Raising feedlot cattle with good microbes in mind

Cria y engorda de ganado con buenos microbios en mente

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Host-associated microbiome
Microbioma asociado al huésped

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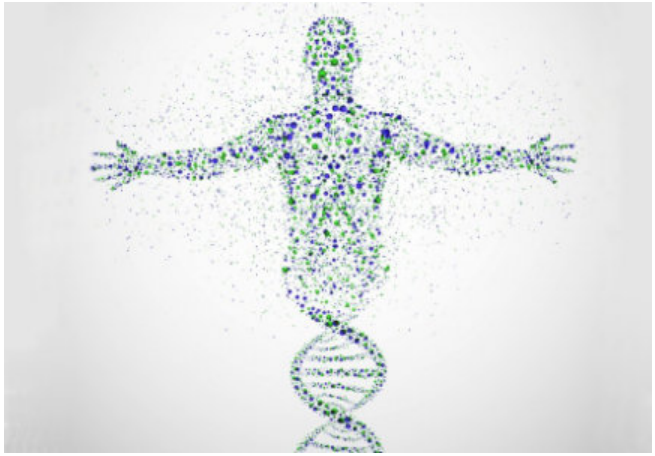
Microbioma asociado al huésped

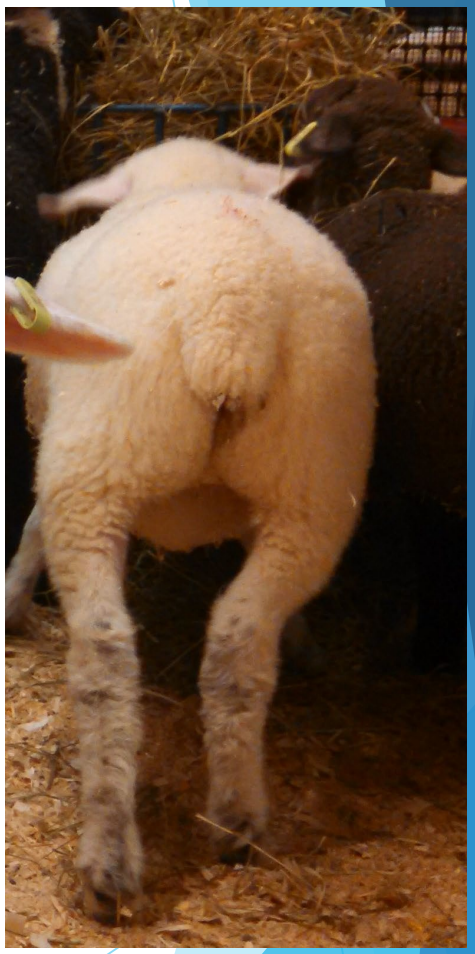


http://microbeminded.com/wp-content/uploads/2018/01/microbiome_sm.jpg

https://www.foodbusinessnews.net/articles/11241-the-human-microbiome-holds-great-promise-for-innovation

Illustration: Charis Tsevis

The research is less glamorous than it sounds in the news
La investigación es menos glamorosa de lo que parece en las noticias



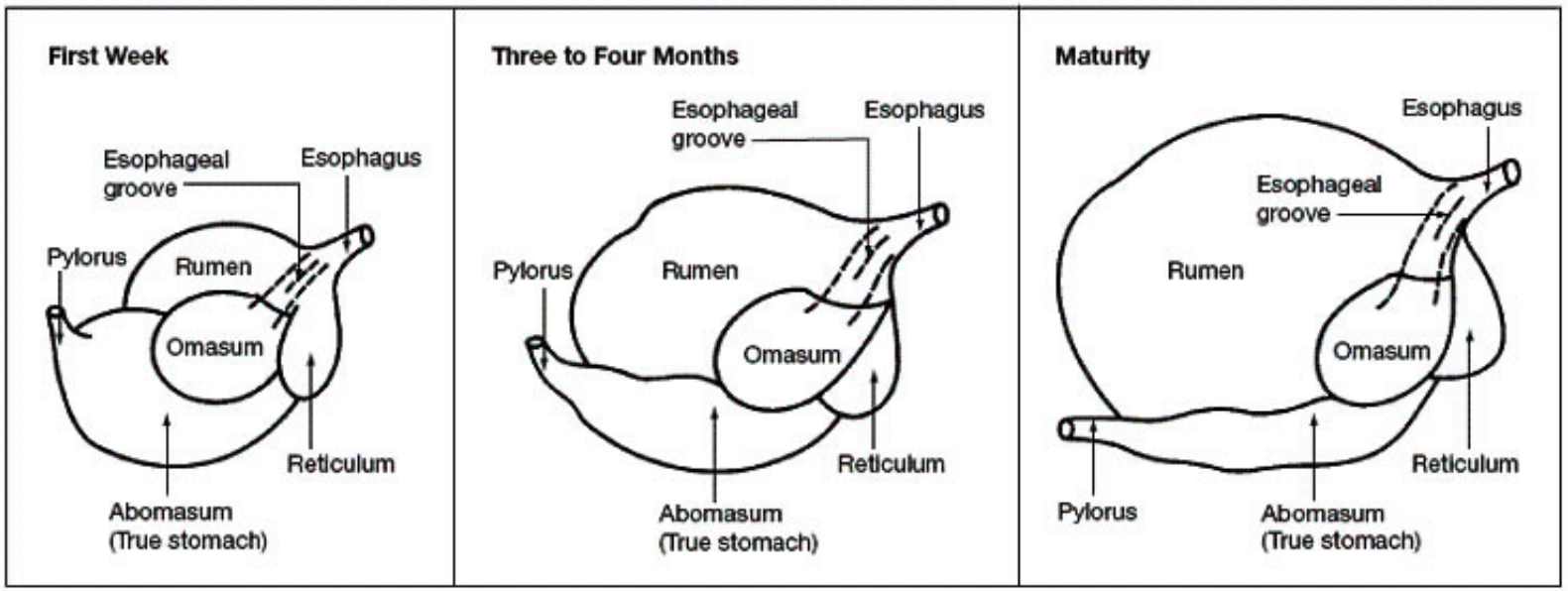
Why do we care about microbes?
¿Por qué nos importan los microbios?

Pixabay

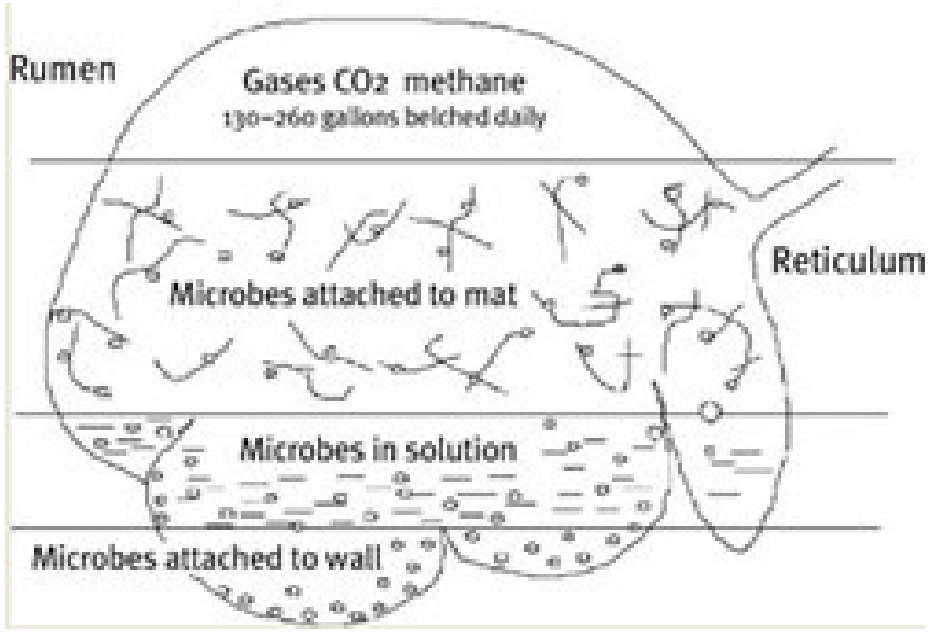
Early microbial exposure improves rumen growth and development

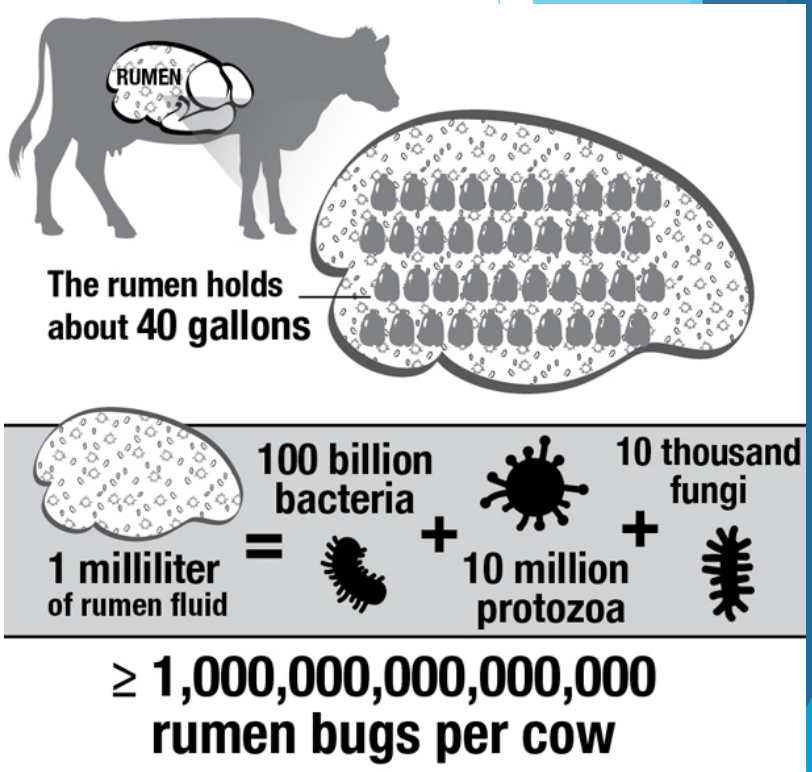
La exposición microbiana temprana mejora el crecimiento y desarrollo del rumen

Figure 1. Development of bovine stomach compartments from birth to maturity.

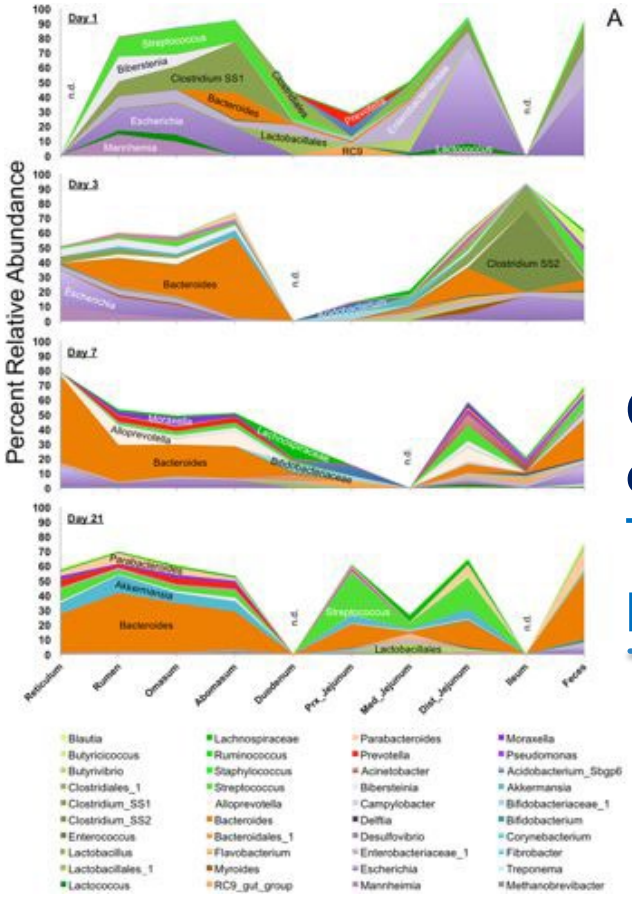


The rumen is an interesting place
El rumen es un lugar interesante





GI microbiota is dynamic by body site
La microbiota GI es dinámico según el sitio del cuerpo

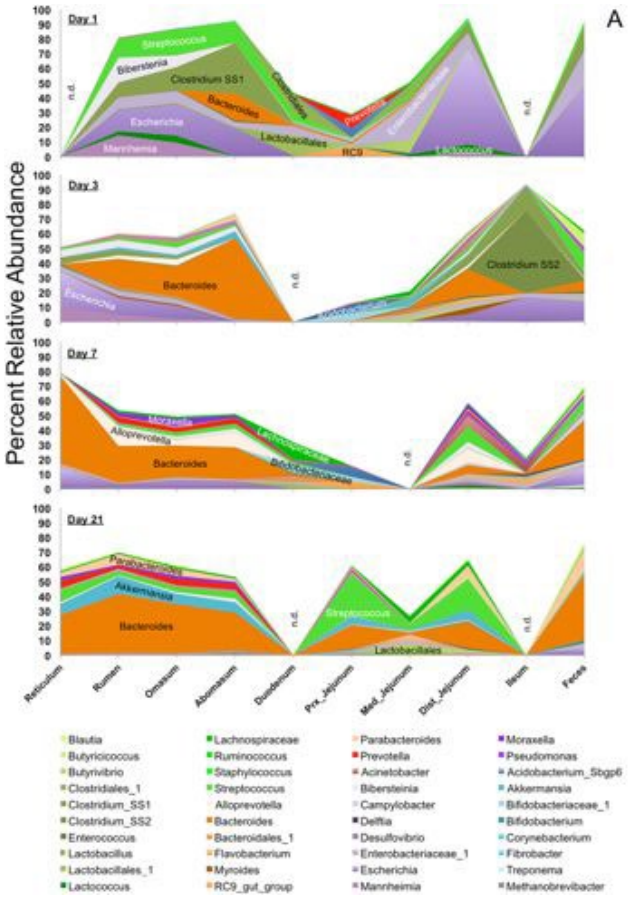


GI tract proximal to distal

Tracto gastrointestinal proximal a distal

Yeoman and Ishaq et al. 2018

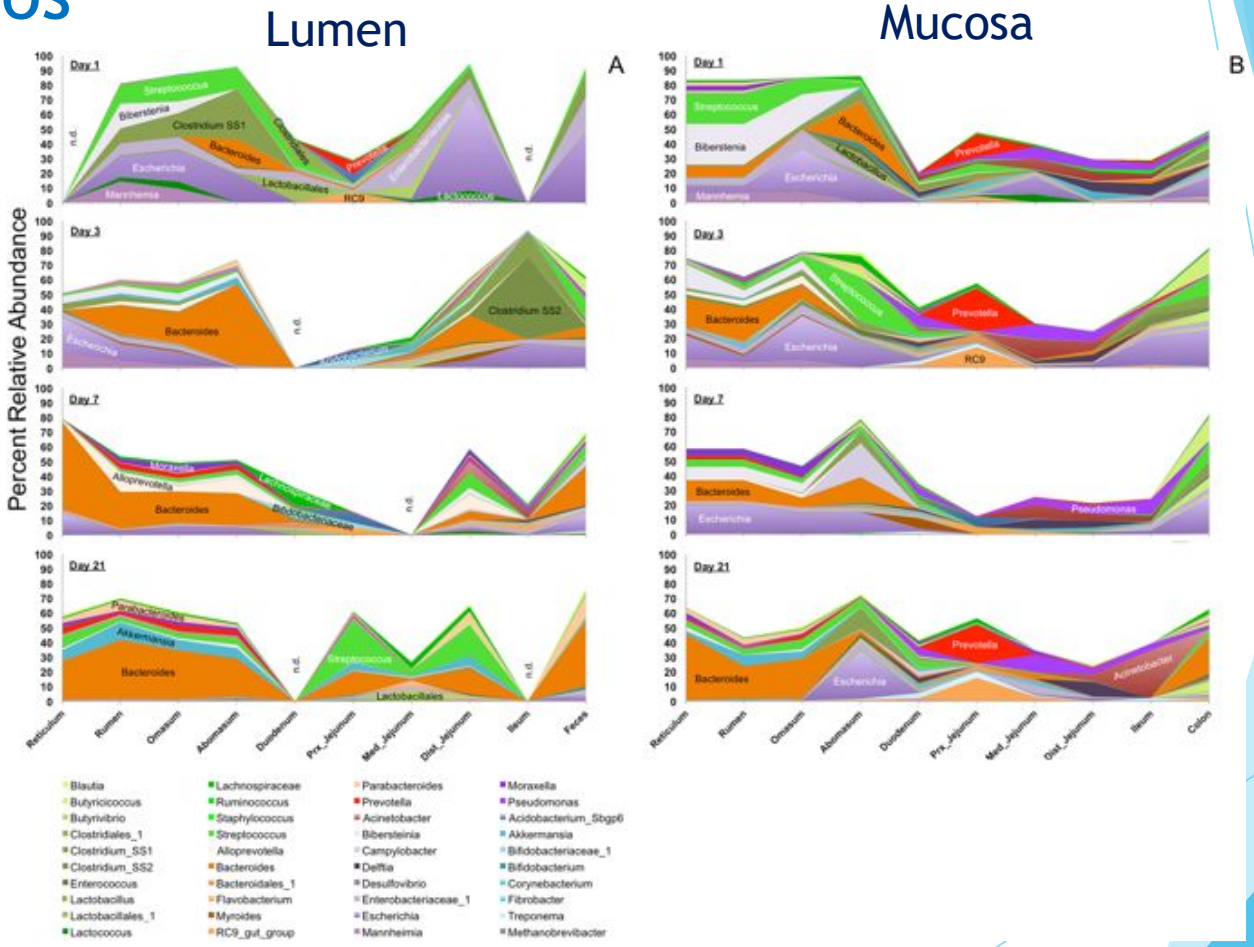
GI microbiota is dynamic by day
La microbiota GI es dinámica de día



Day 1 to 21
Día 1 al 21

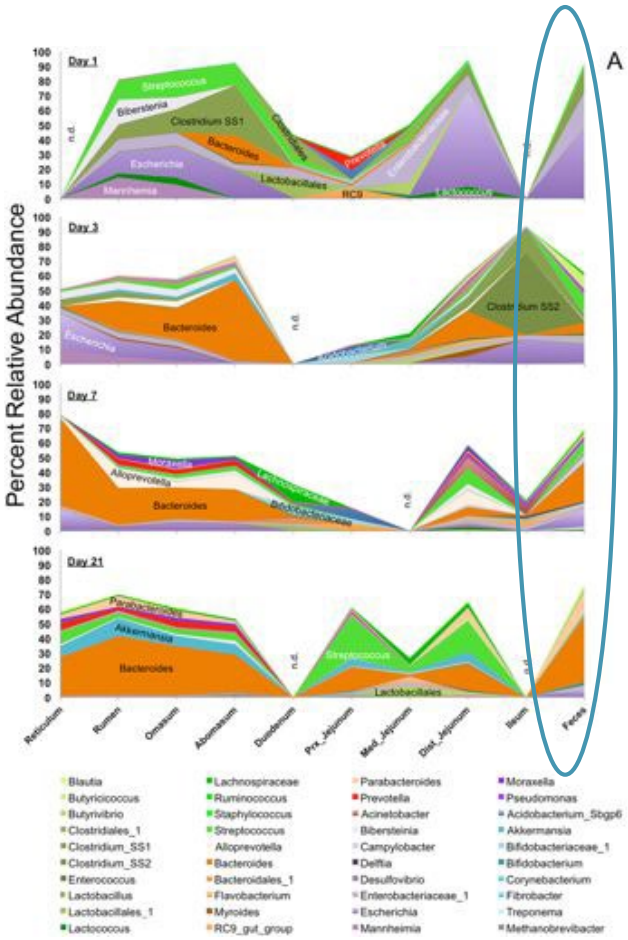
Yeoman and Ishaq et al. 2018

GI microbiota is dynamic near epithelia
La microbiota GI es dinámica cerca de los epitelios



Yeoman and Ishaq et al. 2018

Feces does not show the whole picture
Las heces no muestran la imagen completa



Important when designing an experiment!

¡Importante al diseñar un experimento!

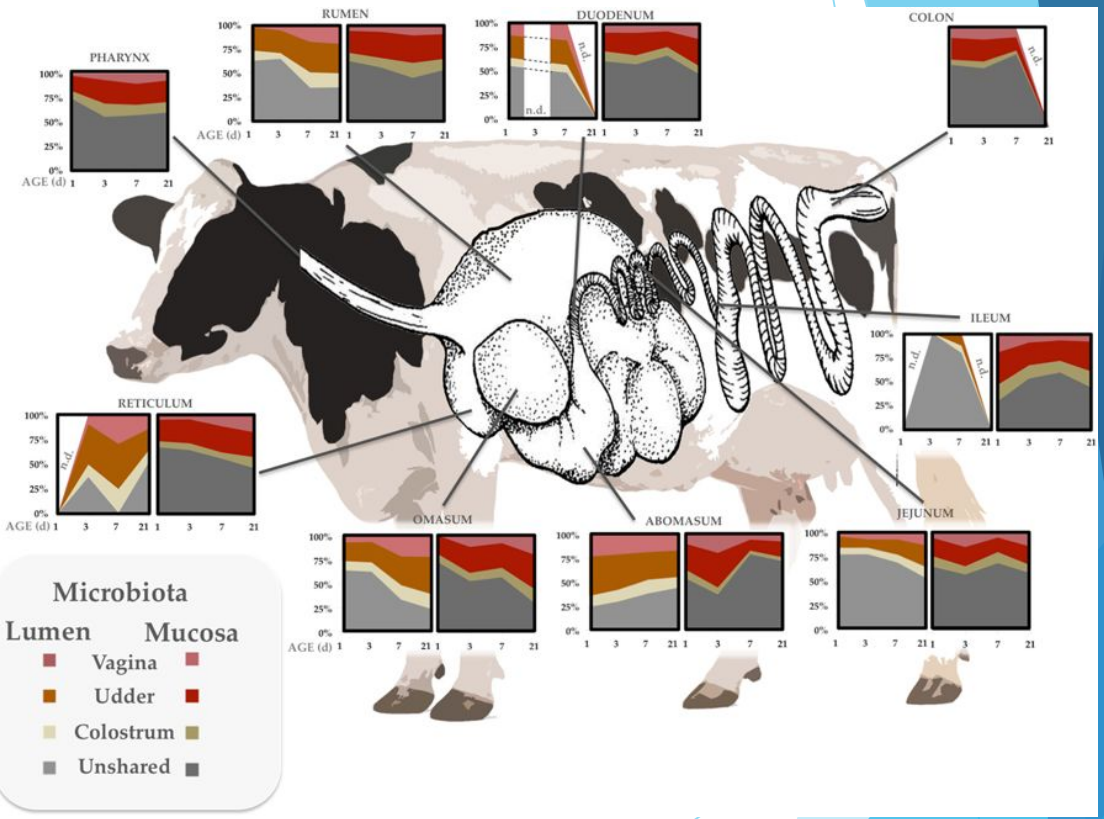
Yeoman and Ishaq et al. 2018

Where is the GI microbiota sourced from?

¿De dónde proviene la microbiota GI?

Where is the GI microbiota sourced from?
¿De dónde proviene la microbiota GI?

- Environmental or mother?
- Ambiental o madre?

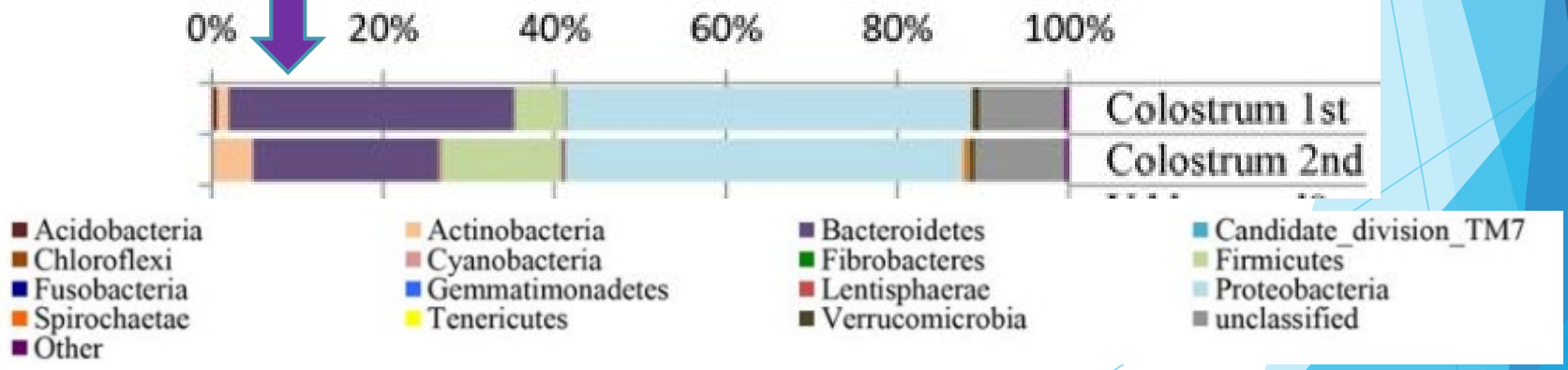


Yeoman and Ishaq et al. 2018

Colostrum contains lots of bacteria
El calostro contiene muchas bacterias

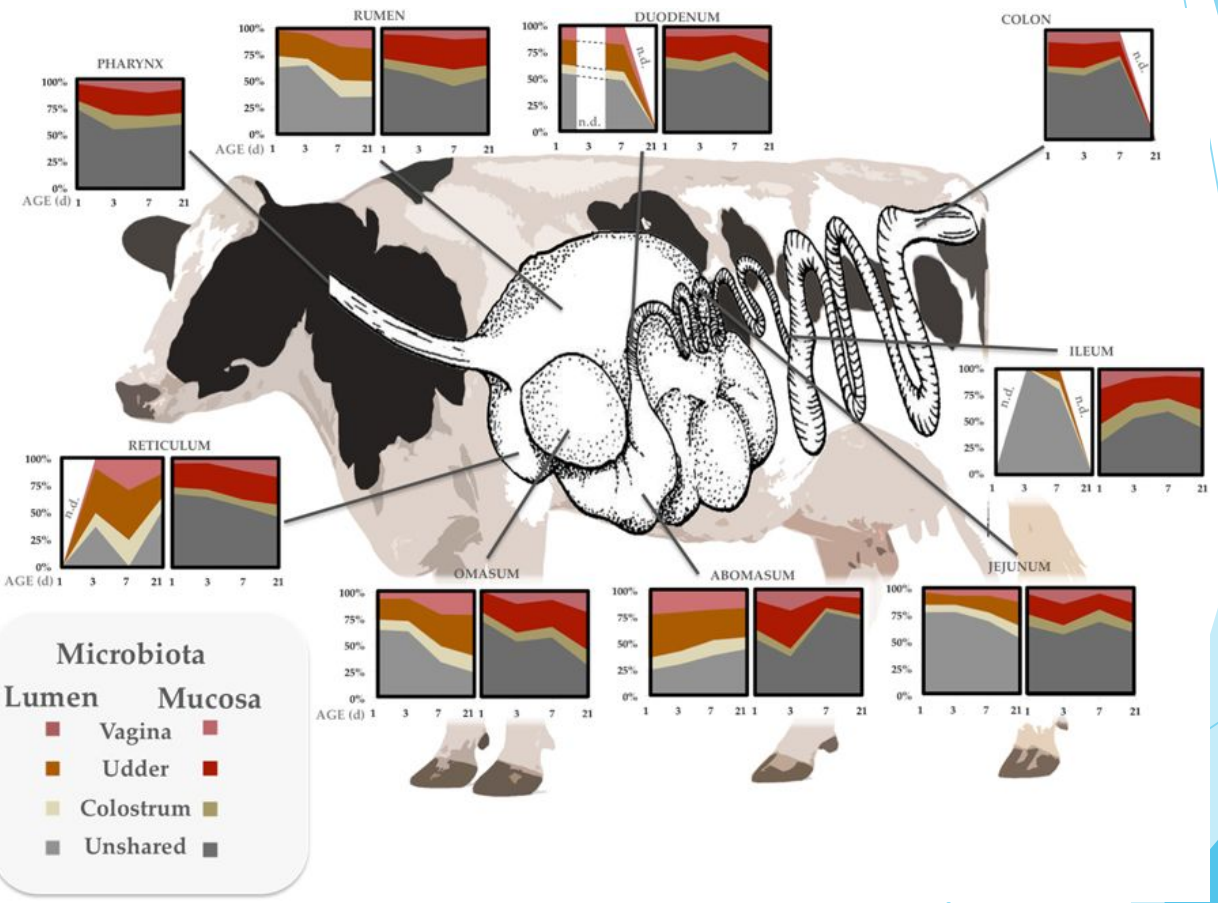
Much of this is *Prevotella*, **which is found in all mammalian gut**

Gran parte de esto es Prevotella, que se encuentra en todas los intestinales de mamíferos



Yeoman and Ishaq et al. 2018

Bacteria from the colostrum found along calf GI tract
Bacterias del calostro encontradas a lo largo del tracto gastrointestinal de la pantorrilla

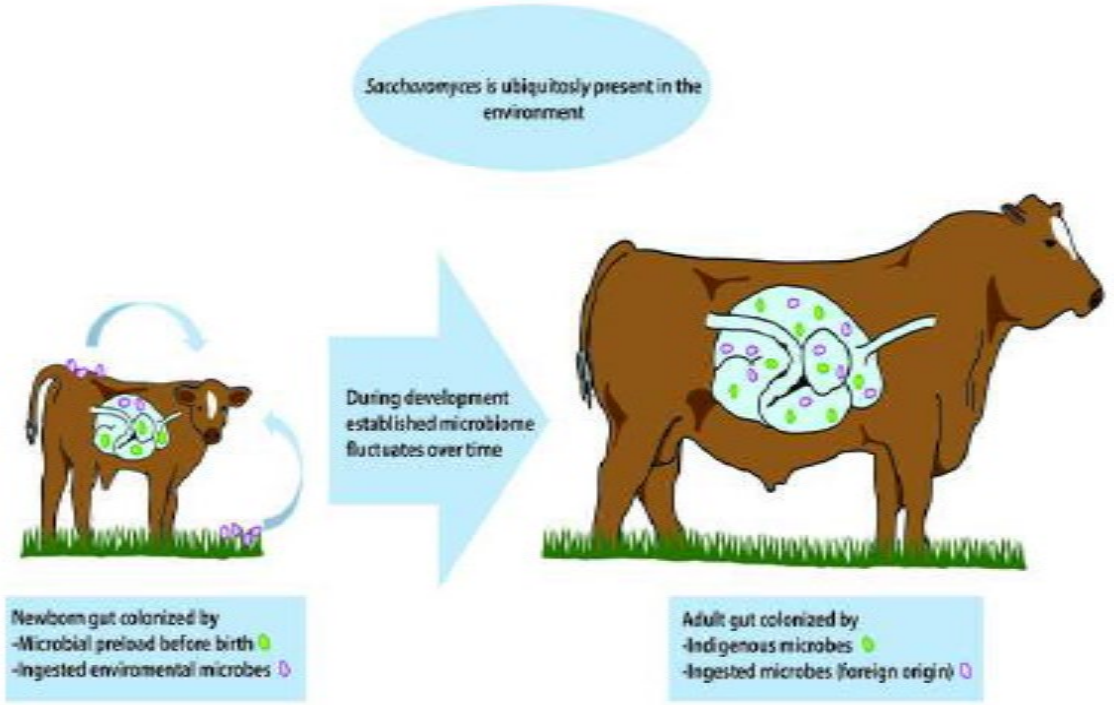


Yeoman and Ishaq et al. 2018

Where is the GI microbiota sourced from?
¿De dónde proviene la microbiota GI?

- Would any microbes do?
- ¿Harían algún microbio?

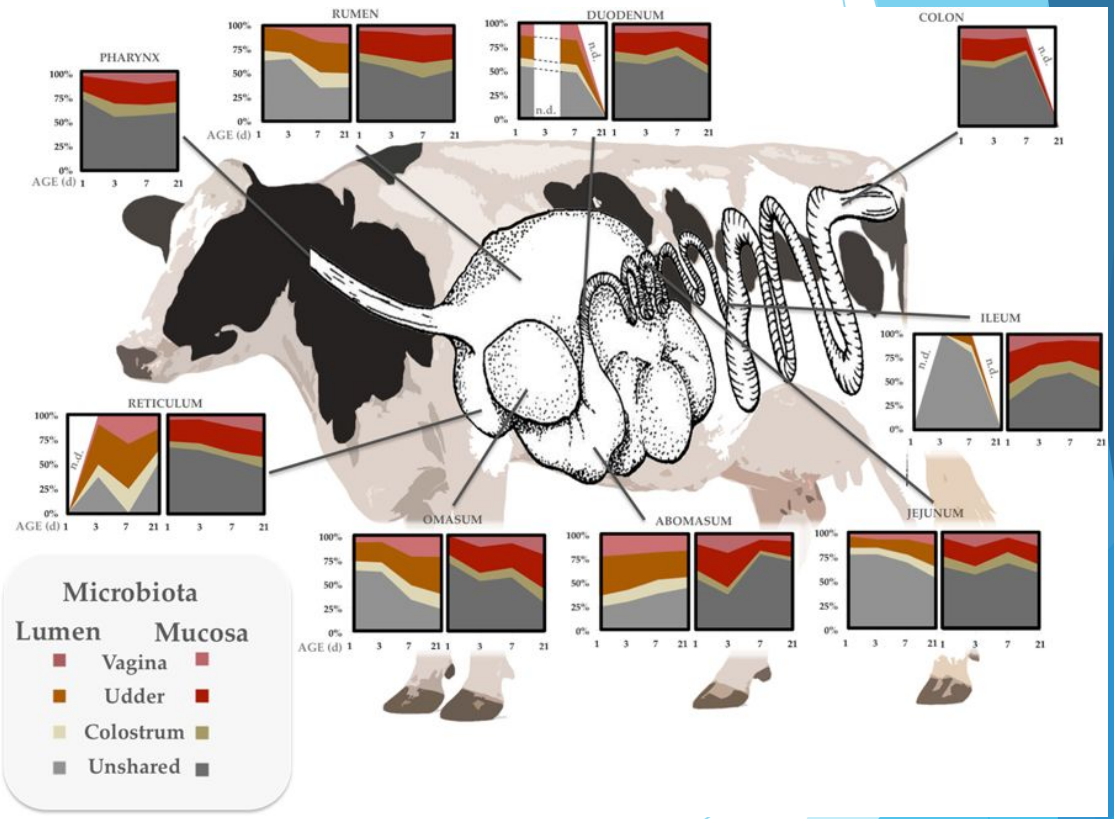
- Is it more effective if a probiotic species is indigenous or not?
- ¿Es más efectivo si una especie probiótica es indígena o no?



Garcia-Mazcorro et al. 2019

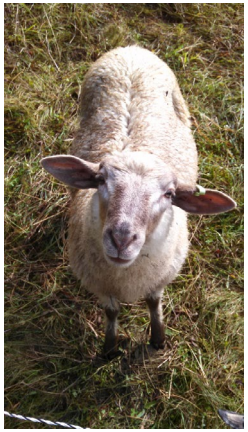
Where is the GI microbiota sourced from?
¿De dónde proviene la microbiota GI?

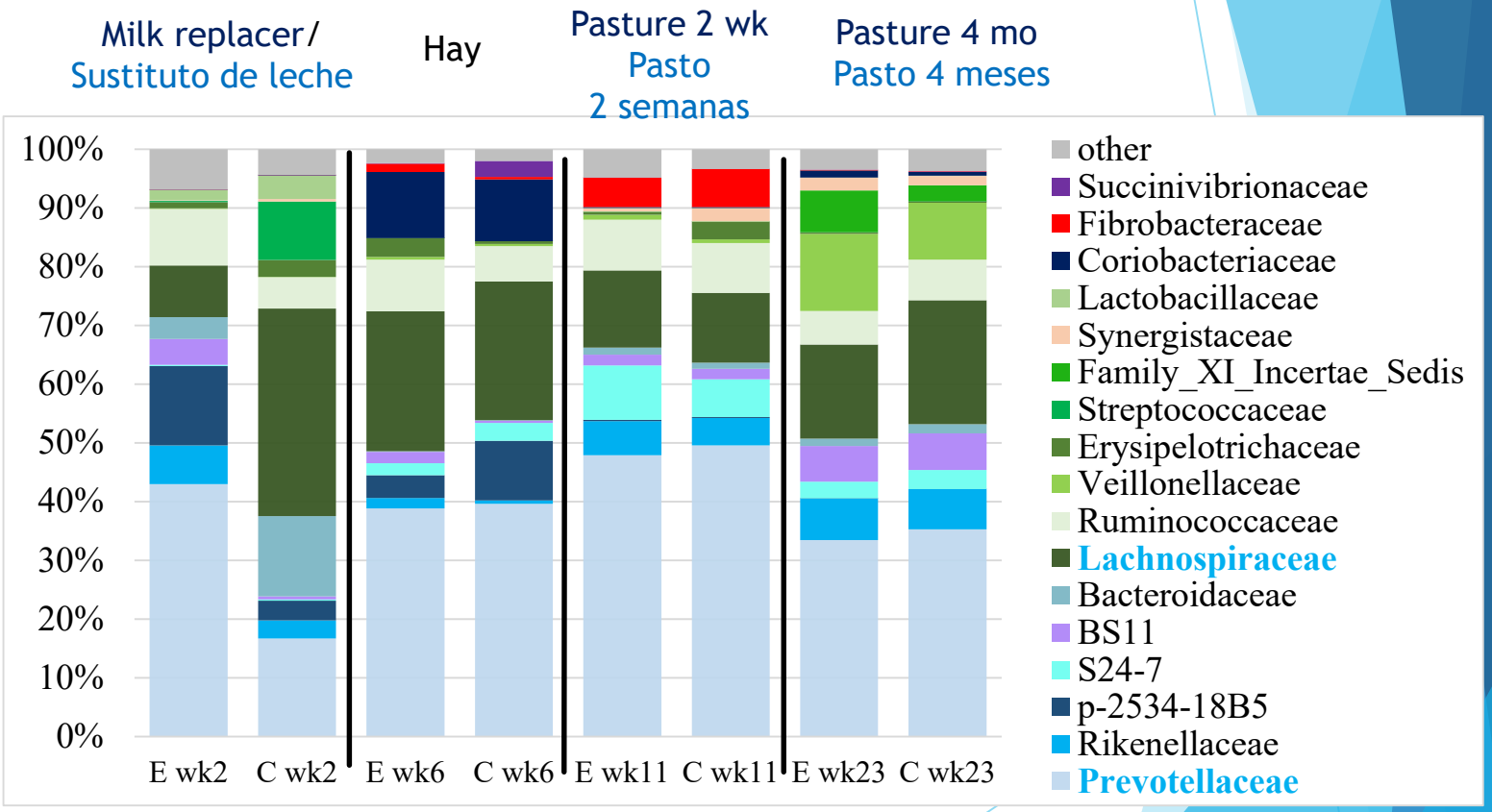
- Are they important to health?
- ¿Son importantes para la salud?
- Develop treatments to recreate this effect?
- ¿Desarrollar tratamientos para recrear este efecto?



Yeoman and Ishaq et al. 2018

As diet changes, so does rumen diversity
A medida que cambia la dieta, también lo hace la diversidad ruminal

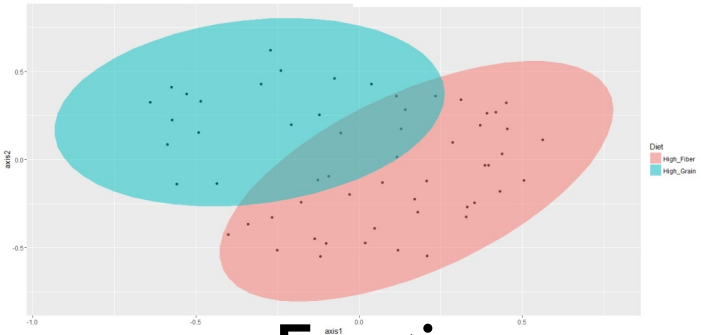




Ishaq et al. 2015

Diet can drive microbial imbalance and systemic dysbiosis

La dieta puede conducir al desequilibrio microbiano y la disbiosis sistémica



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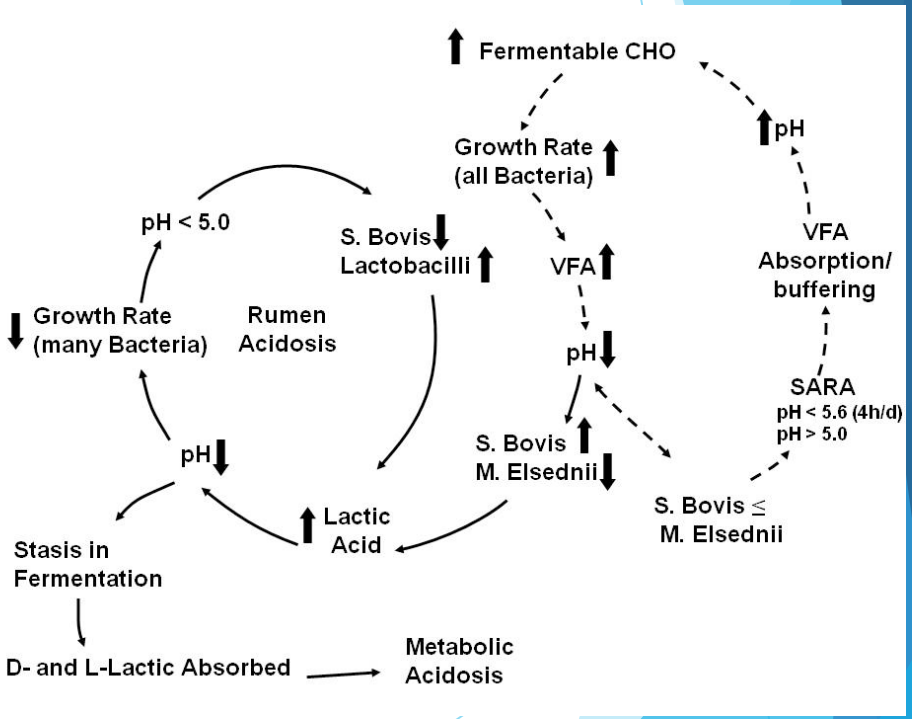
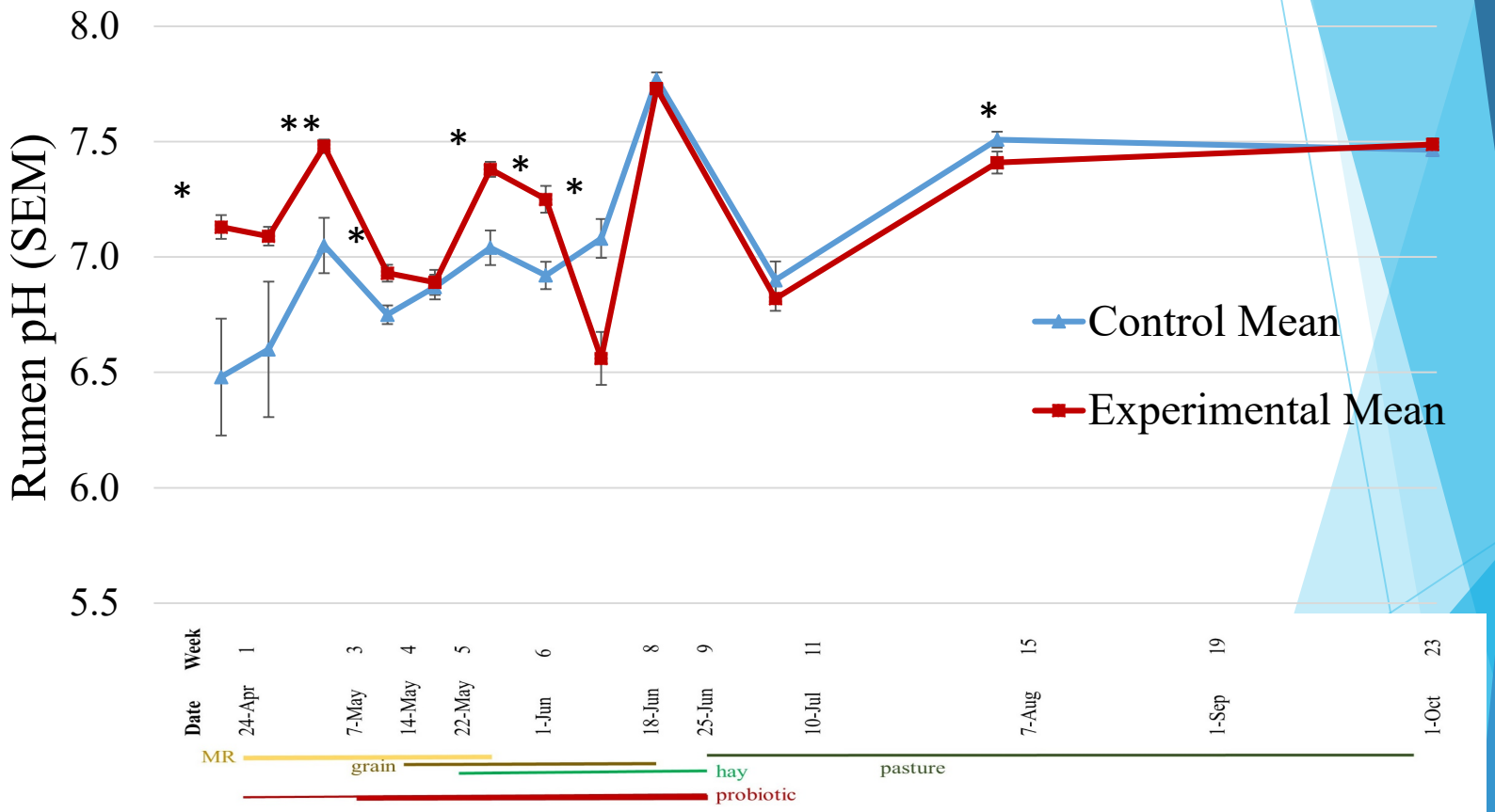


Ishaq et al. 2017

AlZahal et al. 2008

Bacterial probiotics stabilized rumen pH in lambs
Los probióticos bacterianos estabilizaron el pH del rumen en corderos

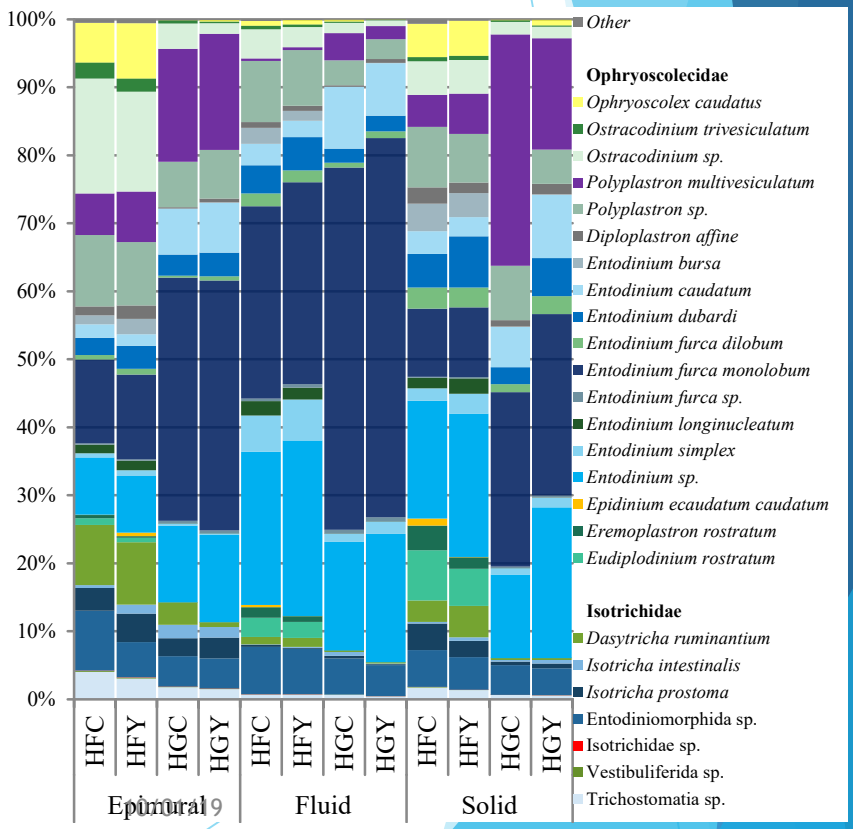


Ishaq et al. 2015

Saccharomyces cerevisiae yeast probiotic rescues cow from sub-acute ruminal acidosis

La levadura Saccharomyces cerevisiae probiótico rescata a las vacas de la acidosis ruminal subaguda

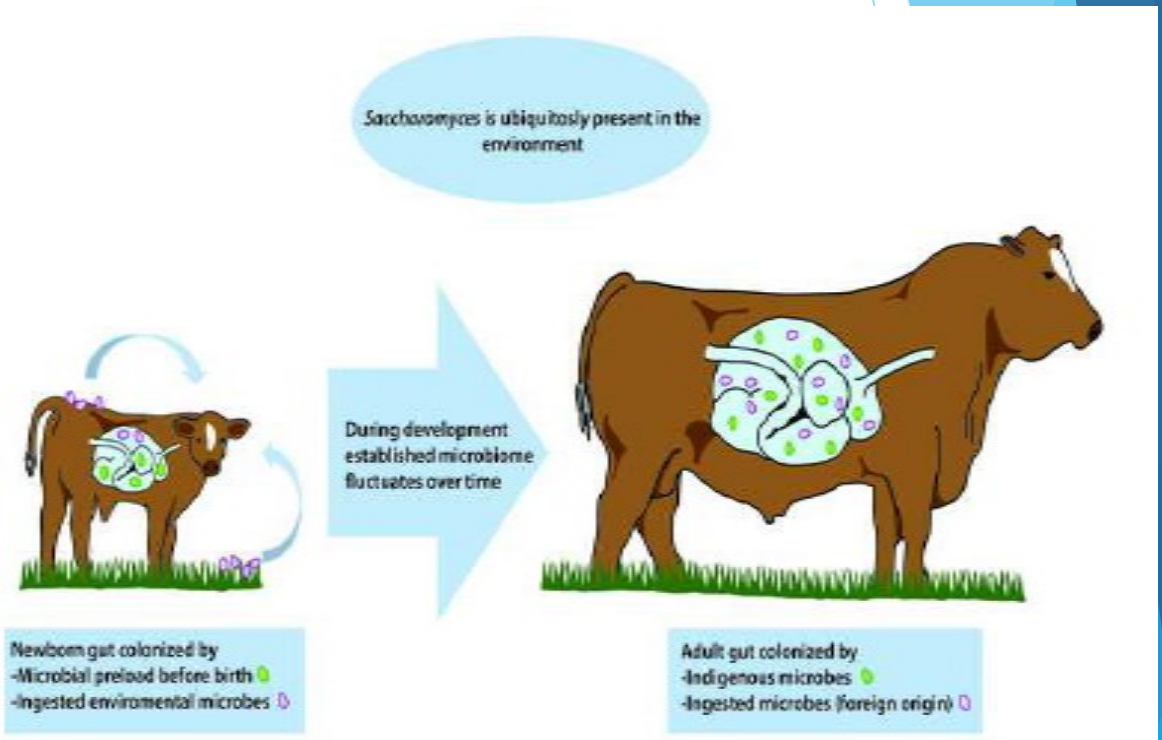
- Increases bacterial and protozoal (shown) diversity
- Aumenta la diversidad bacteriana y protozoaria (mostrada)
- Recovers some fibrolytic species
- Recupera algunas especies fibrolíticas



Ishaq et al. 2017

Is it more effective if a probiotic species is indigenous or not?
¿Es más efectivo si una especie probiótica es indígena o no?

- Does *Saccharomyces cerevisiae* probiotic succeed because you are **repopulating** or **replacing**?
- ¿El probiótico Saccharomyces cerevisiae tiene éxito porque está repoblando o reemplazando?

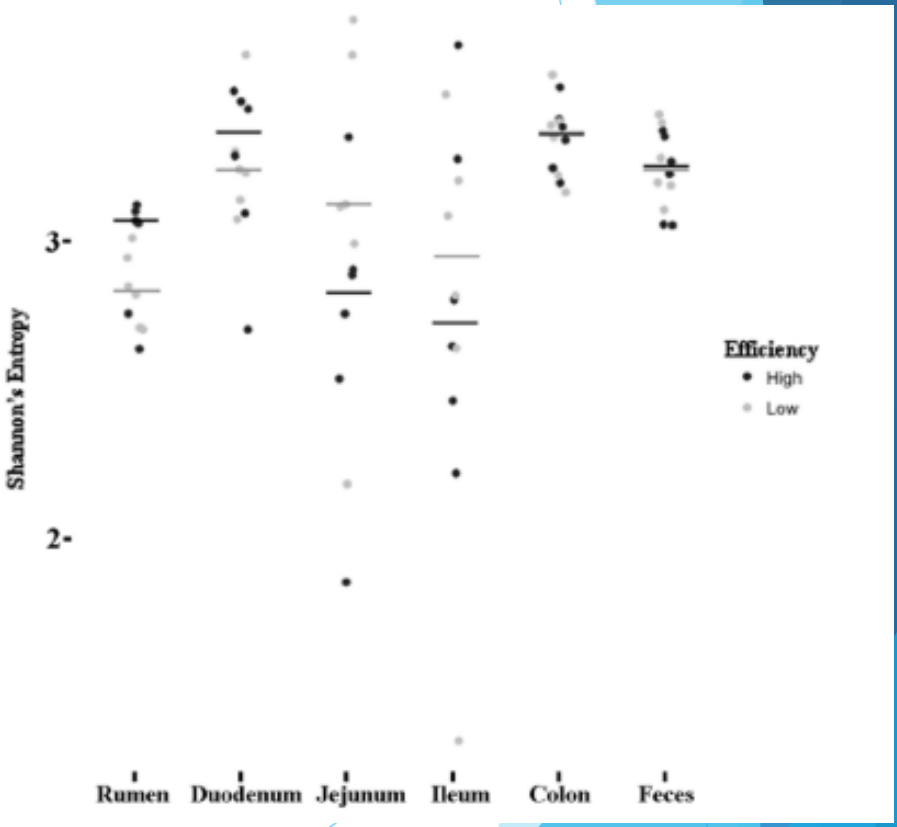


Garcia-Mazcorro et al. 2019

Feed efficiency associated with GI bacterial communities

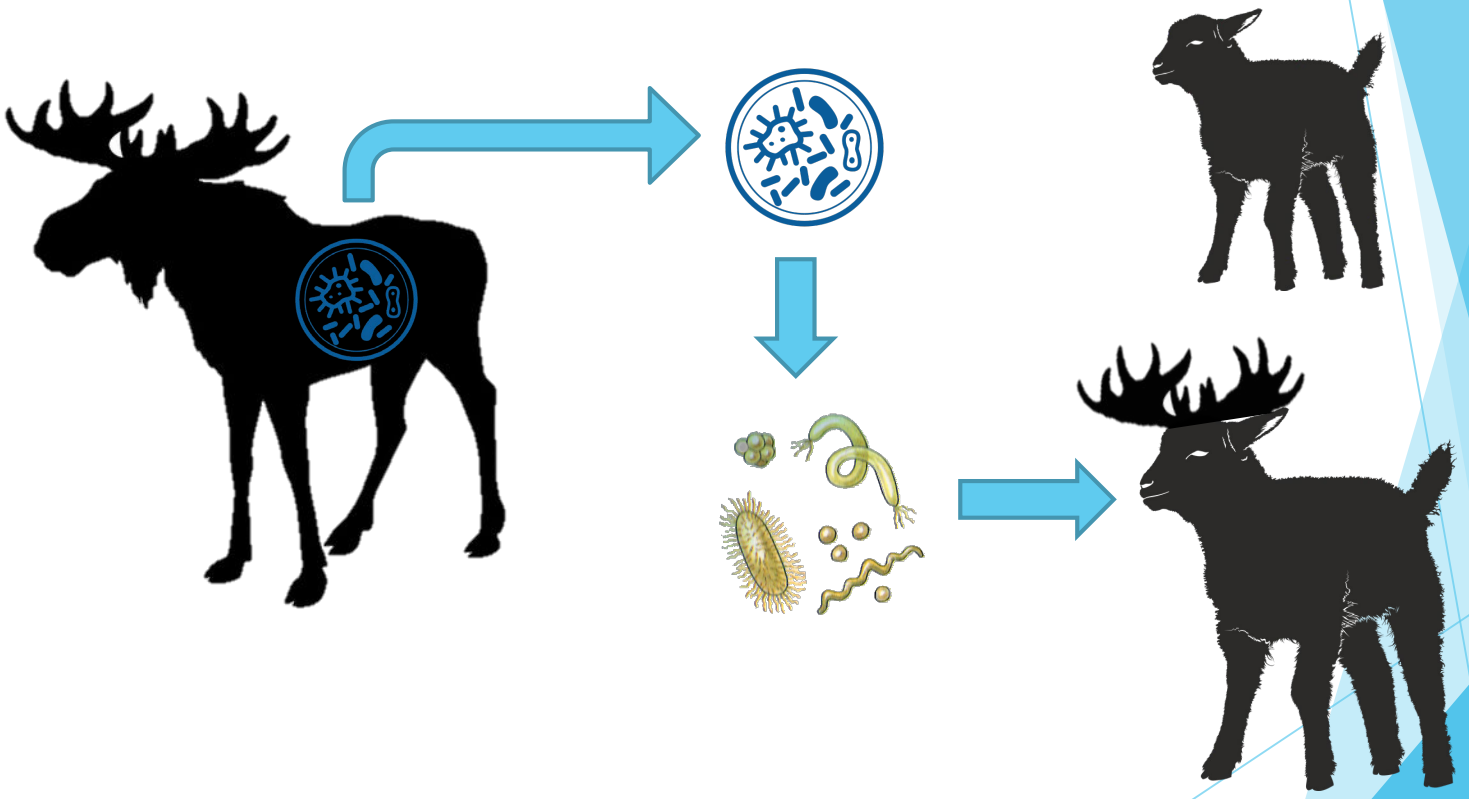
Eficiencia alimentaria asociada con comunidades bacterianas gastrointestinales

- Higher bacterial diversity in rumen and duodenum
- Mayor diversidad bacteriana en rumen duodeno
- Lower bacterial diversity in jejunum ar ileum
- Baja diversidad bacteriana en yeyuno e íleon



Perea et al. 2017

Moose probiotics



Bacterial probiotic lambs weighted same, cost less to produce

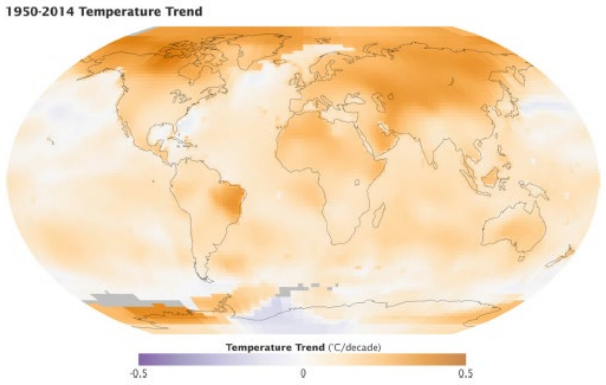
Los corderos probióticos bacterianos pesan lo mismo, cuestan menos producir

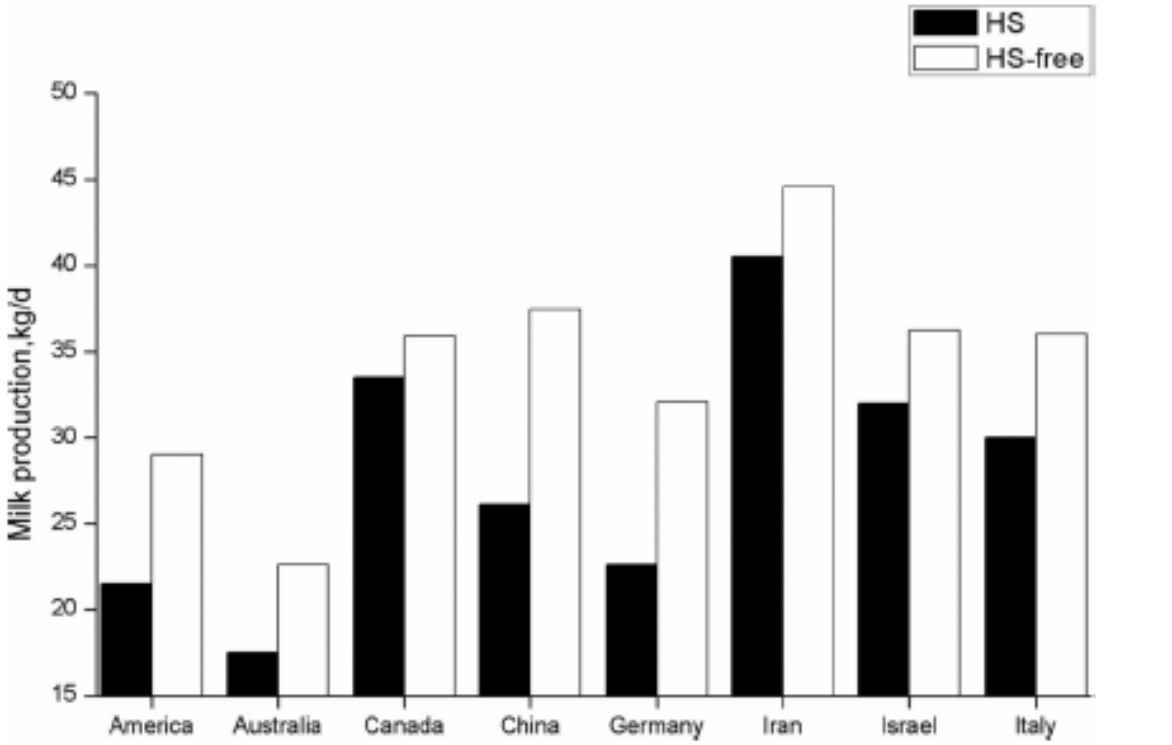
	Probiotic	**Control**
Total feed cost	**$1,564.63**	$1,592.17
Group market weight (6 mo)	257.25 kg	256.95 kg
Cost to produce $USD	**$6.08 / kg lamb**	$6.19 / kg lamb

Ishaq et al. 2015

Can we use microbes to manage temperature stress?
¿Podemos usar microbios para controlar el estrés por temperatura?

Heat stress negatively impacts livestock
El estrés por calor afecta negativamente al ganado





National Aeronautics and Space Administration (NASA) 2015

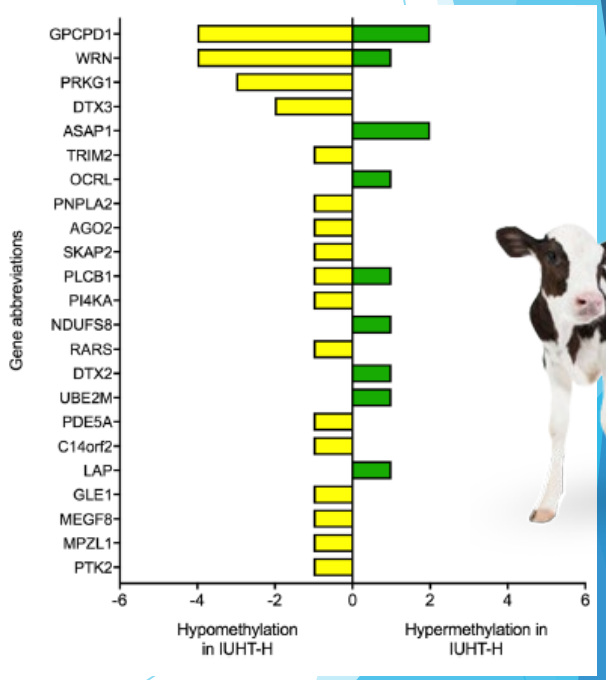
Min et al. 2017

Heat stress *in utero* alters gene expression in calves

El estrés por calor en el útero altera la expresión génica en terneros

- >1,500 CpG sites differently methylated in calves heat-stressed while *in utero*
- >1,500 CpG sitios metilados de manera diferente en terneros estresados por calor mientras están en el útero

- Associated with ~400 genes
  - … innate immune defense…
- Asociado con ~ 400 genes
  - …defensa inmune innata…

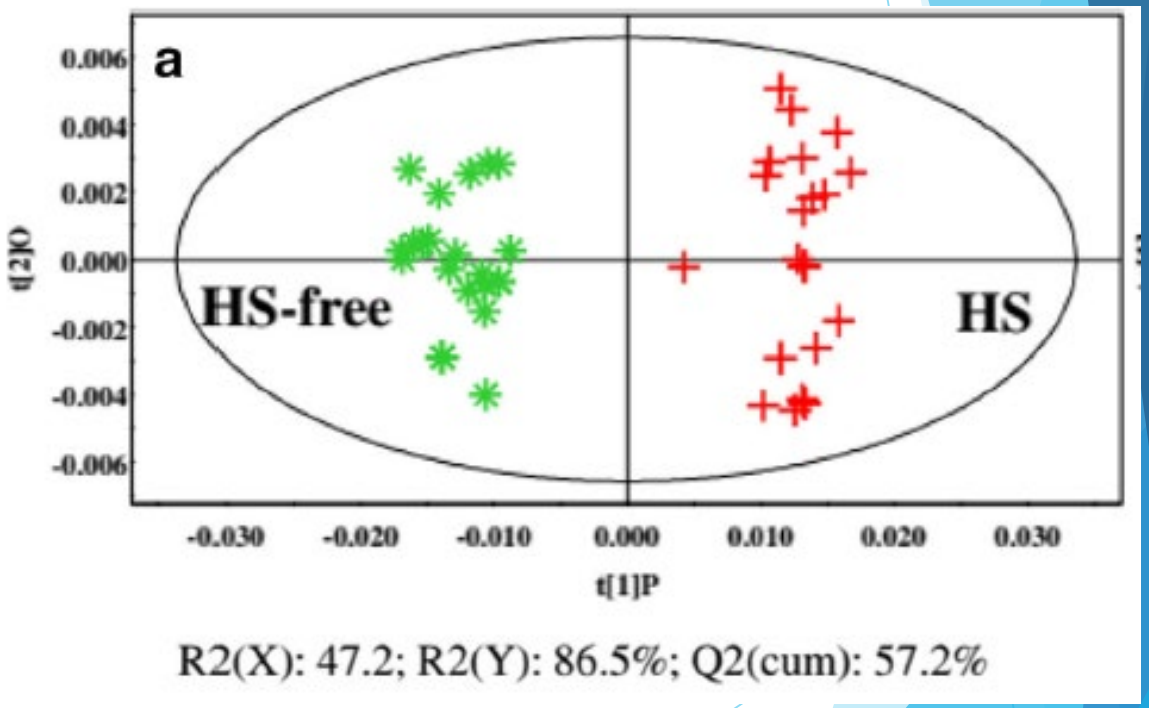


Skibel et al. 2018

Heat stress (HS) alters gut microbiome and derived metabolites

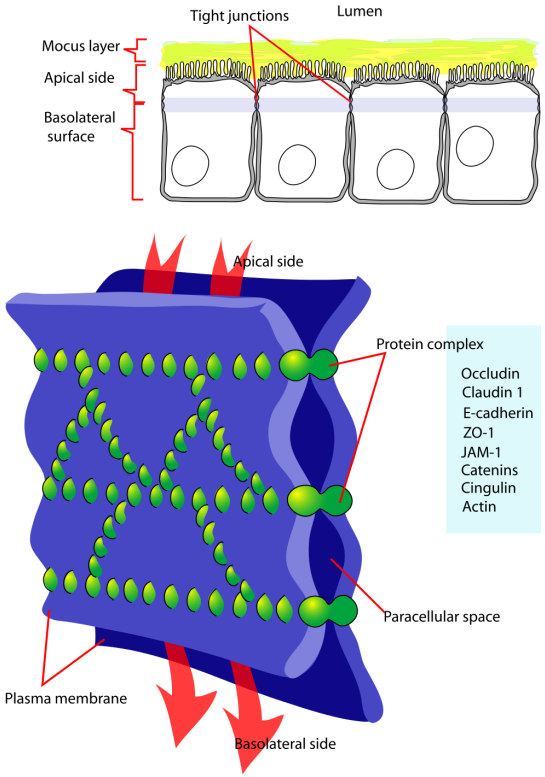
El estrés por calor (HS) altera el microbioma intestinal y los metabolitos derivados

- Repercussions for feed efficiency
- Repercusiones para la eficiencia alimenticia

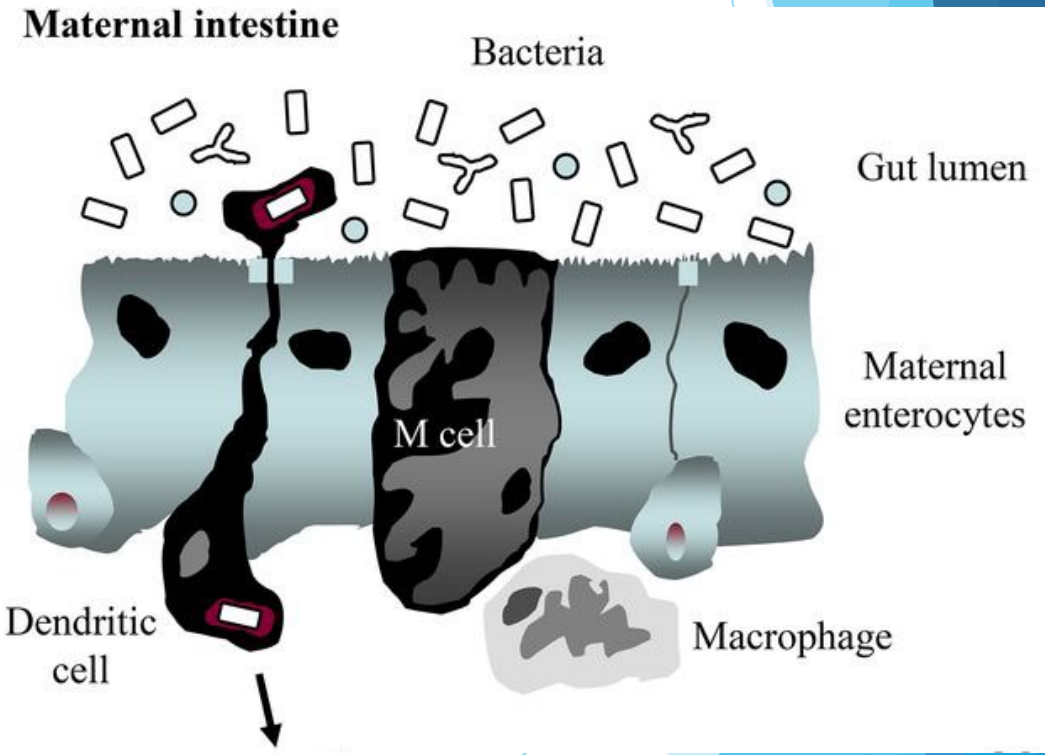


Tian et al. 2015

Heat stress in cattle causes ‘leaky gut’
El estrés por calor en el ganado causa "intestino permeable"



Claudin, wikipedia



Rodriguez, 2014

Can we use microbes to manage heat stress?
¿Podemos usar microbios para controlar el estrés por calor?

- Bacterial probiotics reduce heat stress in laying hens
- Los probióticos bacterianos reducen el estrés por calor en gallinas ponedoras

Parameter		
	H	H + P_M
Egg production rate, %	80.70 ± 0.03^{B}	83.92 ± 0.03^{A}
Average daily feed intake, g	88.10 ± 6.25^{Bb}	93.64 ± 8.56^{Ba}
Average egg weight, g	52.18 ± 2.62^{Bb}	53.90 ± 1.07^{Ba}
Feed-egg ratio, %	2.09 ± 0.17	2.05 ± 0.23
Broken egg ratio, %	0.40	0.21
Mortality, %	2.30	1.00

Lhwf.co.uk

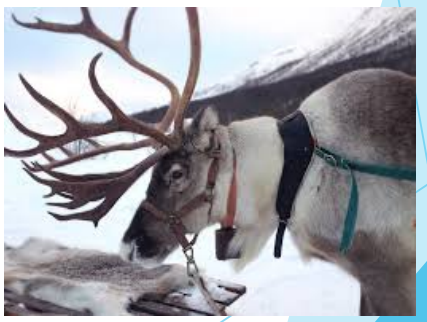
Zhang et al. 2017

Can we use microbes to manage cold stress?
¿Podemos usar microbios para controlar el estrés por frío?

- Plant secondary compounds increases rumen temperature
- Los compuestos secundarios de la planta aumentan la temperatura del rumen

Dearing Lab, Colorado

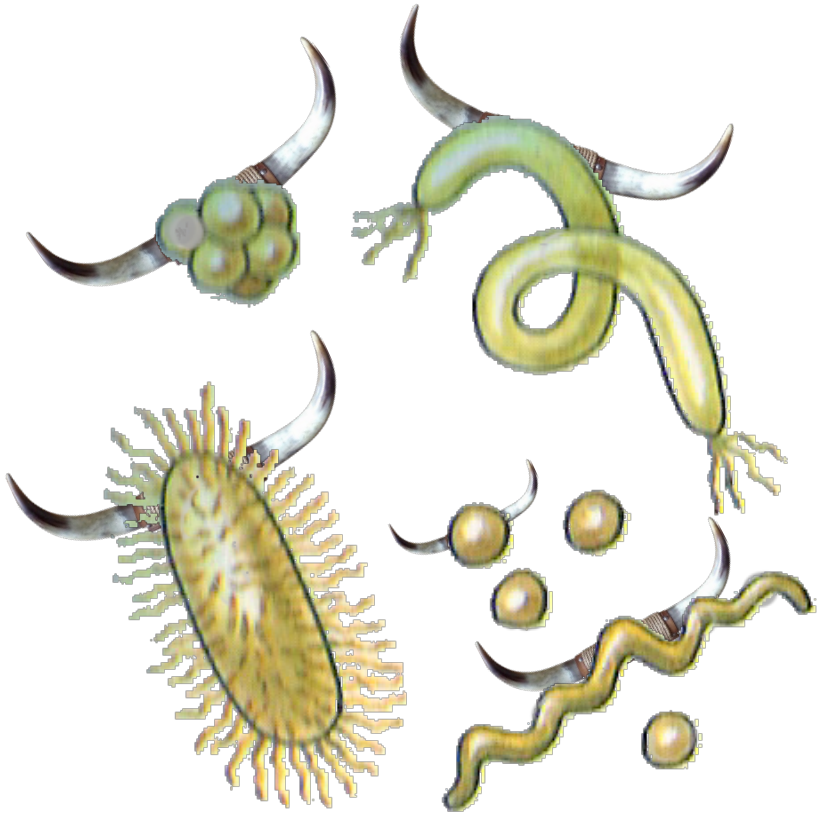
- Certain microbes specialized in detoxification
- Ciertos microbios especializados en desintoxicación



Sundset Lab, Tromsø

Feed the microbes, feed the cow
Alimenta a los microbios, alimenta a la vaca

Feed the microbes, feed the cow
Alimenta a los microbios, alimenta a la vaca



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