

Interspecies Inhibition: Assessing the Capability of Commensal Nasal Swab Isolates to Inhibit the Colonization of *Staphylococcus aureus*

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Abstract

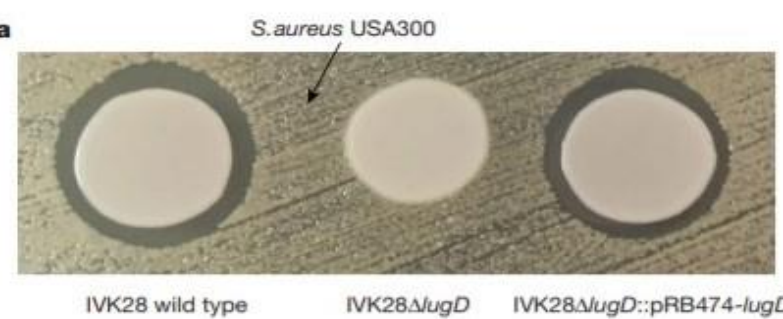
Some commensal bacterial species have the ability to block the growth of harmful pathogens. The focus of this research was to evaluate different commensal nasal swab isolates' capability to inhibit the colonization of the opportunistic pathogen *Staphylococcus aureus*. An Interspecies Inhibition assay was conducted to determine the potential growth inhibition of 16 non-*S. aureus* strains against four characterized *S. aureus* isolates. After conducting the research, three commensal nasal isolates (0879, 0880, and 0887) all inhibited the growth of *S. aureus* strain S0037. Additionally, commensal nasal isolate 0887 did not inhibit the growth of *S. aureus* strain S0028. These results suggest that the commensal isolates exhibiting growth inhibition possess antimicrobial activity that confirm the role of commensal nasal bacteria in limiting the virulence of *S. aureus*.

Introduction

- Staphylococcus aureus* (*S. aureus*) is a clinically relevant Gram-positive opportunistic pathogen that colonizes the anterior nares (nostrils) of approximately 30% of the human population.¹
- As a commensal member of the human microbiota, the presence of *S. aureus* does not typically cause harm. However, once the bacterium is allowed entry into the internal tissues or bloodstream, *S. aureus* can cause a variety of invasive and often life-threatening clinical manifestations, such as endocarditis, osteomyelitis, and Toxic Shock Syndrome (TSS).
- Treatment of *Staphylococcus aureus* remains challenging due to the emergence of multi-drug resistant strains such as Methicillin Resistant *Staphylococcus aureus* (MRSA) that confer resistance to the β -lactam antibiotics commonly used to treat *S. aureus* infections.²

Interspecies Inhibition

- Previous research has confirmed the ability of some species of commensal bacteria to block colonization of pathogenic bacteria such as *S. aureus* in the nasal cavity through their antimicrobial activity and strong competition for space and nutrients.
- One human nasal commensal identified to have a particularly strong capacity to block *S. aureus* colonization is *S. lugdunensis* IVK28.
- S. lugdunensis* produces lugdunin, a peptide antibiotic that has potent antimicrobial activity against many major human pathogens including *S. aureus*. This suggests that lugdunin-producing commensal bacteria may be used to prevent *S. aureus* infections.³
- Interspecies Inhibition is a bacterial interaction assay that is conducted by co-culturing two bacterial species to analyze the antimicrobial potential of commensal nasal isolates against *S. aureus*.



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- Ultimately, evaluating the ability of commensal bacteria within the nasal microbiota to inhibit the colonization of *S. aureus* may provide a guideline for the ultimate development of novel therapies and/or alternative antibiotic treatments for *S. aureus* infections.

Authenticating the Variation of Growth Inhibition Capacity Among Commensal Nasal Swab Isolates 0879, 0880, and 0887 Against *Staphylococcus aureus* Strains S0023, S0025, S0028, and S0037.

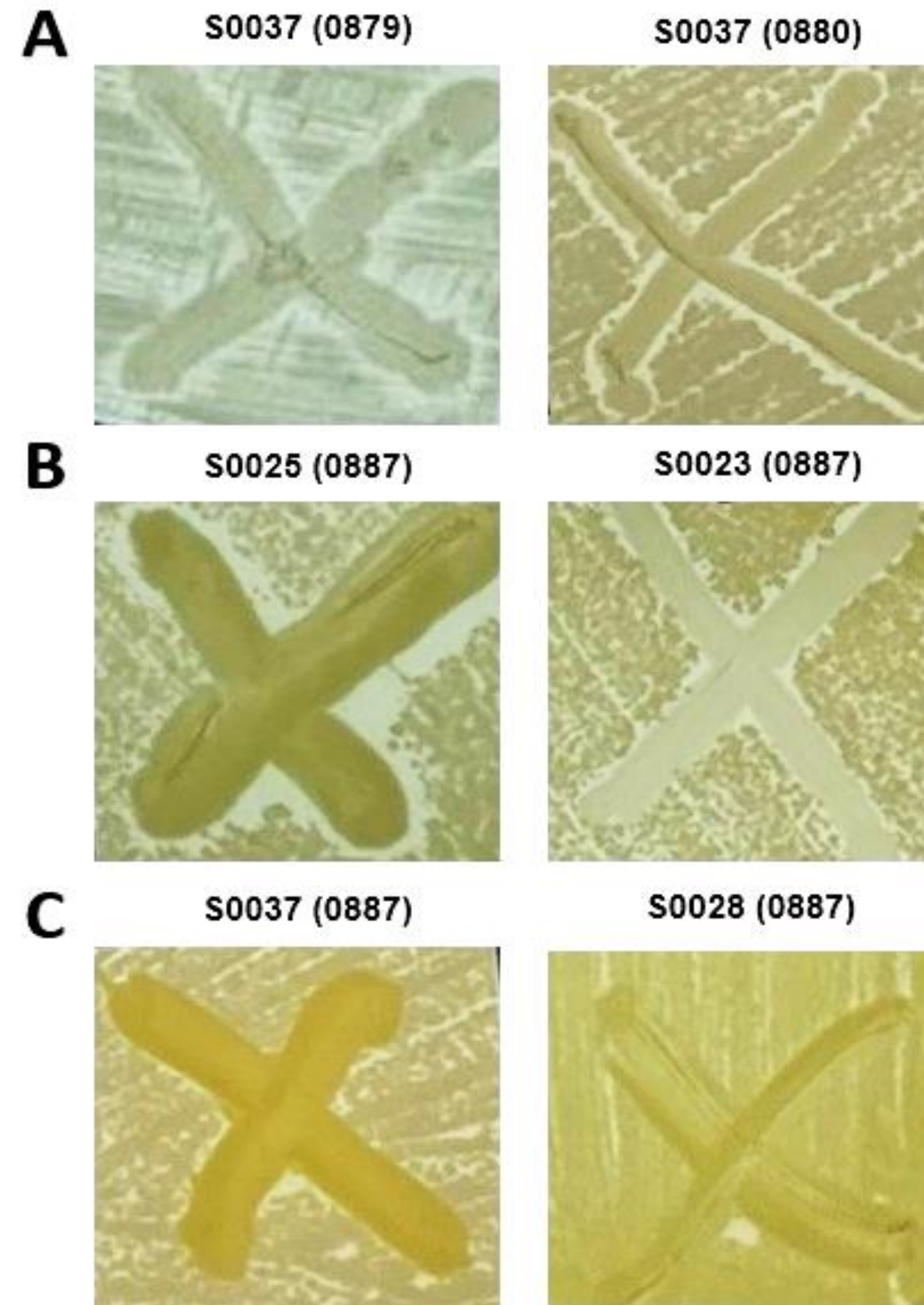
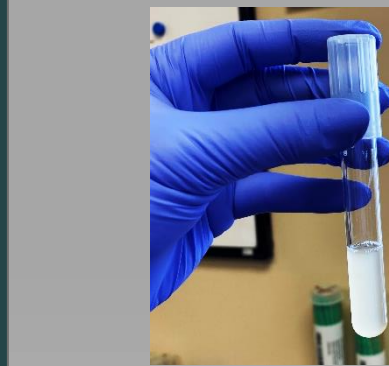


Figure 1. Human commensal nasal swab isolates 0879, 0880, and 0887 inhibit the colonization of characterized *S. aureus* strains S0023, S0025, S0028, and S0037. (A) Commensal nasal isolates 0879 and 0880 demonstrate the capacity to prevent the growth of *S. aureus* isolate S0037. **(B)** Commensal nasal isolate 0887 exhibits growth inhibition of *S. aureus* strains S0025 and S0023, proving the ability to block the growth of different strains of the same pathogen. **(C)** Commensal isolate 0887 visualizes less prominent growth inhibition of *S. aureus* strain S0037, and no inhibition of *S. aureus* strain S0028.

Methodology



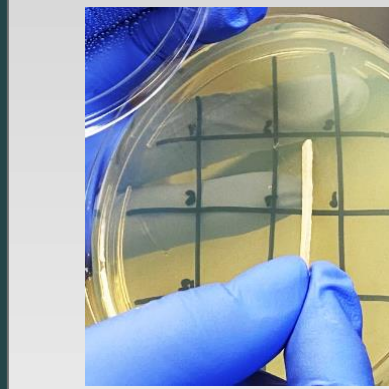
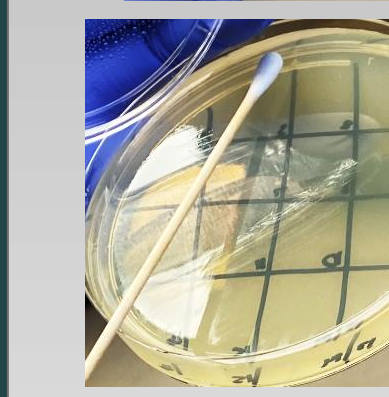
Grow 1 colony of *S. aureus* from TSA plate in a sterile liquid culture tube containing 3mL TSB in the incubator for 24 hours at 37°C.



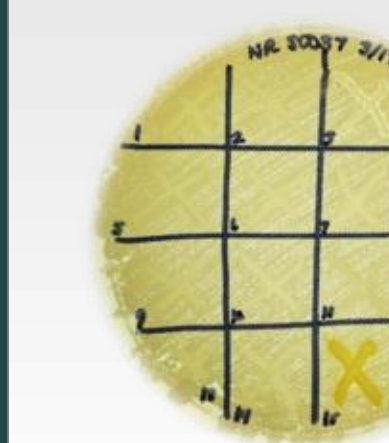
Insert blank cuvette into spectrophotometer, then pipette 1.5mL *S. aureus* liquid culture into new cuvette and record bacterial concentration at 600nm.



Label TSA plate with a 4x4 grid -16 numbered squares for each nasal isolate. Dip sterile swab into sterile liquid culture tube once and streak onto TSA plate using a 3-way lawn technique.



Pull 1 colony from each of the 16 commensal nasal isolates and gently streak on top of freshly swabbed *S. aureus* in the form of an "X," using a sterile toothpick each time.



Incubate plate at 37°C. Take images and assess growth inhibition at 24 and 48 hours.

Conclusion

- Three commensal nasal swab isolates 0879, 0880, and 0887 demonstrated the ability to block the growth of *S. aureus* strain S0037.
- Commensal nasal isolate 0887 indicated growth inhibition capacity against *S. aureus* strains S0023, S0025, and S0037, but did not suppress the growth of *S. aureus* strain S0028.
- Variation of growth inhibition potential among commensal nasal isolate 0887 validates the importance of testing multiple different strains of human commensals against *S. aureus*. Each commensal nasal isolate does not individually possess the capacity to block colonization of all strains of *S. aureus*. Thus, conclusions cannot be made about the isolate's therapeutic potential when other strains of *S. aureus* are still able to colonize.
- Results indicate that the select commensal nasal swab isolates exhibiting growth inhibition possess specific microbial compounds that are toxic to *S. aureus*, as proven in their ability to block the colonization of *S. aureus* when co-cultured in an Interspecies Inhibition assay.
- The antimicrobial compounds produced by inhibitory commensal nasal isolates may be used in further research to discover new antimicrobials to treat *S. aureus* and other opportunistic pathogens.

References & Acknowledgements

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