

Exploitation of animal microbiomes for veterinary applications

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Animal Microbiome Webinar: September 14th 2023



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Overview

- ✓ Animals (Livestock)
- ✓ Microbiomes
- ✓ Microbiome derived compounds
- ✓ Exploitation for Veterinary applications
 - Case studies

Animals (Livestock)

Livestock are domesticated terrestrial animals that are raised to provide a diverse array of goods and services such as traction, meat, milk, eggs, hides, fibres and feathers.



A third of all proteins consumed by people comes from animal food sources.

For many people, animals including livestock are synonymous to living, livelihood and wellbeing

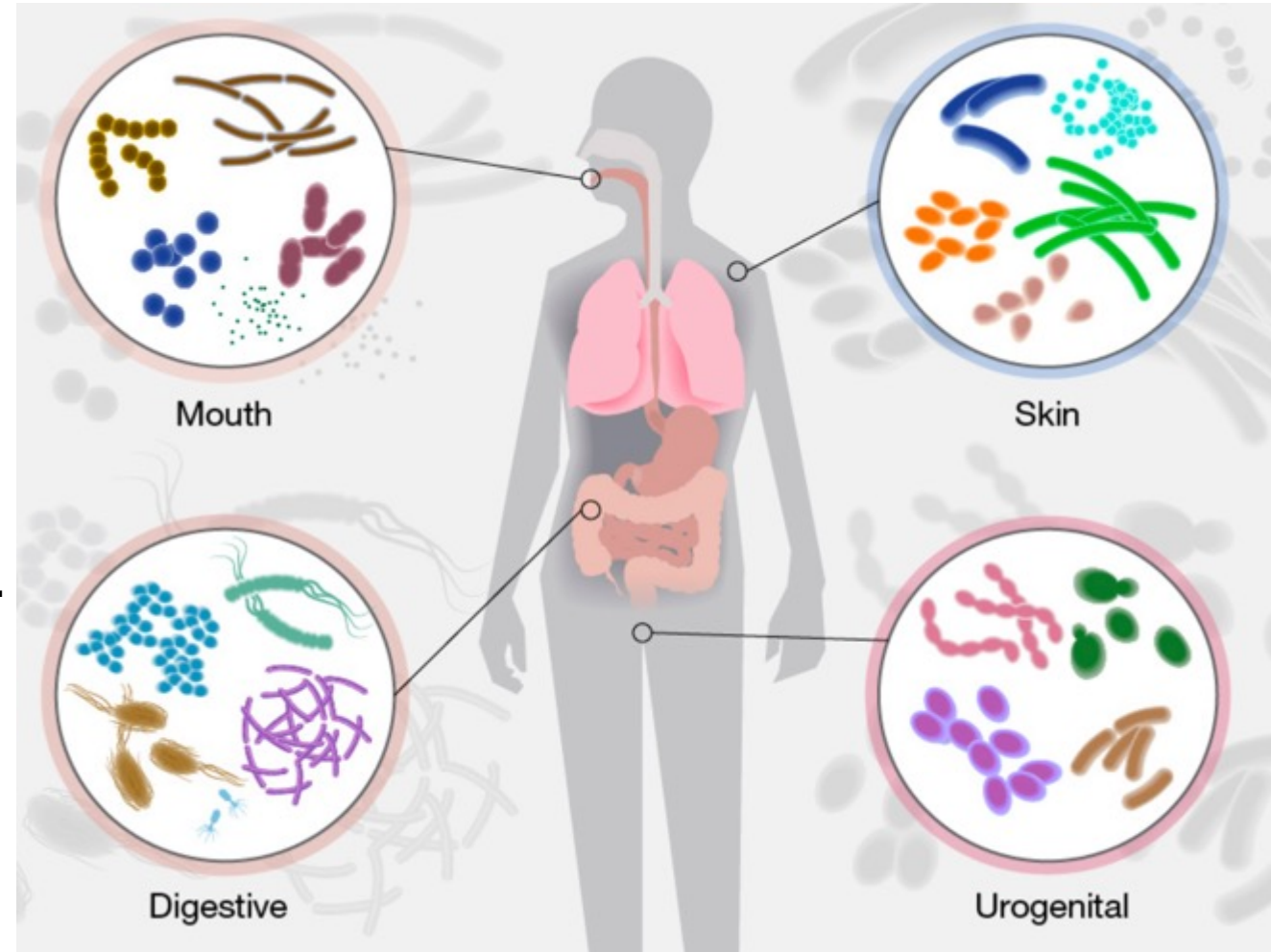


Microbiome

“Microbiome” is a combination of the words “micro” and “biome”, meaning a “characteristic microbial community” in a “reasonably well-defined habitat which has distinct physio-chemical properties” as their “theatre of activity”

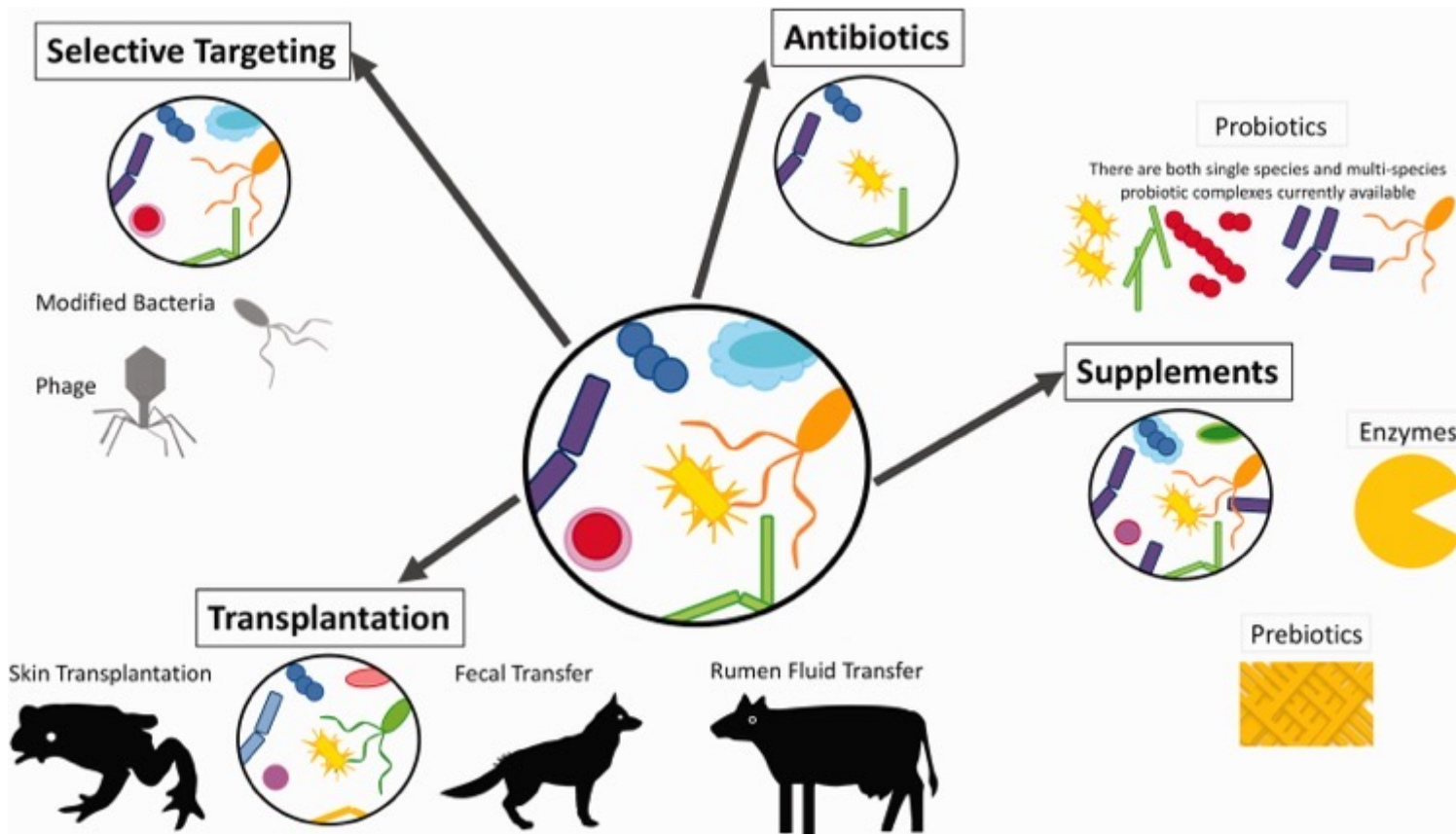
The microbiome is the community of microorganisms (such as fungi, bacteria, archaea, viruses and) that exists in a particular environment.

It is often used to describe the microorganisms that live in or on a particular part of the body, such as the skin or gastrointestinal tract.



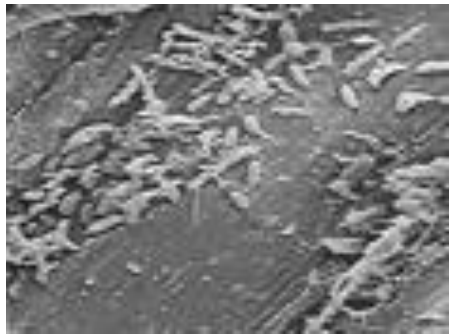
Microbiome

These groups of microorganisms are dynamic and change in response to a host of environmental factors, such as exercise, diet, medication and other exposures.

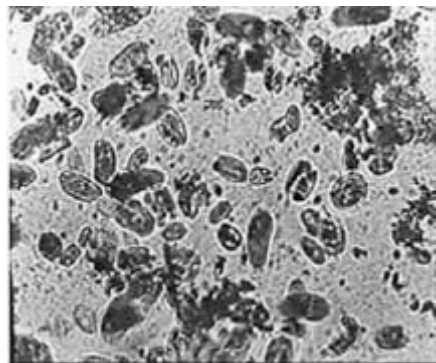


Animal gut: A case study of microbiome exploitation

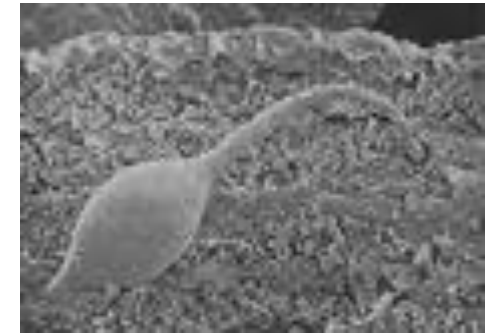
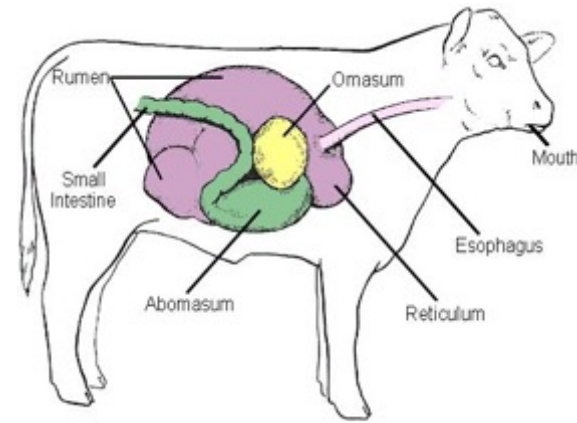
Animal microbiomes offer a wealth of bioactive compounds for veterinary applications



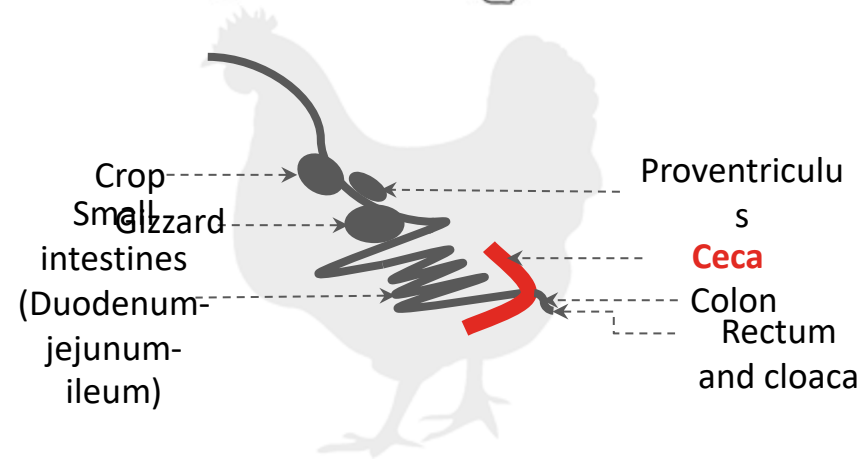
Bacteria: 10^9 - 10^{10} /mL



Protozoa: 10^4 - 10^6 /mL



Fungi: 10^3 - 10^4 /mL



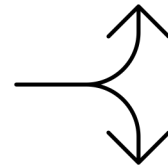
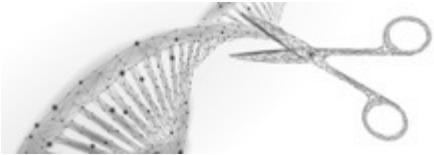
Archaea (methanogens)
 $\sim 10^4$ /mL

The rumen microbiome in action



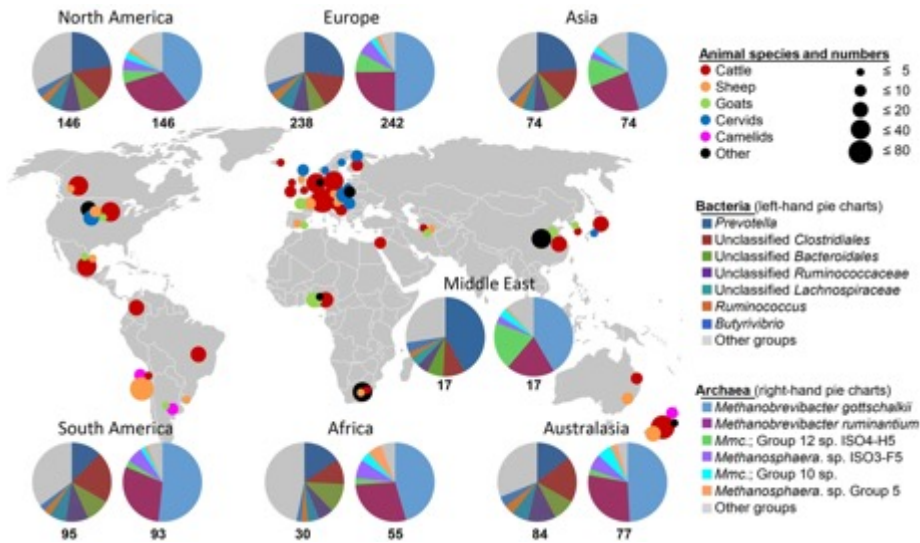
Enabling technologies for microbiome exploitation

Genomic Technologies



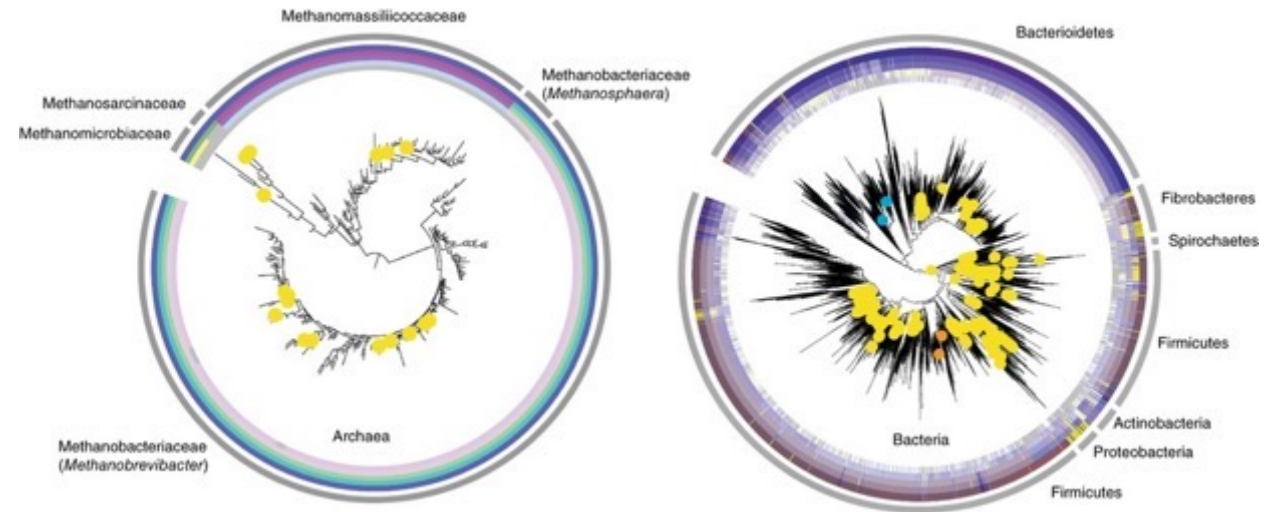
Understand the microbiome community: who is there?

Understand the microbiome function: what do they do?



Global Rumen Census samples

Henderson et al 2015 *Sci Rep* 5, 14567
<https://doi.org/10.1038/srep14567>



Hungate Collection: 410 bacteria and archaeal genomes sequenced

Seshadri et al. 2018. *Nat Biotechnol.* 36(4):359-367. doi: 10.1038/nbt.4110.

Animal Microbiome derived antimicrobials

Treating infections, particularly those from multi-drug resistant bacteria increasingly challenging.



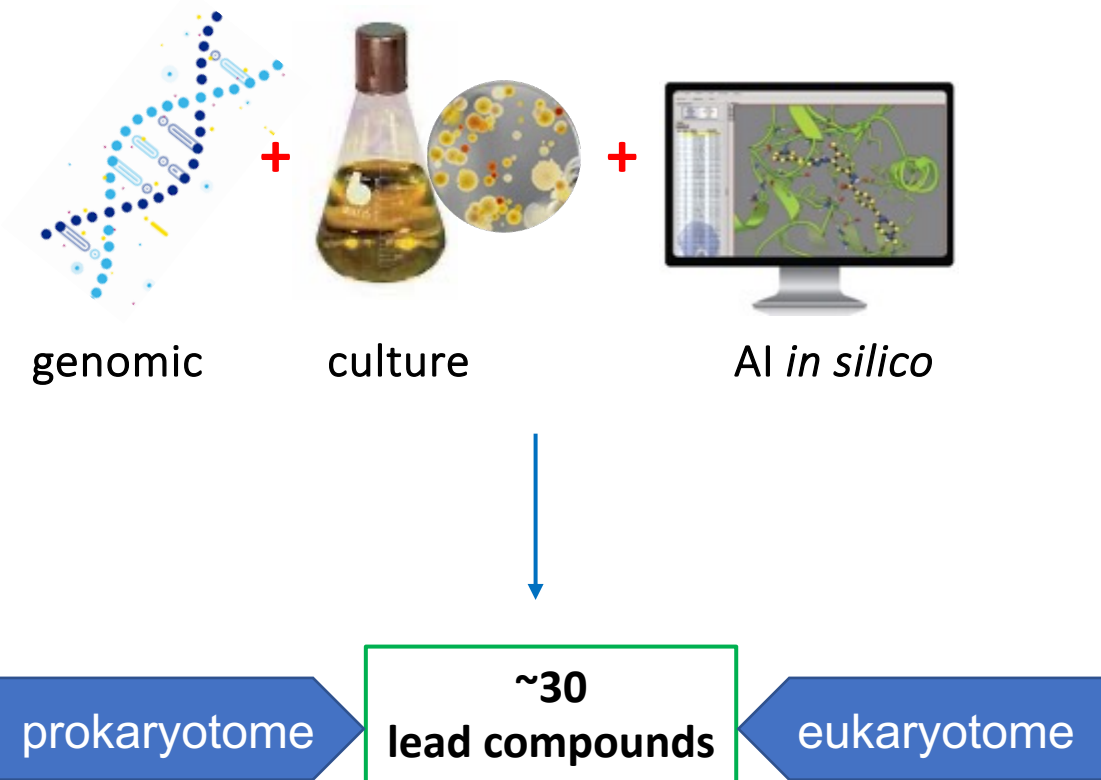
‘there are few public health issues of greater importance than antimicrobial resistance (AMR) in terms of impact on society’

Novel source for alternative solutions?

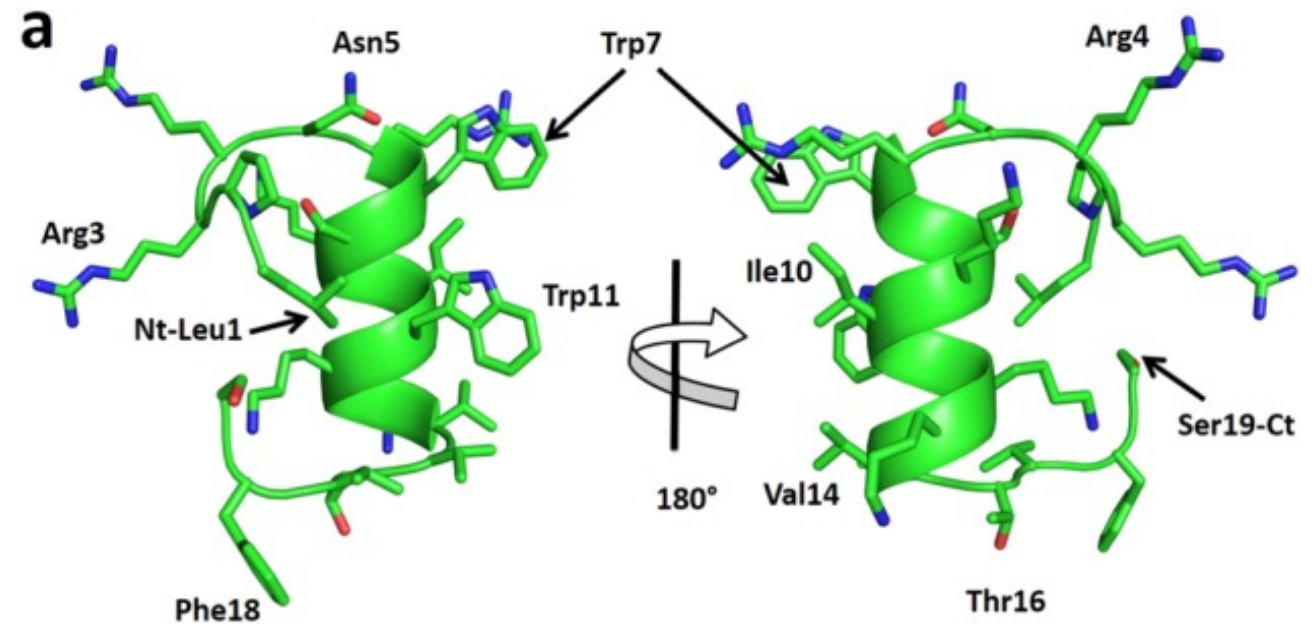
The ‘UK Five Year Antimicrobial Resistance (AMR) Strategy’, developed by BBSRC, Veterinary Medicines Directorate (VMD) of the Department for Environment, Food and Rural Affairs (Defra), the Northern Ireland Executive, the Scottish government, the Welsh Government and the UK Public Health agencies

Exploiting animal microbiomes: Novel antimicrobials

Several antimicrobial peptides



UK Patent number: **GB1621737.4**



[Oyama, et al. \(2022\). npj Biofilms Microbiomes 8, 58.](#)

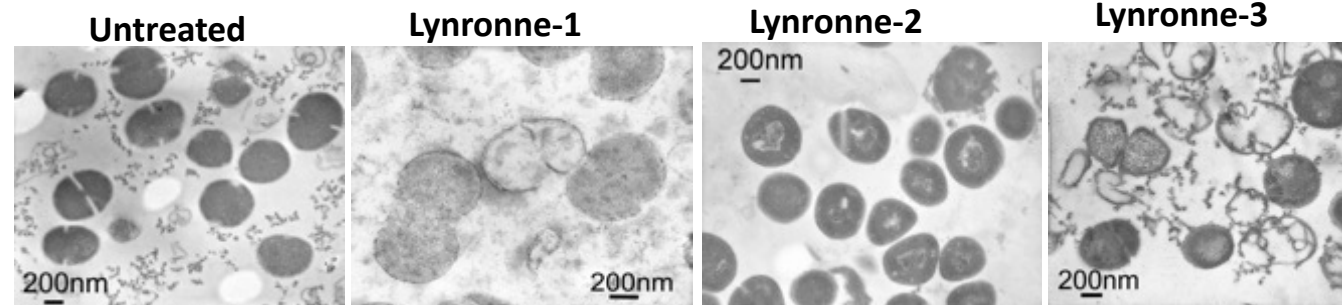
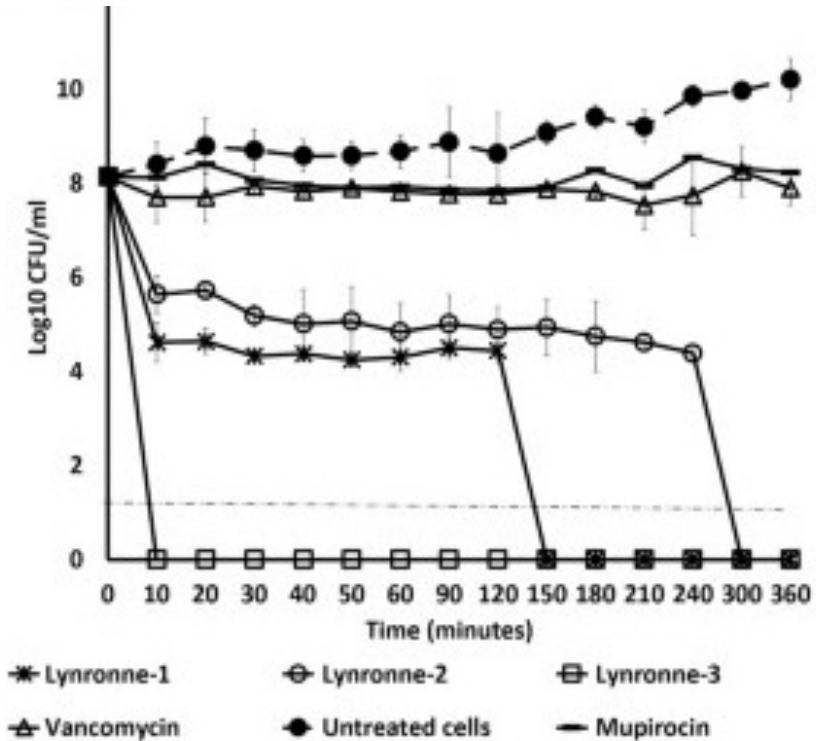
[Oyama, L.B., et al \(2017\). npj Biofilms Microbiomes 3, 33 \(2017\).](#)

[Onime, L.A., Oyama, L.B., et al \(2021\). BMC Microbiol 21, 105 \(2021\).](#)

[Mulkern, A.J., Oyama, et al \(2022\). npj Biofilms Microbiomes 8, 70 \(2022\).](#)

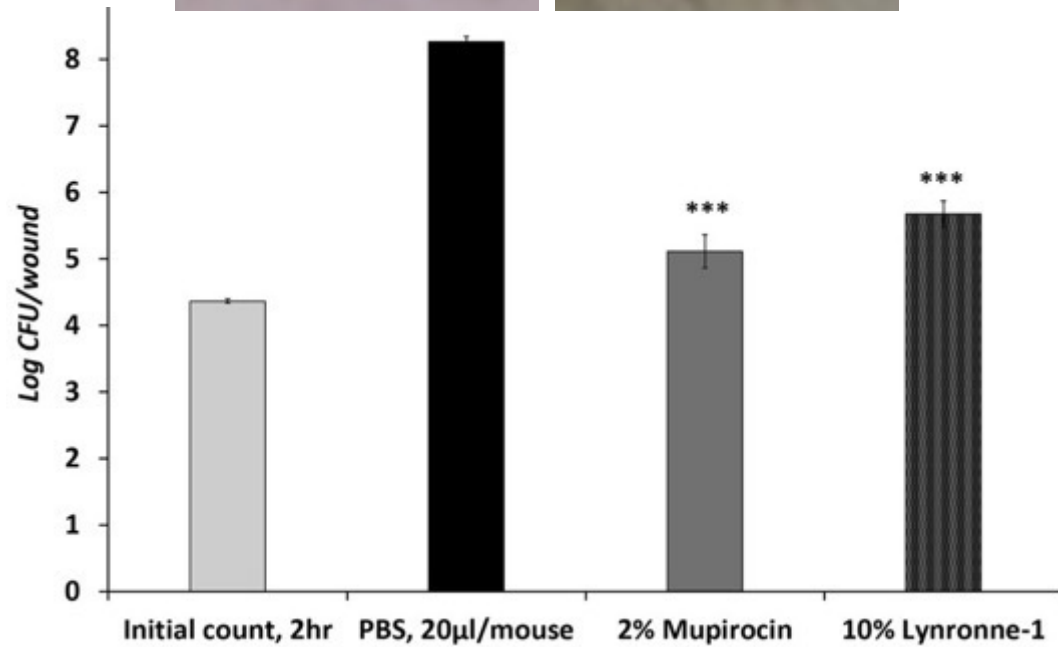
Exploiting animal microbiomes: Novel antimicrobials

- ✓ Short AA AMPs – low cost
- ✓ Low MICs against a range of pathogenic bacteria
- ✓ Rapid bactericidal killing
- ✓ Anti-biofilm activity
- ✓ Minimal cytotoxicity against mammalian cell lines
- ✓ Multimodal target/mechanism of action
- ✓ No detectable resistance
- ✓ Excellent templates for the design of novel veterinary therapies
- ✓ Further opportunities for modifications and positive improvements



Exploiting animal microbiomes

Murine model of MRSA wound infection



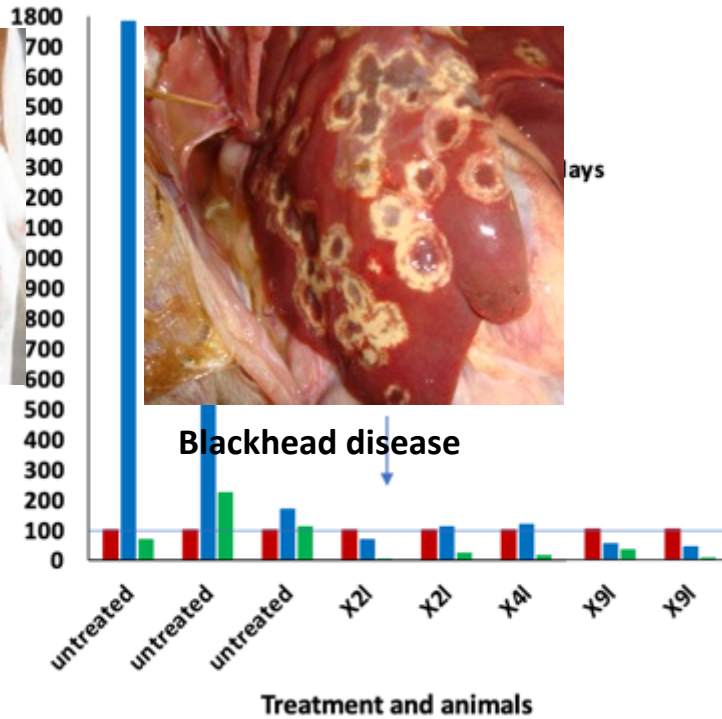
Veterinary applications

Exploiting animal microbiomes

Livestock and poultry production



Mastitis



Feed additive

Immunomodulants

Anti-inflammatives

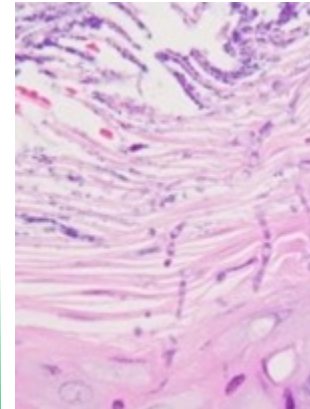
Veterinary medicine

Bacteraemia

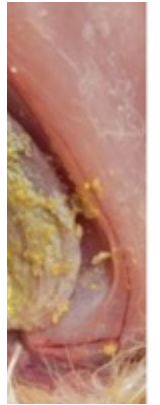
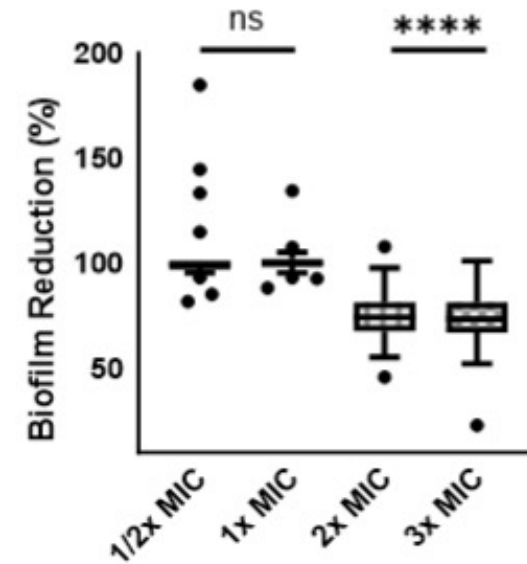
Mycoses

Probiotics

Cecacin_56 Biofilm prevention



Esophageal candid
By Rosalie Ierardi



Turkey

Conclusion

Animal microbiomes are complex but offer an abundance of explorative research outcomes crucial for veterinary applications



Partner with us



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