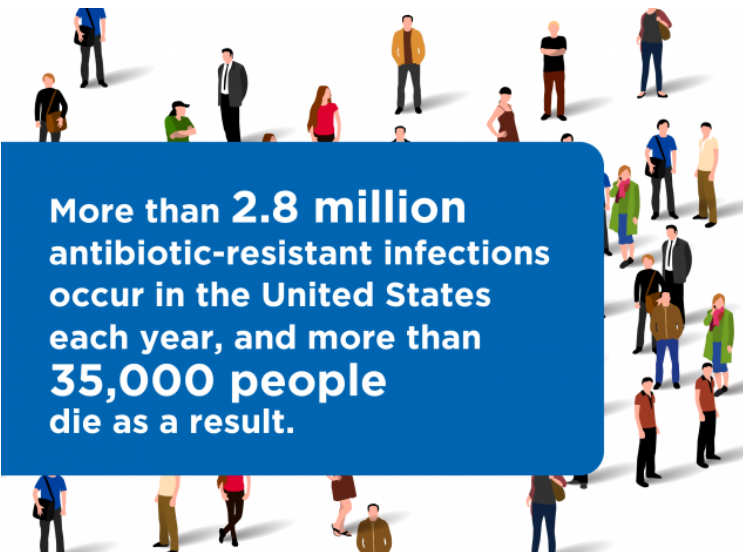


Mechanisms of Zinc Oxide Antibacterial Activity in *Staphylococcus aureus*

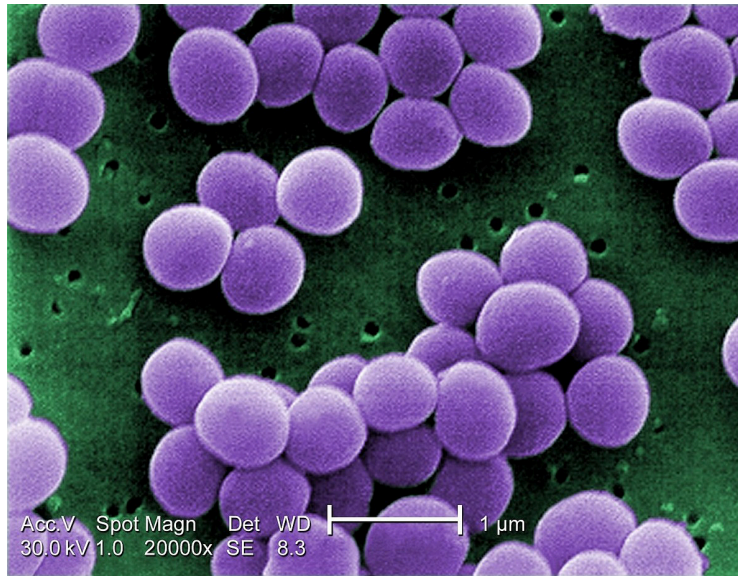
Iman Ali

Supervising Professor: Dr. McGillivray

Antibiotic Resistance on the Rise

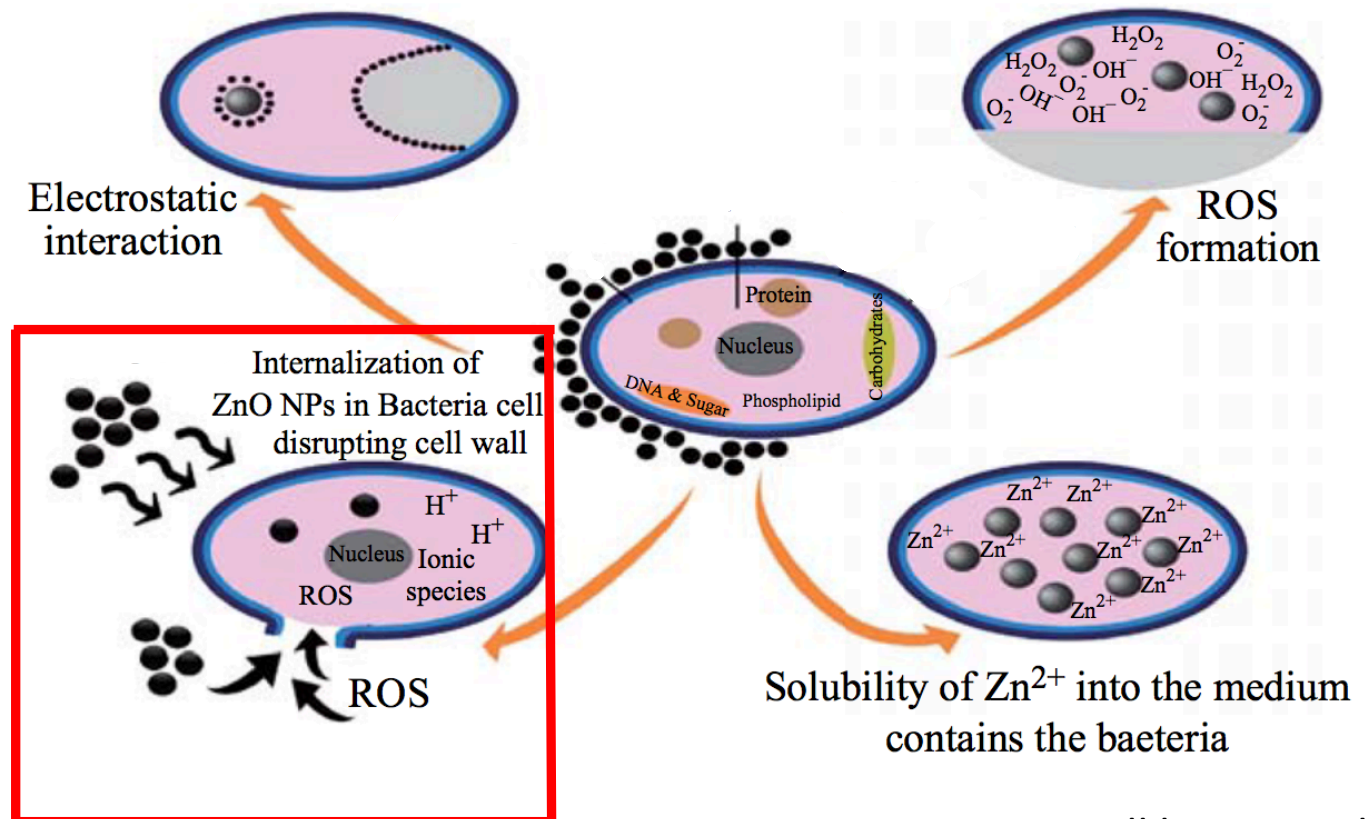


More than **2.8 million** antibiotic-resistant infections occur in the United States each year, and more than **35,000 people** die as a result.

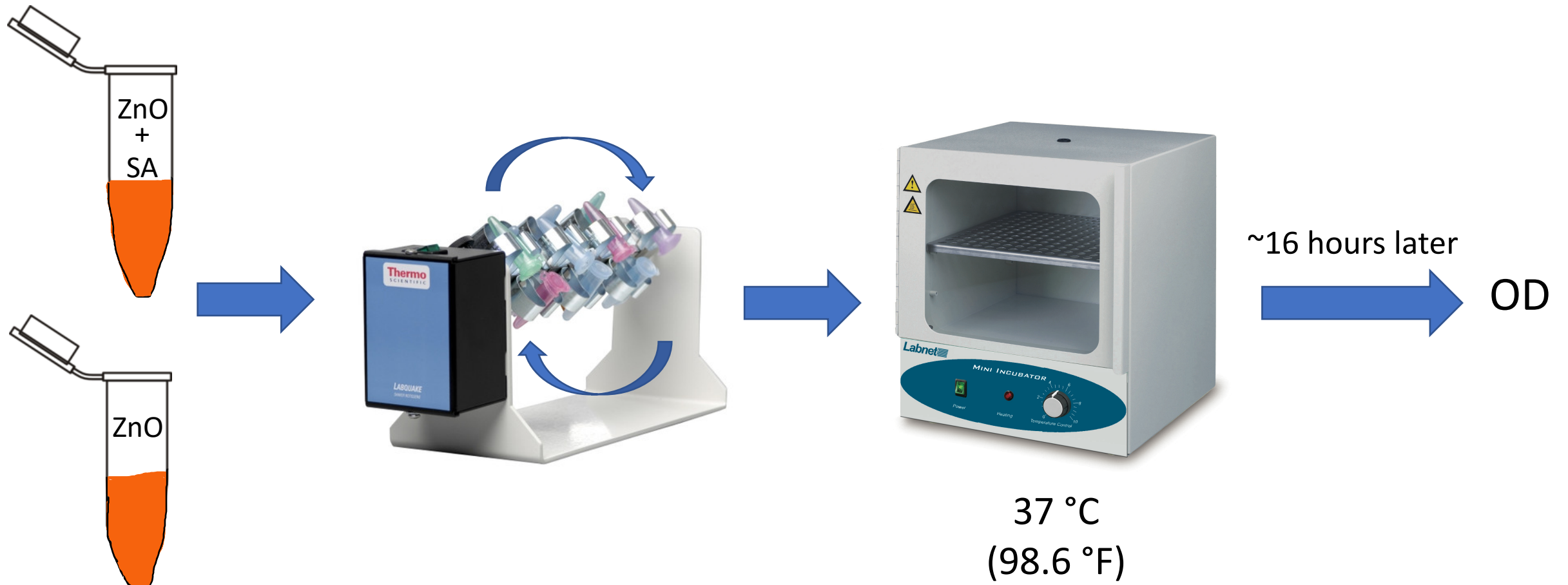


Why Zinc Oxide (ZnO)?

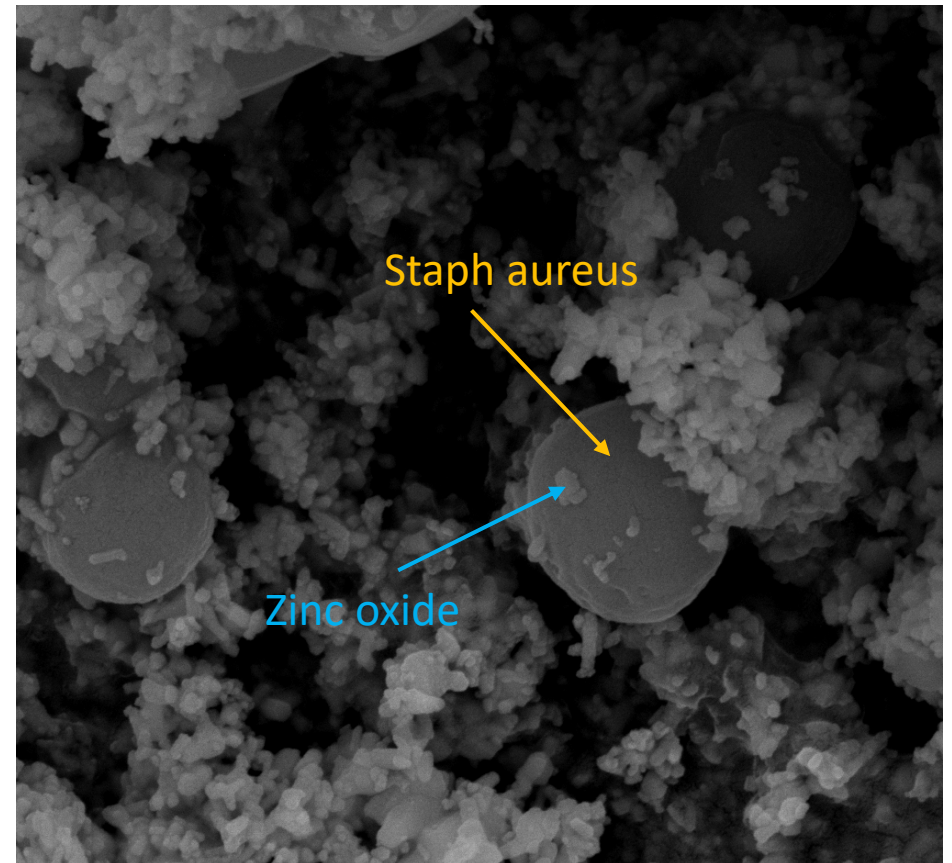
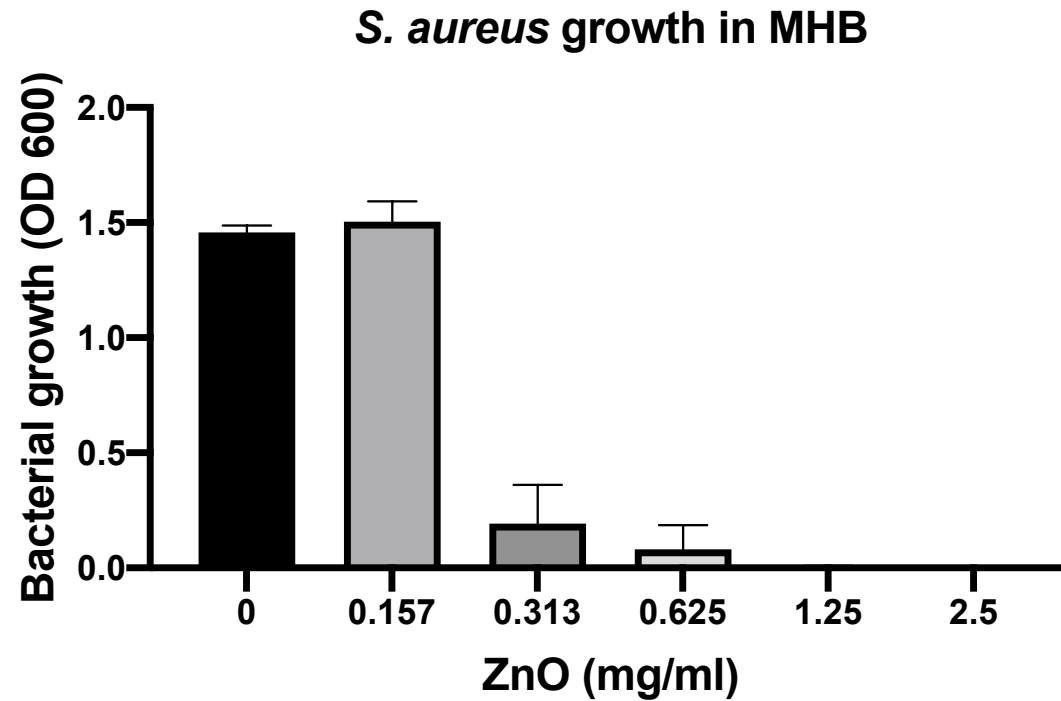
- Known antimicrobial activity
- Low toxicity to mammalian cells
- Physical and chemical properties can be manipulated



Experimental Methods – Particle Size

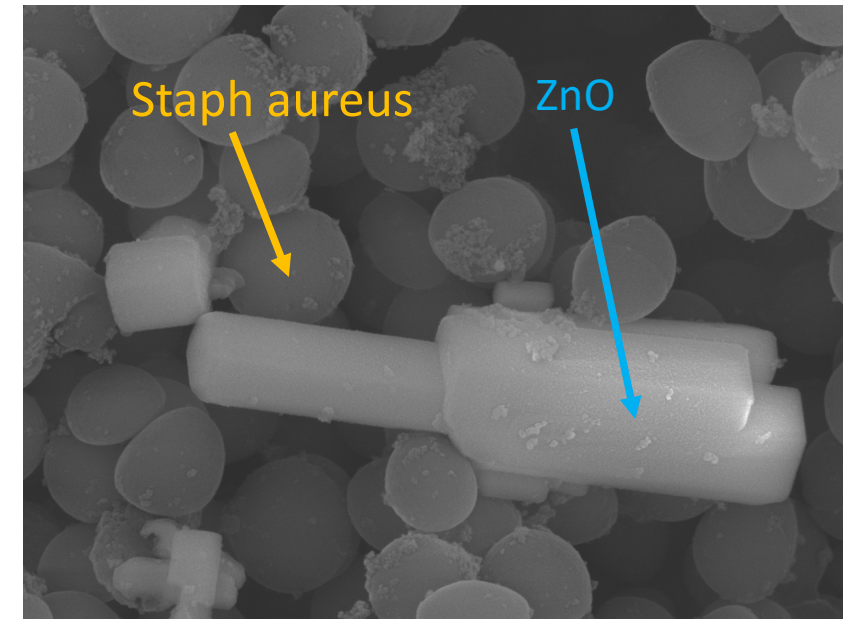
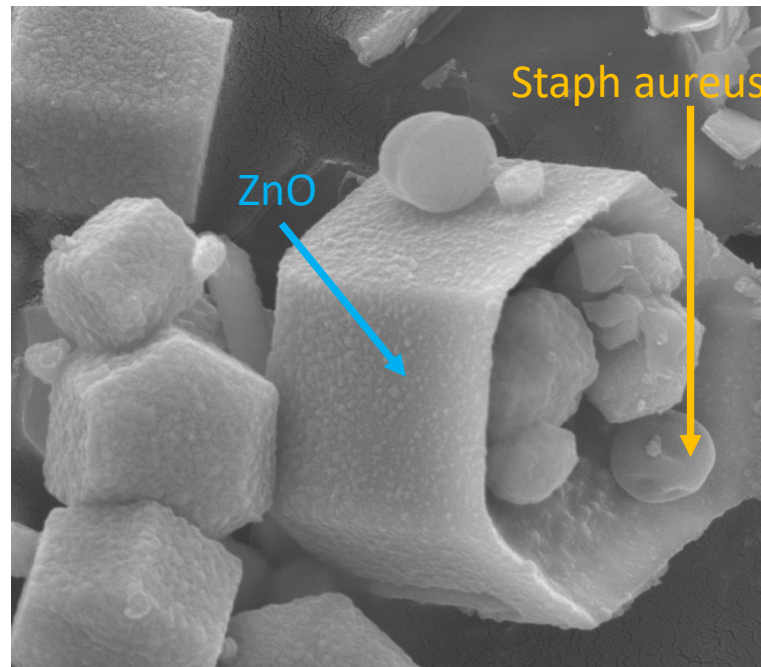
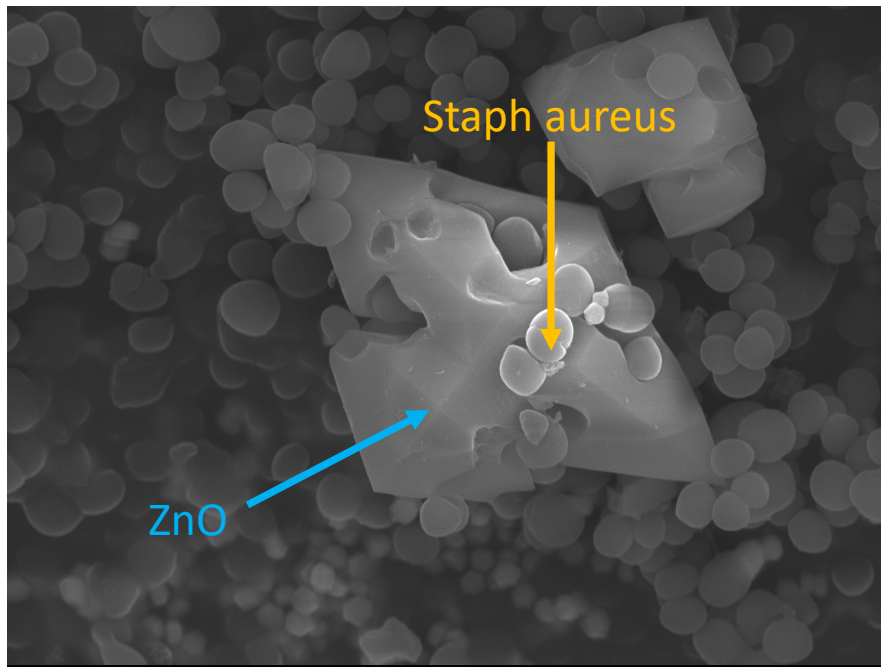


Growth Inhibition with Small Particles



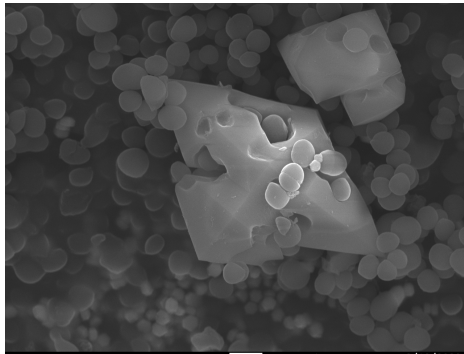
Commercial Particles from Sigma-Aldrich

Growth Inhibition with Large Particles

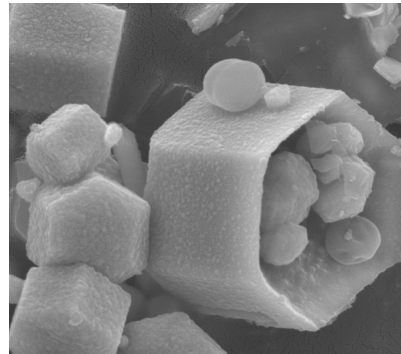
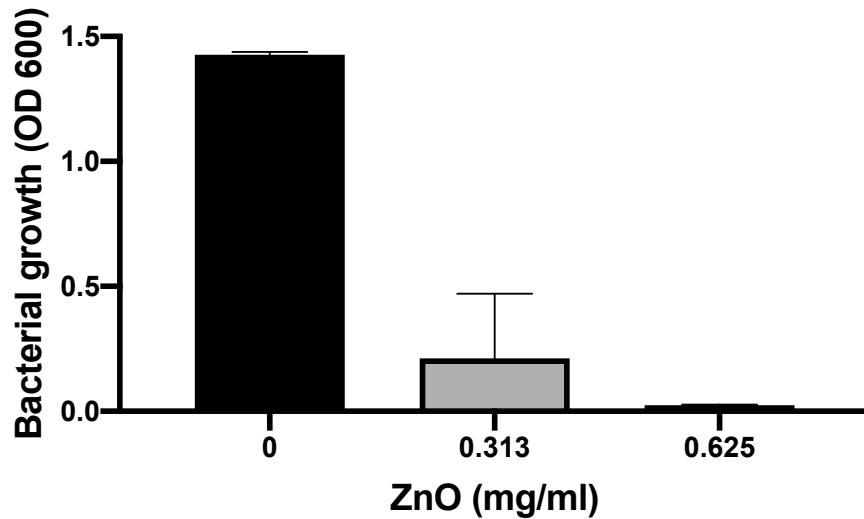


Synthesized by John Reeks

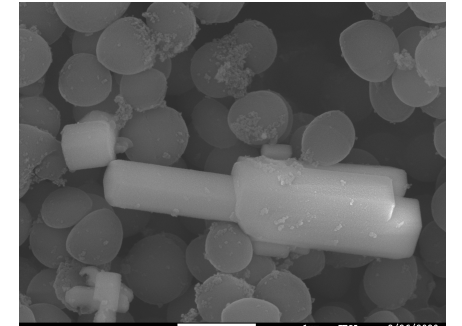
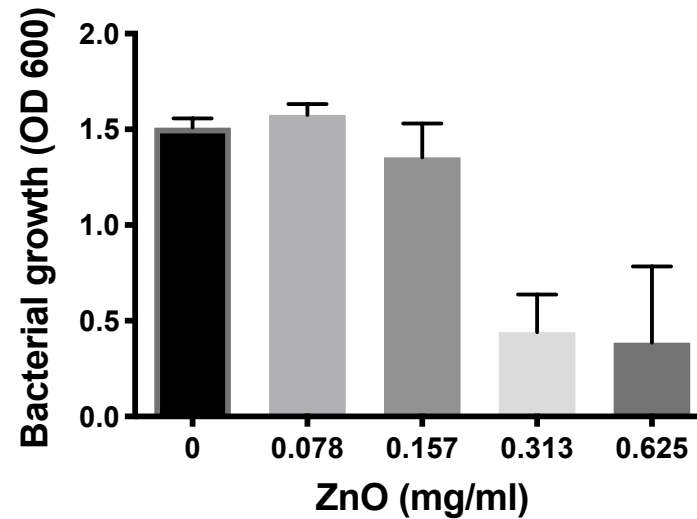
Growth Inhibition with Large Particles



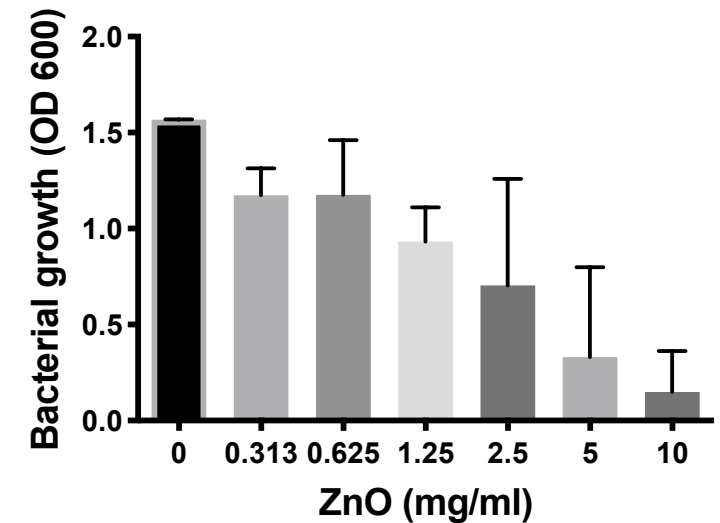
S. aureus growth



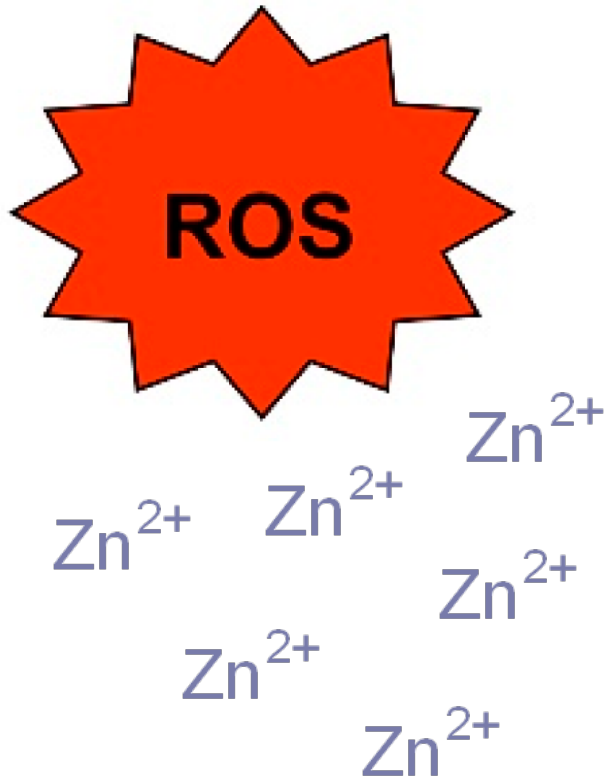
S. aureus growth



S. aureus growth



Future Directions



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- Dr. Shauna McGillivray

Department of Physics and Astronomy collaborators

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- Dr. Yuri Strzhemechny

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Questions?



References

- CDC. Antibiotic Resistance Threats in the United States, 2019. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2019.
- Sirelkhatim, A. et al. Review on Zinc Oxide Nanoparticles: Antibacterial Activity and Toxicity Mechanism. *Nanomicro Lett* **7**, 219-242 (2015).
- Slavin, Y. N., Asnis, J., Häfeli, U.O. & Bach, H. Metal nanoparticles: understanding the mechanisms behind antibacterial activity. *Journal of nanobiotechnology* **15**, 65 (2017).
- Lallo da Silva, B. et al. Relationship Between Structure And Antimicrobial Activity Of Zinc Oxide Nanoparticles: An Overview. *Int J Nanomedicine* **14**, 9395-9410 (2019).
- Raghupathi, K. R., Koodali, R. T. & Manna, A. C. Size-dependent bacterial growth inhibition and mechani