiome intestinal





1. Les souris Gc-/- contrôlent mieux la croissance tumorale

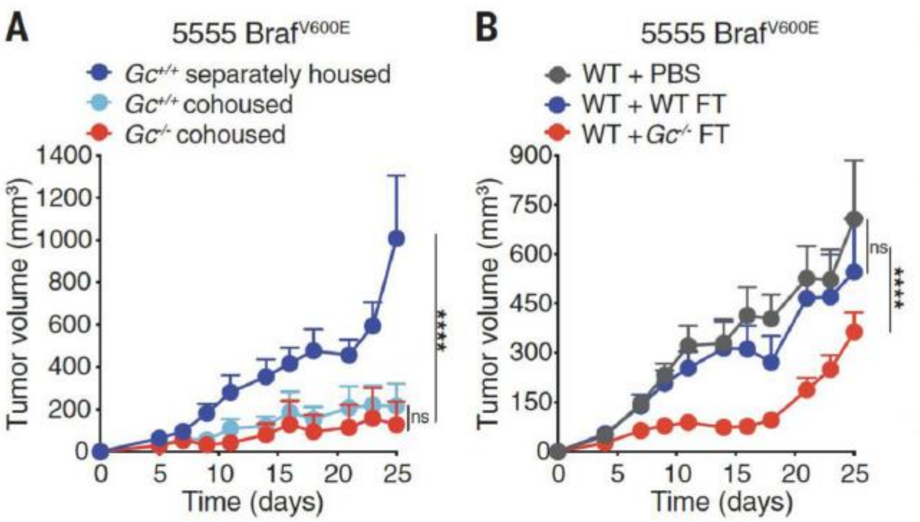
2. Infiltration intra-tumorale des CD4+ CD8+ augmentée chez les Gc-/-



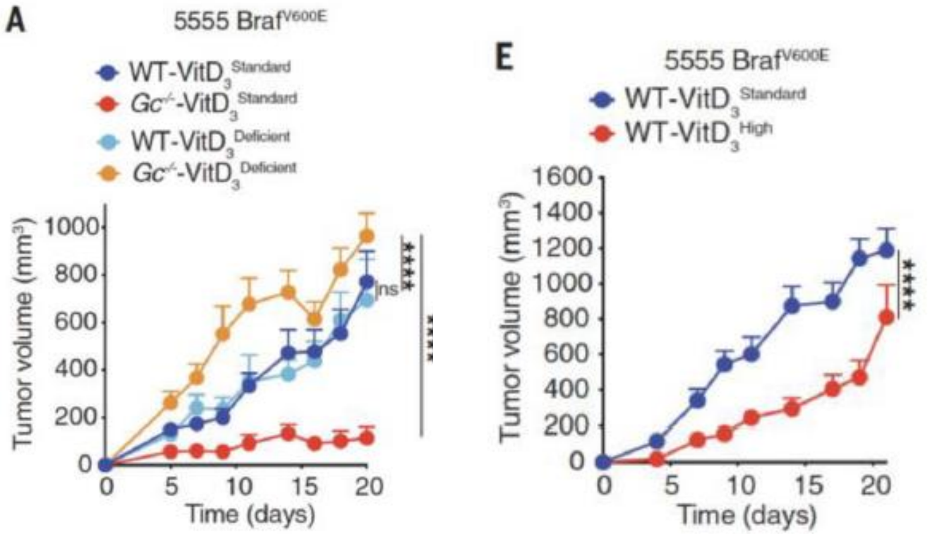
3. Meilleure réponse à l'immunothérapie chez les souris Gc-/-

Giampazolias *et al*. Science. 2024

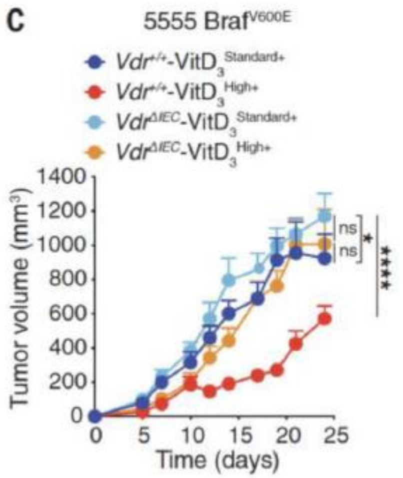
Un exemple récent de l’effet indirect de la VitD sur le microbiome intestinal



4. La résistance à la croissance tumorale est transférable

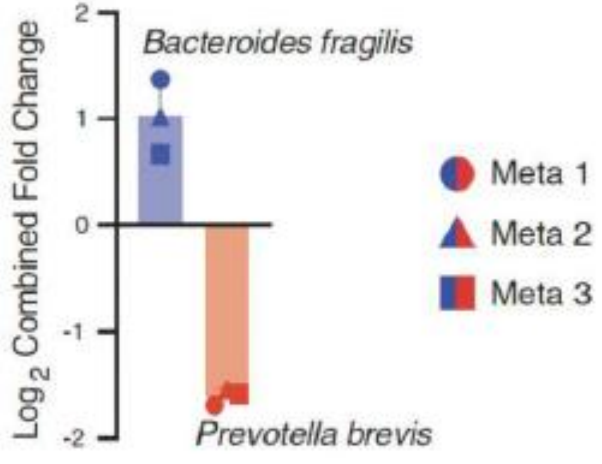


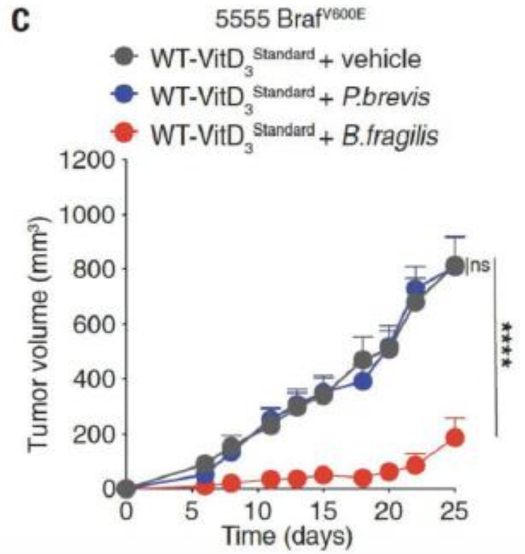
5. L’effet est dépendant de la biodisponibilité de la VitD3….



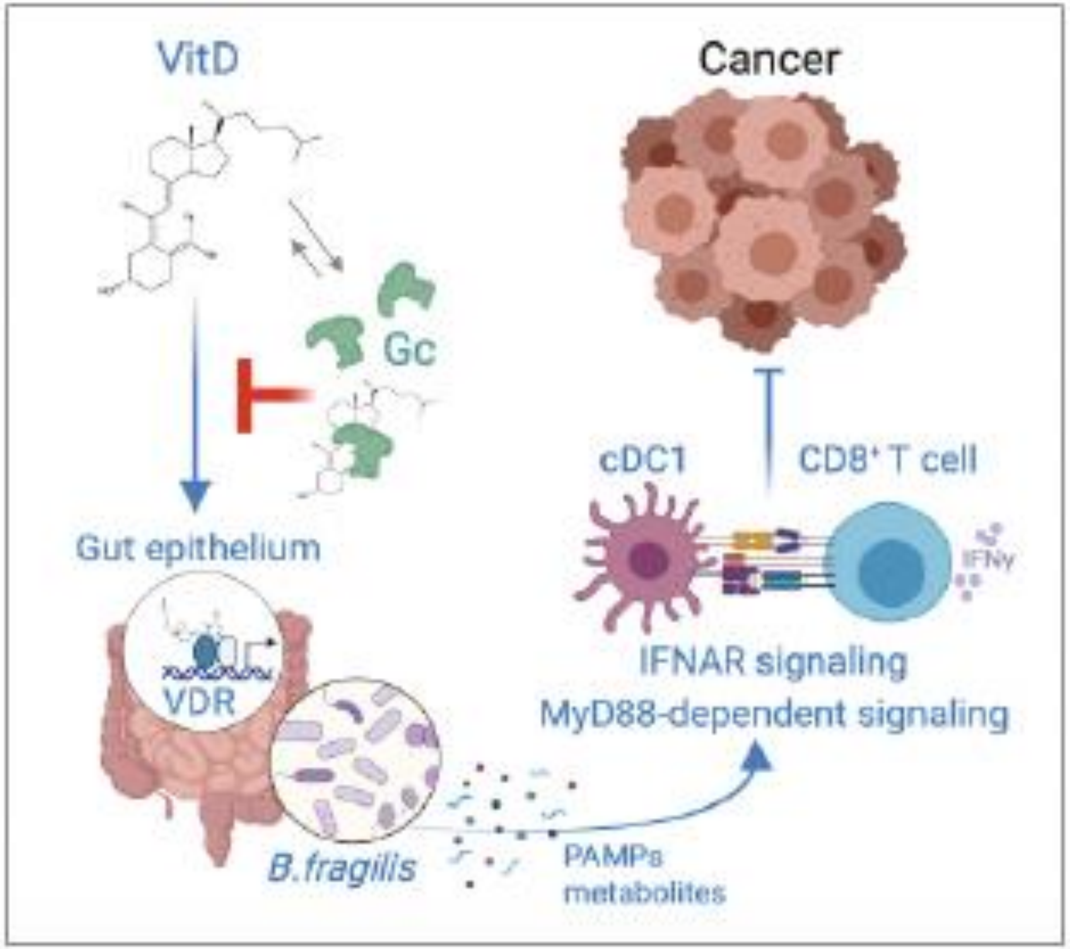
6. … et du récepteur VDR dans l’intestin !

Un exemple récent de l'effet indirect de la VitD sur le microbiome intestinal

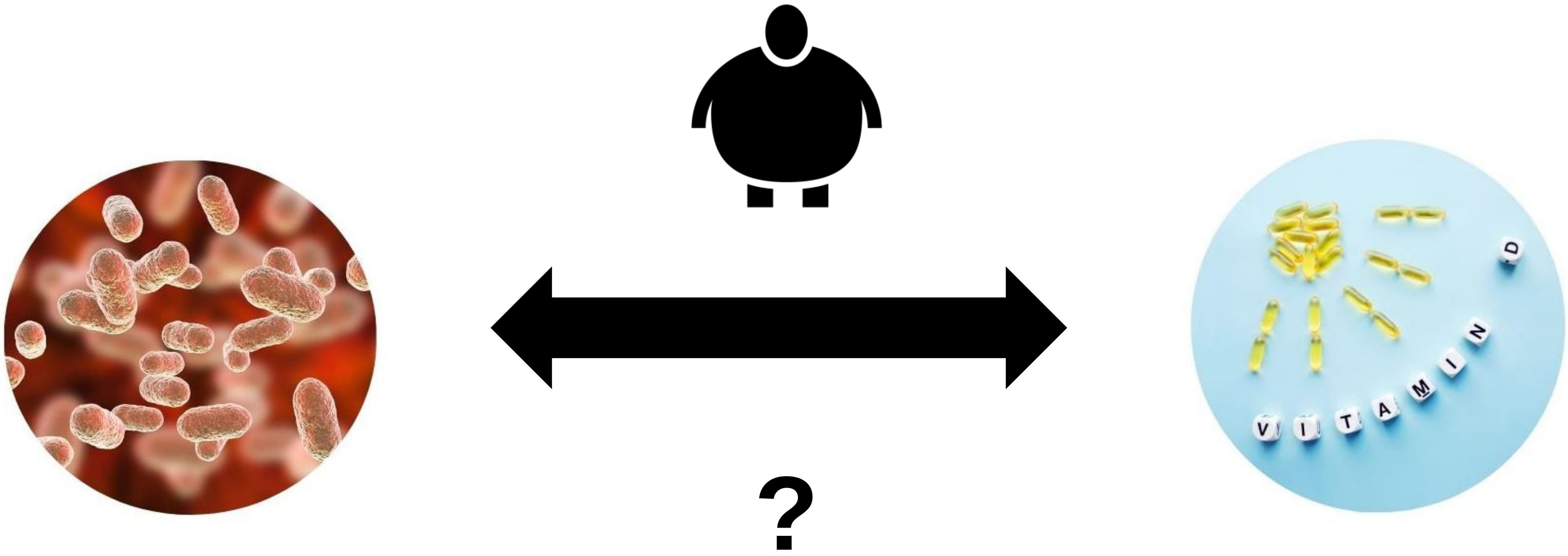




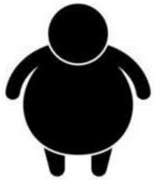
7. Le gavage oral de *Bacteroides fragilis* induit une résistance à la croissance tumorale



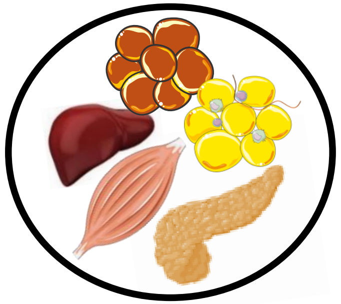
Interactions entre le microbiome intestinal et la vitamine D au cours du syndrome métabolique

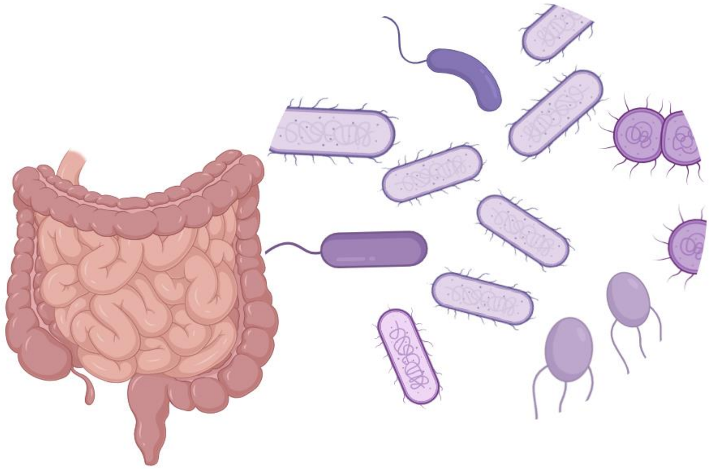


L'obésité a des causes multifactorielles → a-t-on pris en compte tous les facteurs ?

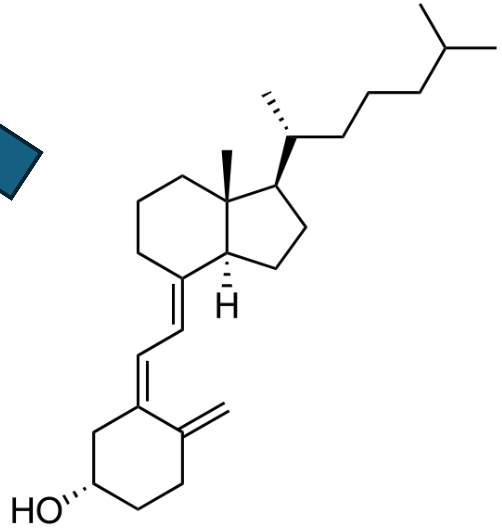


En 2022: **1 personne sur 8** dans le monde était atteinte d'obèsité (WHO)
En 2050: prédiction de **1 personne sur 2** *(GBD 2021 Adult BMI Collaborators. Lancet. 2025)*
Causes multifactorielles et encore incomplètement comprises *(Rubino et al. Lancet Diabetes Endocrinol. 2025)*





Microbiote Intestinal

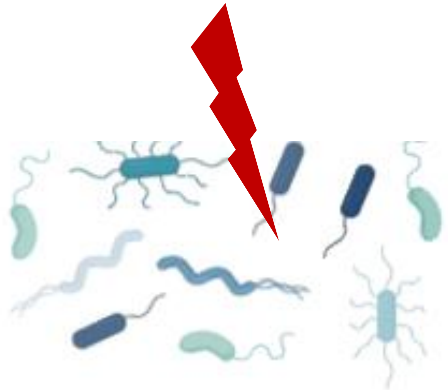


Vitamine D (VitD)

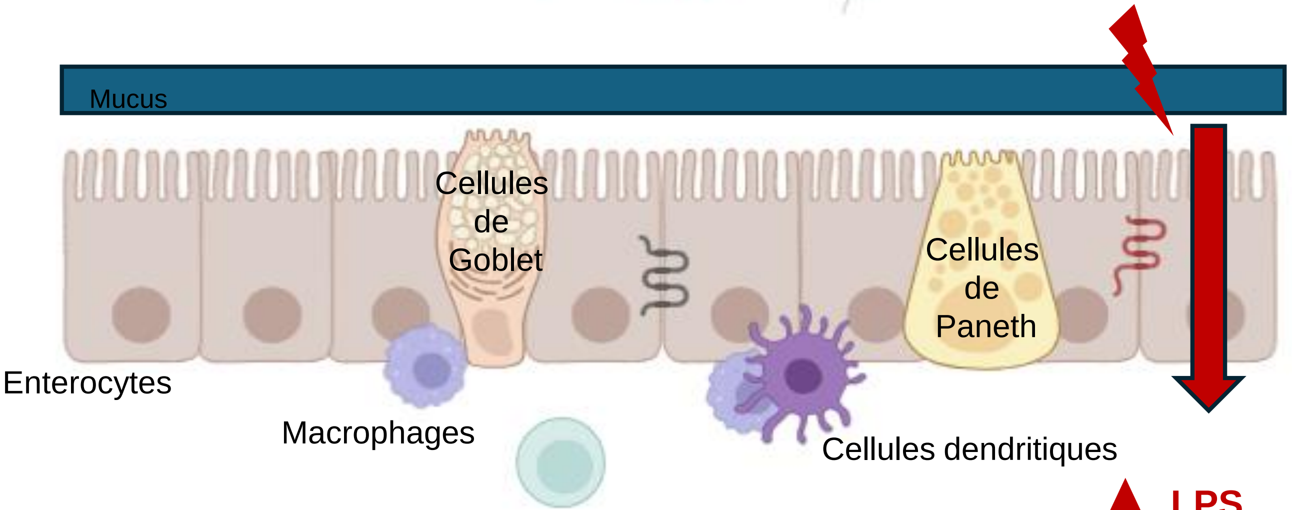
Un déséquilibre du MI est observé au cours du syndrome métabolique

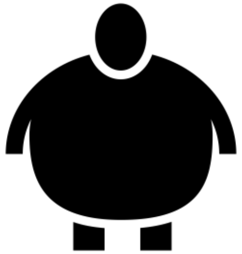
↓ Diversité bactérienne

↓ Bactéries « bénéfiques »
Bifidobacterium (immunité)
F. prausnitzii (anti-inflammatoire, butyrate)
Roseburia intestinalis (butyrate)
Dysosmobacter welbionis (métabolisme)
Akkermansia muciniphila (fonction barrière, métabolisme)



↑ Pathobiontes
Desulfovibrio spp., Collinsella,
Beta-proteobacteria





▲ LPS

▼ Acides gras à chaine courte

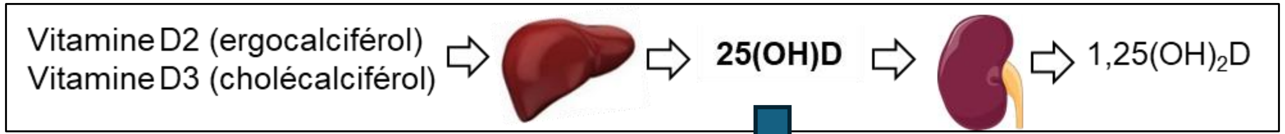
▲ Imidazole Propionate

▲▼ Acides biliaires

▲ Acide phénylacétique

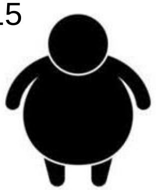
Adapté de la revue: Rodriguez et al. Mol Nutr Food Res. 2021

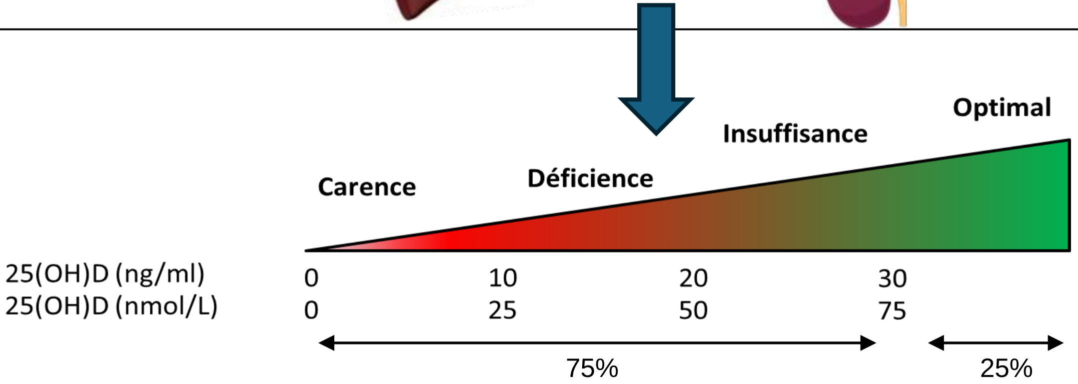
La triade Métabolisme – Microbiome - Micronutriments



Niveaux plus faibles de 25(OH)D

Pereira-Santos *et al*. Obes. Rev. Off. J. Int. Assoc.Study Obes. 2015

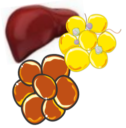




Population générale :
Cui et al. Front. Nutr. 2013;
Etude Esteban 2015

Centre de Recherche en CardioVasculaire et Nutrition

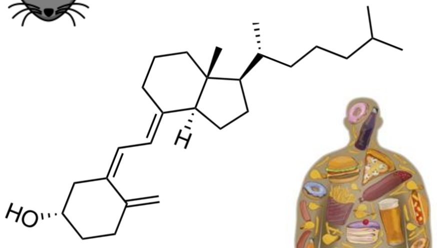
Effets de la supplémentation en VitD



↓ Inflammation

↑ Homéostasie glucidique et lipidique

Marcotorchino *et al.* J Nutr Biochem. 2014
Karkeni *et al.* Endocrinology. 2015
Karkeni *et al.* Epigenetics. 2018
Bonnet *et al*. J Steroid Biochem Mol Biol. 2019
Marziou *et al.* Nutrients. 2020
Payet *et al*. Mol Nutr Food Res. 2023
Payet *et al.* Biofactors. 2025



↓ Expression de gènes proinflammatoires

↑ Homéostasie du glucose

Lontchi-Yimagou *et al.* Mol. Metab. 2020

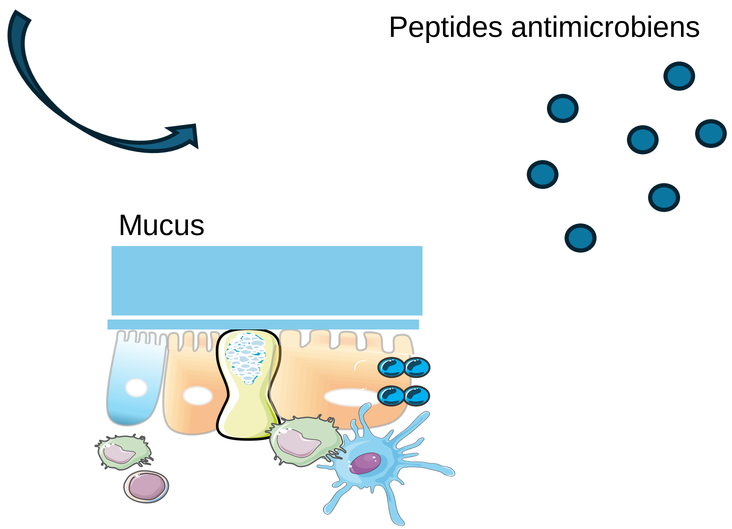
Méta-analyse (39RCT- n=2982 T2D)

Effets sur HbA1c, HOMA-IR, glycémie & insulinémie à jeun dépend de la durée/ dosage supplémentation ET 25(OH)D basale + BMI

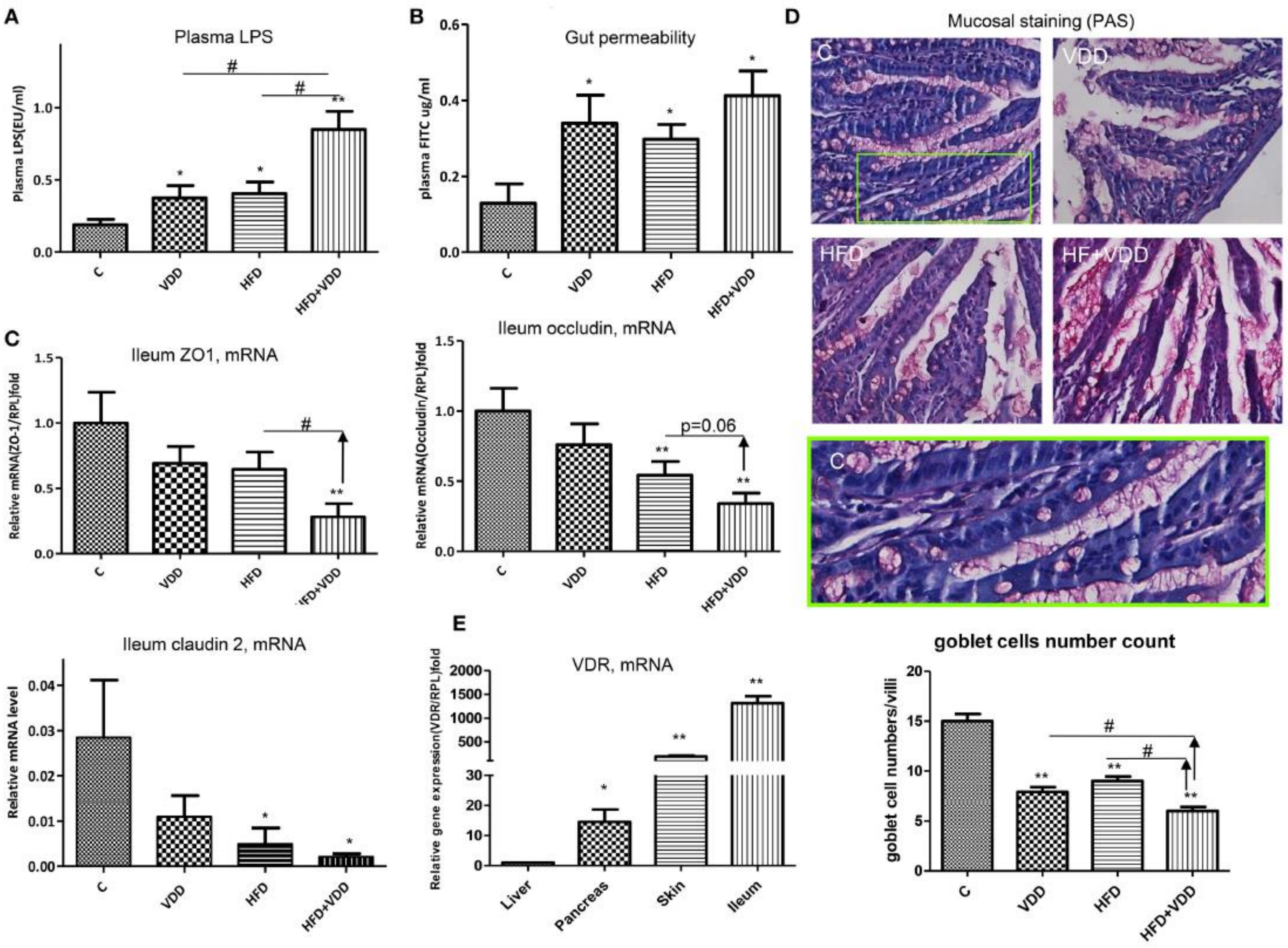
Chen *et al.* Diabetes Obes. Metab. 2024

Effet de la modulation de l'apport en VitD sur le microbiome intestinal et les altérations métaboliques induites par un régime HFHS

Modulation de la teneur en VitD

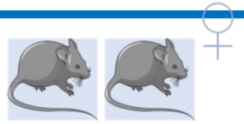


HFD 60%
18 weeks
Iléon



Su *et al.* Frontiers in Phys

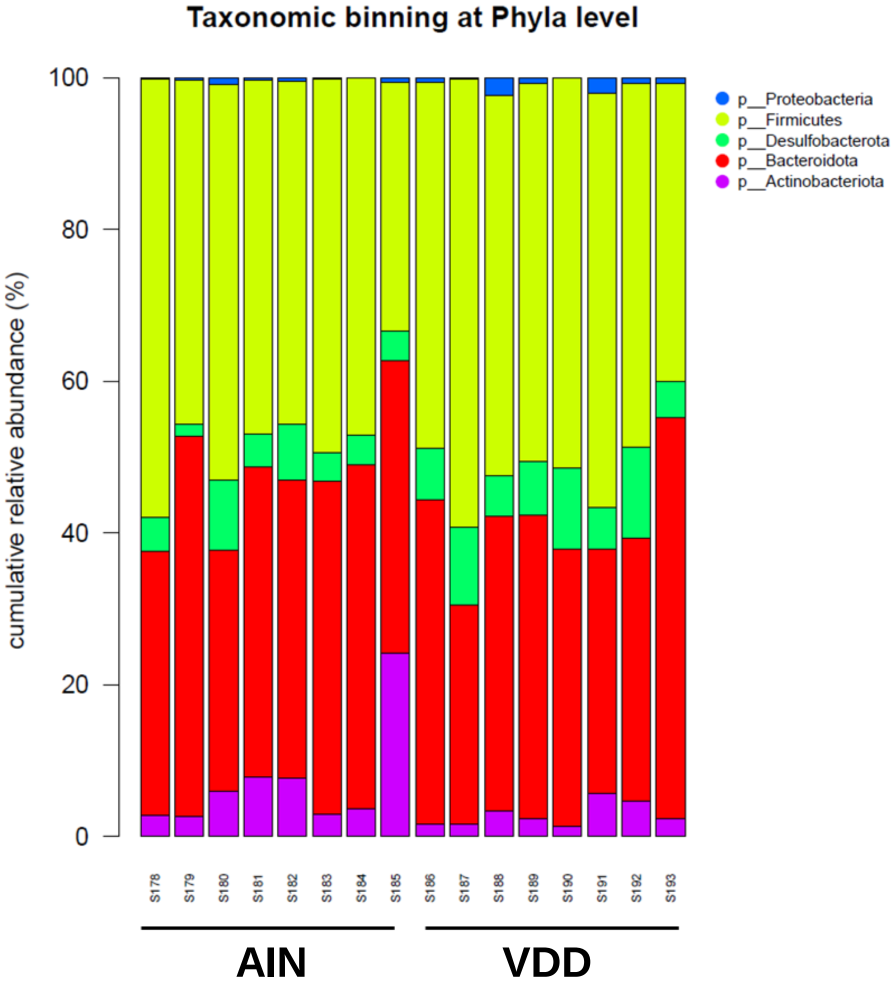
La composition du microbiome intestinal est altérée chez les souris déficientes en vitD

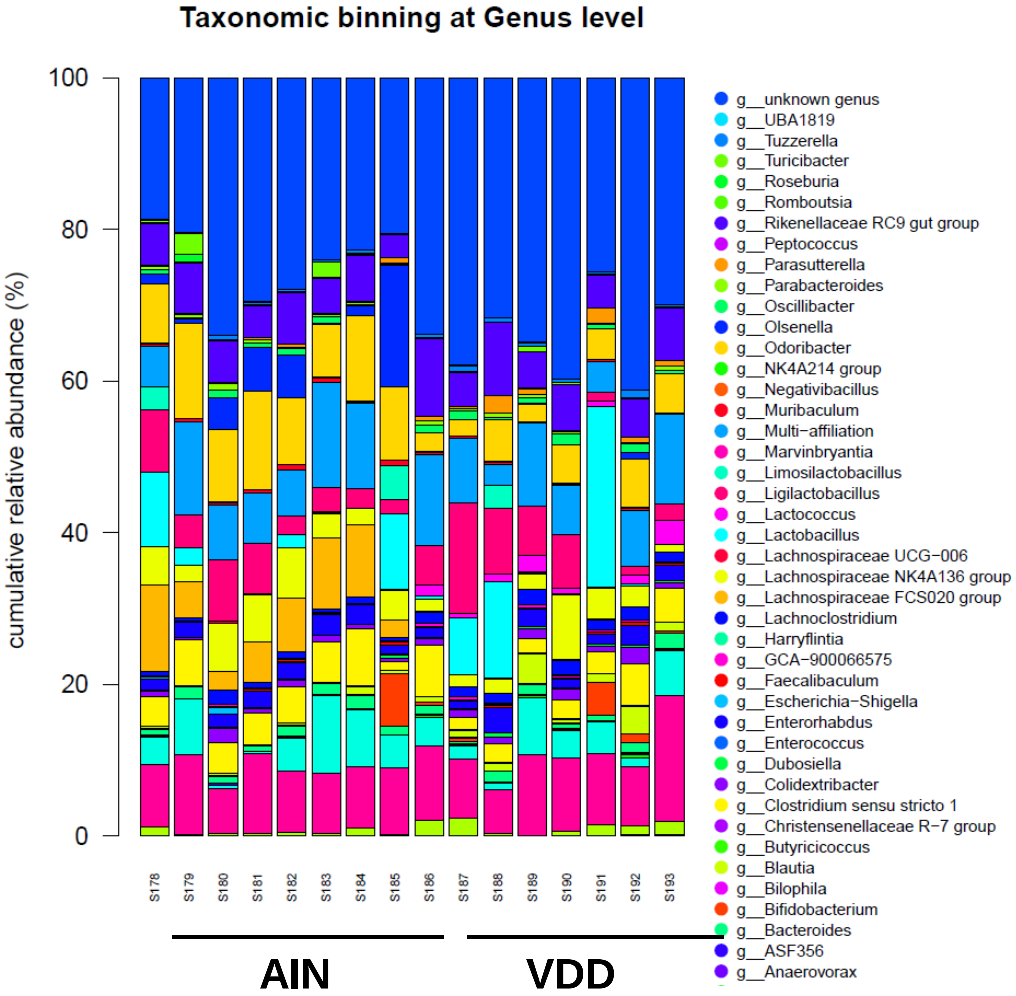


Alimentation	Standard 10% graisses	
Vitamine D dans l'alimentation	–	1250 IU/kg

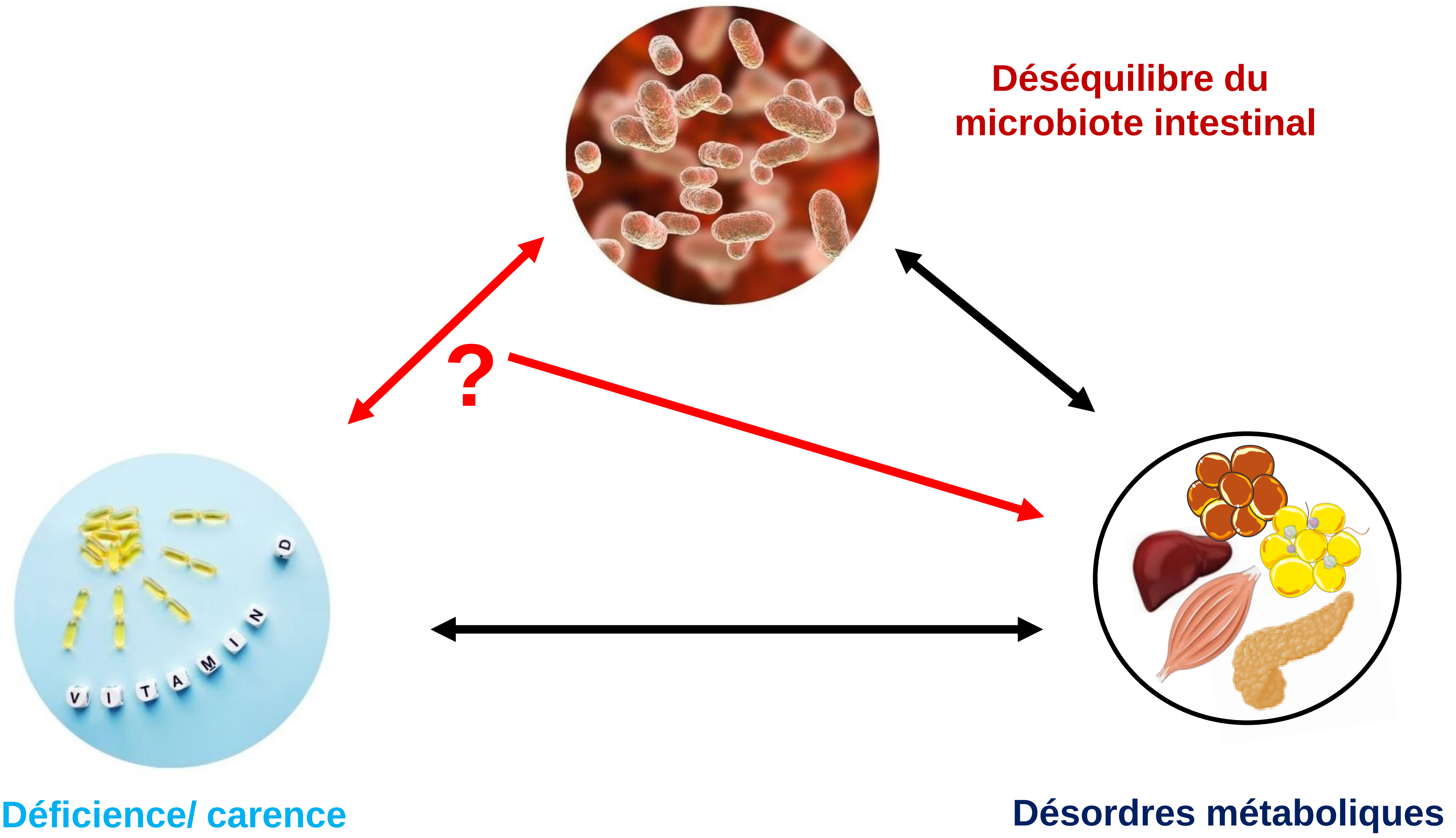
Analyse taxonomique:
16S rRNA gene sequencing

Domaine
Phylum
Classe
Ordre
Famille
Genre
Espèce





Comprendre les interactions au sein de cette triade est un défi important



Messages importants

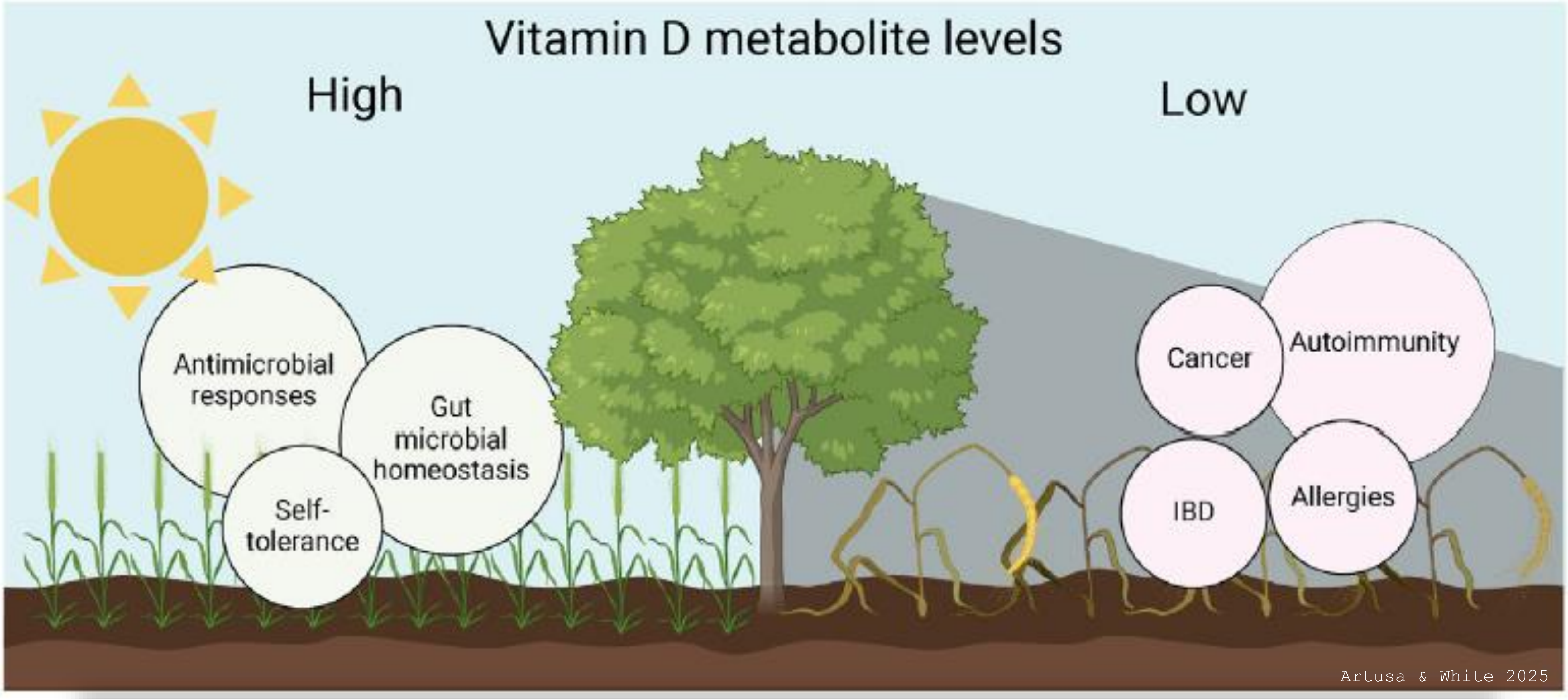
- Le microbiome intestinal et la Vitamine D jouent un rôle important dans la régulation du métabolisme de l'hôte.

- Le Microbiome intestinal régule le métabolisme de la vitamine D.

- La Vitamine D influence la communication bidirectionnelle entre le microbiome et la barrière intestinale.

- Le statut en 25(OH)D (forme circulante de la vitamine D) mérite plus d'attention dans les études d'intervention.

- **Les interactions Micronutriments – Microbiome constituent un champ de recherche prometteur à approfondir**



Merci de votre attention