

The Australian Society for Microbiology



bringing Microbiologists together

NSW-ACT Branch

Syntrophy

Volume 21 Issue 2 2020

From the editor

By Jim Manos

Greetings to everyone from the bunker!

It is my fervent hope that you are all safe and well, and that you are not too restricted in your ability to live and work. COVID-19 has caused a worldwide retreat from daily routines, but as microbiologists we expected that. We as part of the global microbiology community are however in a prime position to help conquer this virus, and it is so encouraging to see the efforts underway to develop a vaccine, to re-purpose or develop a useful antiviral treatment, and the work to understand how COVID-19 causes vascular disease. We are now in the spotlight as far as the general public is concerned!

Before the COVID-19 crisis broke out in Australia, we had our 6th annual and very successful one-day Molecular Micro meeting (Sydney Micro) organised once again by the very capable Chris Harmer. 106 people from around NSW came along on January 31st (the highest attendance ever!) to listen to ECRs and PhD students give excellent presentations, with any of them easily qualifying as a symposium talk at the National Meeting. Professor Kat Holt (Monash University) and Dr Amy Cain (Macquarie University) were our two invited lab heads, and they gave all attendees an exciting glimpse into the world of bacterial genomics.

Your ASM branch, as with all organisations, has been impacted in not being able to have face-to-face meetings and functions. We have had our most recent committee meeting (April 23) using Zoom; and have adapted to the times with online meetings such as the COVID-19 seminar by Dr Matthew O'Sullivan on March 24 (Tim Newsome has written an account for *Syntrophy* below). The success of this live-streamed event has encouraged us all to plan more seminars live-streamed to members. Stay tuned for one by Professor Eddie Holmes in the near future.

In this issue we also have an article by Scott Mitchell from Nick Coleman's lab on *The equine hindgut as a reservoir of integrons and antimicrobial resistance* looking at the important area of animal reservoirs and sources of resistance genes within them. Scott examined gene reservoirs in wild and domesticated horses.

Don't forget to check out the poster by Peter White and Emma Harding demonstrating important COVID-19 tips for the elderly on page 5; so very timely to have this information for our older generations.

The next few months will continue to present challenges, however the NSW branch will be working to bring you relevant online seminars when possible, so that branch activity is maintained. We are also open to suggestions for high-profile microbiologists who would like to present online seminars.

Contact Details

ASM National Office

9/397 Smith Street
Fitzroy Victoria 3065
Australia
Tel 1300 656 423
Fax 1300 655 841
www.theasm.org.au
admin@theasm.com.au

ASM NSW-ACT State Branch

www.asmnsw.com.au

ASM NSW-ACT Branch Chair

Jim Manos
Tel +61 2 93518942
jim.manos@sydney.edu.au

ASM NSW-ACT Branch Secretary

Tim Newsome
Tel +61 2 93512907
tim.newsome@sydney.edu.au

ASM NSW-ACT Branch Treasurer

Christopher Harmer
Tel +61 2 93516028
christopher.harmer@sydney.edu.au

Syntrophy is distributed via email to ASM members located in NSW and the ACT using details included on the ASM National Office Database.

Not yet a member? Join today!

www.theasm.org.au/membership

Submissions and enquiries can be directed to the Syntrophy Coordinator via the ASM NSW-ACT Branch Secretary.

Organisations with research opportunities, or companies seeking to fill positions are welcome to place an advertisement in an upcoming issue of Syntrophy. Please contact the Syntrophy Coordinator with your details for inclusion.

Focus Article

The equine hindgut as a reservoir of integrons and antimicrobial resistance

Scott Mitchell¹, Michelle Bull², Belinda Chapman², Gary Muscatello¹, Nicholas Coleman¹

¹ School of Life and Environmental Sciences, University of Sydney

² Quantal Bioscience Pty. Ltd.

Antibiotic resistance in bacterial pathogens is a growing problem for both human and veterinary medicine. Mobile genetic elements (MGEs) such as plasmids, transposons and integrons drive the spread of antibiotic resistance genes (ARGs) among bacteria, in combination with the misuse and overuse of antibiotics, which provides the selection pressure for resistance genes to establish and persist in bacterial populations. Because bacteria, MGEs and resistance genes can readily spread between different ecological compartments (e.g. soil, plants, animals, humans, wastewater), a 'One Health' approach is needed to combat the problem of resistance; i.e. we need to investigate antibiotic usage and resistance genes in many contexts, not just that of human pathogens¹.

Some animal production systems (e.g. piggeries and slaughterhouses) are already known to be important reservoirs and sources of resistance genes², but other animal types and facilities are less well studied. In our research, we have focused on the equine hindgut as an understudied but potentially significant reservoir of antibiotic resistance genes and MGEs. Our rationale is that horses have close contact with humans, their manure is used in agriculture and horticulture, they have a dense and complex gut microbiome of both bacteria and fungi, and they are treated with veterinary antimicrobials similar or identical to those used in human medicine. Our focus was especially on class 1 integrons, since these are notorious for capturing and expressing resistance genes³, and also have been used as markers of anthropogenic impact on bacterial communities⁴.

We examined the frequency and types of antibiotic resistance, ARGs, and class 1 integrons in domestic and wild horses, via plating of faecal samples onto 8 different antibiotic agars (streptomycin, kanamycin, gentamicin, ampicillin, tetracycline, trimethoprim, sulfamethoxazole, and chloramphenicol), and genetic analysis of resultant isolates (int1 PCR, 16S rDNA PCR, genome sequencing). Three groups of horses were investigated: wild brumbies [n=11], healthy farm horses [n=11], and horses receiving antimicrobials at a veterinary hospital [n=11]. Our hypothesis was that the abundance of ARGs and class 1 integrons would be greatest in horses exposed to antimicrobials, and least in horses with no human contact.

The frequency of resistance to antimicrobials varied greatly among the microflora obtained from the three equine cohorts. Most of the veterinary hospital horses (7/11) gave counts of $>1 \times 10^6$ resistant cfu/g for at least two antimicrobials and two of these horses had counts of $>1 \times 10^6$ resistant cfu/g for seven antimicrobials. By comparison, in the healthy farm horses, only one animal gave counts above this threshold, and that was for a single antimicrobial, while none of the brumbies produced counts of greater than this level for any of the antimicrobials tested. From approximately 12,000 total bacterial isolates screened, we detected class 1 integrons at frequencies of 0.05% (brumbies), 0.31% (healthy farm horses), and 9.8% (sick horses).

To date, we have identified fourteen integron-positive isolates: *Kocuria palustris*, *Arthrobacter citreus*, *Arthrobacter luteolus*, *Microbacterium esteraromaticum*, *Micrococcus terreus*, *Microbacterium aurum*, *Rhodococcus coprophilus*, *Escherichia hermannii*, *Leclercia adecarboxylata*, *Pantoea* sp., and *Pseudomonas* sp. The abundance of Actinobacteria carrying class 1 integrons in horse faecal samples was surprising, given that these MGEs are usually considered as associated with Gram-negative bacteria. Six distinct ARGs were identified in integron cassette arrays; *aadA2*, *aadA6*, *aadA9*, *dfrA1*, *dfrA5*, and *dfrA16*.

The integrons in the Actinobacteria were flanked by IS6100 elements while in the Enterobacteriaceae, the integrons were associated with IS4321. Schematics of the integron structures in the equine Actinobacteria are given in Figure 1. The presence of conserved structures (e.g. integrons embedded in IS6100-based compound transposons) across multiple species and genera is notable and suggests recent horizontal gene transfer; this is most obvious in the case of the integrons from *Microbacterium*, *Rhodococcus*, and *Kocuria* isolates.

The results confirmed the hypothesis that veterinary antimicrobial usage increased the frequency of resistant bacteria and the frequency of class 1 integrons in the equine hindgut microflora, and thus, domestic horses may be a previously overlooked reservoir of ARGs. Our results also indicate that Gram-positive bacteria are likely to play a larger role in maintaining and transferring class 1 integrons than was previously believed.

About the Author

Scott Mitchell did his undergraduate degree at UTS, majoring in microbiology, and did Honours in Steve Djordjevic's lab, studying antibiotic resistance in pathogens. He moved to Nick Coleman's lab at USyd for his PhD, to look at antibiotic resistance in the equine microbiome. Scott is very involved in science outreach, engaging school kids with microbiology in programs organised by an industry partner (Quantal Bioscience). Outside the lab, he is a keen tabletop gamer, including Warhammer and Magic the Gathering. Scott's PhD is supported by an RTP scholarship.

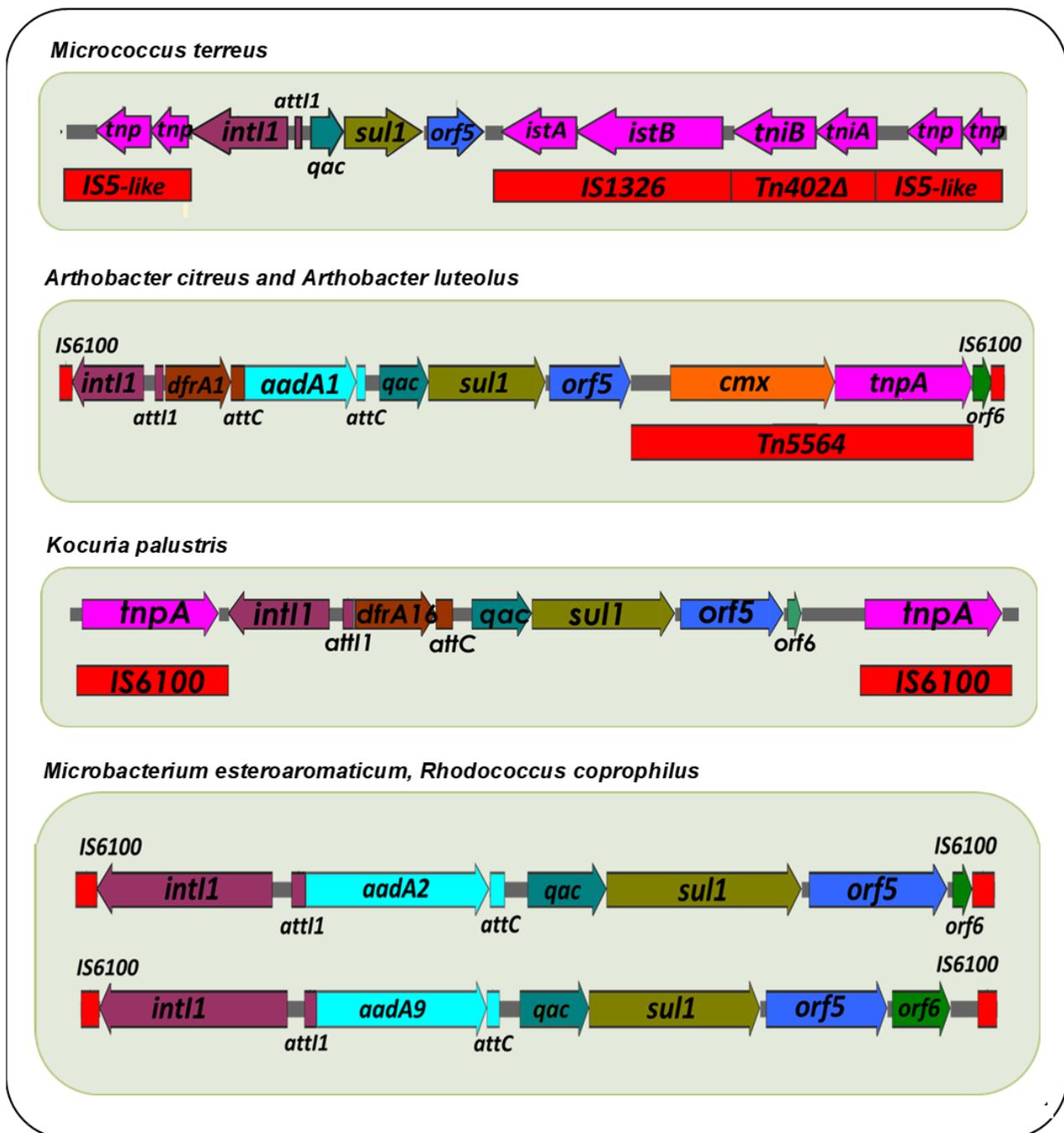


Figure 1. Comparison of integron structures in Actinobacteria isolated from equine faecal samples.

References

1. Baquero, F.; Coque, T. M.; Martinez, J. L.; Aracil-Gisbert, S.; Lanza, V. F., Gene transmission in the One Health microbiosphere and the channels of antimicrobial resistance. *Front Microbiol* 2019, 10, 2892.
2. Binh, C. T.; Heuer, H.; Kaupenjohann, M.; Smalla, K., Piggery manure used for soil fertilization is a reservoir for transferable antibiotic resistance plasmids. *FEMS Microbiol Ecol* 2008, 66, (1), 25-37.
3. Hall, R. M.; Collis, C. M., Mobile gene cassettes and integrons: capture and spread of genes by site-specific recombination. *Mol Microbiol* 1995, 15, (4), 593-600.
4. Gillings, M. R., Integrons: Past, Present, and Future. *Microbiol. and Mol.Biol. Rev.* 2014, 78, (2), 257-277.

Key dates

19th International Symposium on Staphylococci and Staphylococcal Infections

23 – 26 August 2020, Perth Western Australia, see details page 4.

Live streamed seminar

COVID-19: Diagnosis, management and control



In the new age of streamed seminars, we were fortunate to have Dr Matthew O'Sullivan, Senior Staff Specialist in Infectious Diseases and Microbiology at Westmead Hospital, deliver a fascinating update on the SARS-CoV-2 pandemic. Dr O'Sullivan has had experience as a pathologist in preparing Westmead hospital for ebolavirus containment and he was extensively involved in the testing of Australians evacuated from Wuhan to Christmas Island.

Over 280 ASM members tuned in for Dr O'Sullivan's seminar from all around Australia and were treated to a comprehensive overview on the nature of SARS-CoV-2, the virus that causes COVID-19, how the outbreak may have started in the Wuhan region of China, and how the disease presents. He described the challenges faced, and met, in the diagnosis of SRAS-CoV-2 and the development of serological assays that is ongoing, but promising. Given the unique challenges that the current pandemic presents, it was encouraging to gain an inside perspective on the collective efforts by NSW Health to mitigate the spread of this disease.

Dr O'Sullivan was generous with his time and was able to address many questions posed to him by the online audience. We are very grateful for Dr O'Sullivan for delivering such an engaging talk and also to everyone who tuned in.

COVID-19: Tips for the elderly

Peter White and his PhD student Emma Harding have contributed a flyer on COVID-19 for Syntrophy this month, see page 5.

Biography

Peter White is a Professor in Microbiology and Molecular Biology at UNSW. His lab studies the molecular epidemiology of noroviruses and adenoviruses, viral discovery and is working towards developing antiviral agents against RNA viruses, including emerging viral pathogens like SARS-CoV-2, Zika and SARS. Emma Harding is a PhD candidate in the White lab studying novel viruses in marsupials and viral polymerase inhibitors.

Statement from Peter and Emma:

We put this flyer together because our older friends and family members said there was too much information and they were confused. We then took all the best information and put it together. Mum and Dad nagged us for years about washing our hands when we were kids, now it's our turn! Please pass this flyer around, keep safe. Let's protect our oldies.

<https://isssi2020.org/>

Dear Colleagues,

It is a pleasure to invite you to participate in the **19th International Symposium on Staphylococci and Staphylococcal Infections**, which will be held on **23 – 26 August 2020 in Perth, Australia**.



ISSSI 2020 will cover many interdisciplinary subjects regarding staphylococci and staphylococcal infections. Sessions will be presented by the world's leading experts in each of the research fields. Oral and poster sessions will be an integral part of the program as well, and all delegates are invited to submit abstracts. To promote discussion and interaction between delegates and the invited speakers, the meeting's registration includes the welcome reception, lunches, morning and afternoon teas and admission to the ISSSI Dinner.

ISSSI 2020 will be held at the Perth Convention and Exhibition Centre located in the heart of the city. World class public transport, hotels and internationally acclaimed bars and restaurants are all within walking distance from the Centre. The Perth international and domestic airport terminals are only a short transit to the city and are serviced by numerous daily direct flights from Asia and Europe.

We are confident that you will find the symposium's programme both scientifically stimulating and informative and we look forward to meeting you in Perth.

Kind regards from the ISSSI 2020 Organising Committee.

COVID-19: TIPS FOR THE ELDERLY

How it spreads, how to avoid it and what to do if you think you have it

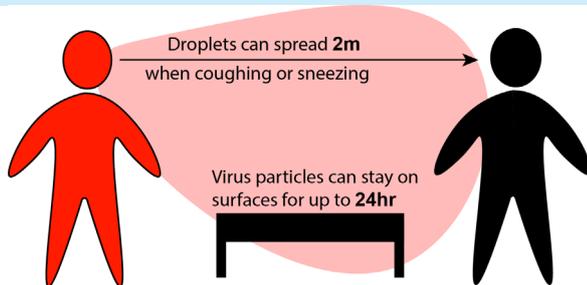
HOW DOES IT SPREAD?

The virus is typically spread in droplets when someone coughs or sneezes.

- To infect you, the virus needs to travel from the throat and lungs of the infected person to you.
- The virus can infect you if it gets into your nose, eyes, mouth, throat or lungs.
- Droplets don't remain suspended in the air for more than a minute or two.

The virus can remain on surfaces for up to 24 hours.

- Touching contaminated surfaces and then touching your face can spread the virus to you.



TIPS FOR STAYING SAFE

- Don't go out more than necessary
- Stock up on medications, toiletries and longer life foods.
- Consider buying vitamin C, D and B12 supplements, as packaged foods can be low in vitamins.
- Get things delivered and left at your door to avoid contact.
- Avoid using cash, use contactless payment instead.
- Do gentle exercises, like walking, in areas that are not crowded. This is good for immunity.
- Have people to call for help and advice.
- Don't be afraid to ask for help for things that you need.
- Have the phone numbers ready for key friends and family members.

HOW DO I PREVENT INFECTION?

STOPPING DIRECT SPREAD:

- **Remain at a distance (about 6 ft/2 m) from people.** You shouldn't get infected if you are walking around or sitting on a bench if you are at least this far away from people.
- **Stay away from anyone coughing or sneezing,** and don't get too close to people talking.
- **Stay away from crowded areas** where you are forced into close spaces with people (eg. buses, trains, lifts).

STOPPING INDIRECT SPREAD:

- **Avoid touching surfaces or shaking hands** with people.
- **Avoid touching your eyes, nose and mouth** if you have touched surfaces that other people may have contaminated.
- **Wash your hands frequently.** Soap and water (for 20 secs) or hand sanitiser will kill the virus.
- If washing hands in a public place, avoid contaminating your hands after by touching surfaces e.g. the door to the bathroom.



Wash or sanitise hands before and after...



Catching public transport



Shopping



Eating



Getting home

WHAT ARE THE SYMPTOMS?

- A continuous cough (repeated coughing, not just a few coughs)
- A high temperature (shivers or fever)
- Feels like you have the flu and are feeling too weak to go about daily activities
 - Muscle aches and pains
 - Headaches
 - Tiredness
 - Dizziness

If you have any of these symptoms, call **1800 022 222** or a GP.

Call 000 for an ambulance if you are having serious difficulty breathing.

KEEP UP WITH NEWS

If you have internet access, go to <https://www.healthdirect.gov.au/coronavirus> for up-to-date advice

DON'T



Don't use cash to buy things if you can help it



Don't touch your face if it has been a while since you washed or sanitised your hands



Don't visit crowded areas



Don't touch public surfaces if you don't need to

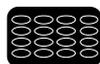
DO



Have family, friends and emergency numbers ready



Try to get things delivered rather than going out



Make sure you have enough medication and food in case you need to isolate



Do light exercise to keep your immunity up