Schenk Lab

Separovic Research Group
NMR and Membrane Biophysics

Gordon Lab

UQ-Plant-Microbe Interactions Group	NMR and Membrane Biophysics Lab	Population biology of micro-organisms Lab

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Discovery of new antimicrobial peptides from environmental samples

Overuse and misuse of conventional antibiotics has become one of the greatest challenges in human health; on the other hand, the rapid spread of antibiotic resistant pathogens is a major threat to our life and environment. It is clear that the broad-spectrum activity of traditional antibiotics has played a key role in the selection for resistance. Antimicrobial peptides provide us with a compelling alternative to antibiotics.

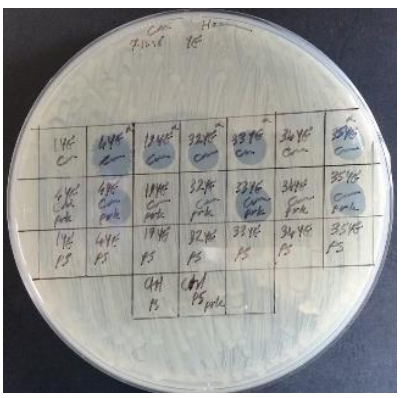
In response to ecological stress, many microorganisms produce natural products to interact with other organisms. Interestingly, our results show that many microorganisms only produce AMPs under stimulation. We have optimised and developed **a high throughput method** for screening many microbial isolates and also a method for inducing AMP biosynthesis.

Overall Aim

✓ Screening of various environmental microbiomes (e.g. soil, seawater, wastewater, plant and insect microbiomes) to discover new antimicrobial peptides (AMPs) and bacteriocins

✓ To use this knowledge to develop a new treatment for superbugs causing human disease and losses in the agriculture and food industries

After initial high throughput screening and stimulation of isolcates, we rapidly test the potential candidates for AMP production by directly incubating peptide profiles of each oranisms with pathogens. This enables immediate identification of the AMPs involved and allows us to verify whether known or new AMPs have been produced. After that the activity spectrum and structure for each new AMP is thoroughly investigated to elucidate the mode of action. The focus of this proposal is to explore antimicrobial peptides (AMPs), especially bacteriocins in the environment.



We have recently identified >20 microbial isolates from soil and food spoilage which produce antimicrobial peptides against plant and food pathogens.

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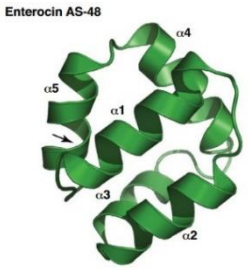


The discovery of new AMPs from microorganisms has recently been flagged as one of the most promising approaches to develop new antibiotics. Our initial studies have demonstrated that environmental samples from various soils, seawater, wastewater, food spoilage and even insectile sources are among the most promising sources for finding new antimicrobial peptides. We are well equipped and have the collective expertise to rapidly identify and develop new AMPs from environmental microbiomes. However, we wish to collaborate with interested parties to take the next steps towards the development of new antibiotics

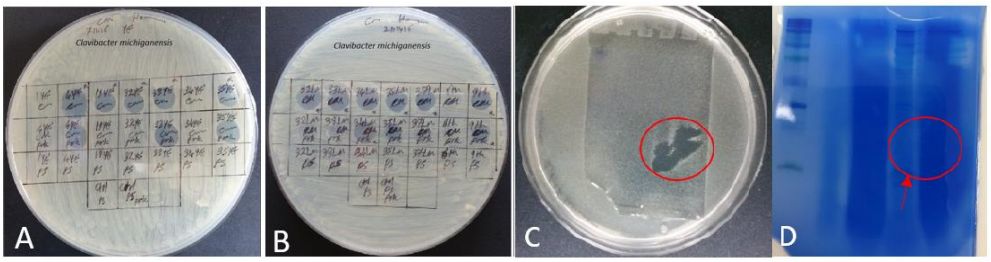
Our team specialises in the following emerging management strategies:

- ✓ **COLLECTING AND SCREENING OF MICROBIAL COMMUNITIES FROM DIFFERENT ENVIRONMENTS.**
  (To do this: Recently we developed a wide range of new cultivation media)
- ✓ **BIODISCOVERY OF ISOLATES PRODUCING NEW ANTIMICROBIAL COMPOUNDS.**
  (To achieve this: High throughput screening method to rapidly identify AMP-producing strains)
- ✓ **A NEW METHOD TO INDUCE BENEFICIAL ISOLATES FOR ANTIMICROBIAL COMPOUNDS PRODUCTION.**
  (To do this: We have developed a new method for inducing AMP and secondary metabolite biosynthesis)
- ✓ **IDENTIFICATION OF NEW BIOACTIVE NATURAL PEPTIDES TO INHIBIT PLANT OR FOOD PATHOGENS.**
  (Focus: Control of plant pathogens *Pseudomonas* and *Clavibacter* and food pathogens *Listeria* and *E. coli*).
- ✓ **PEPTIDE PROFILING AND STRUCTURE ELUCIDATION OF NEW ANTIMICROBIAL PEPTIDES OR COMPOUNDS.**
  (Gel electrophoresis, In situ activity assays, HPLC, MALDI)
- ✓ **INITIAL TRIAL AGAINST HUMAN PATHOGENS, USE AS FOOD PRESERVATIVES AND BIOPESTICIDES.**
  (Collaboration of research teams with industry)

EXAMPLES

High throughput screening against pathogens

Finding and identification of antimicrobial peptides or compounds



Testing antimicrobial peptide (AMP) activity. **(A and B)** *Clavibacter michiganensis*. Identification of antimicrobial peptides with and without proteinase K from different isolates **(C)** Inhibition assay using electrophoresis gel with *Listeria monocytogenes* **(D)** confirmation of AMP using half of the gel for sequencing.

For recent references see: http://www.schenklab.com/publications/
http://biology.anu.edu.au/research/labs/gordon-lab-population-biology-micro-organisms
http://separovic.chemistry.unimelb.edu.au/