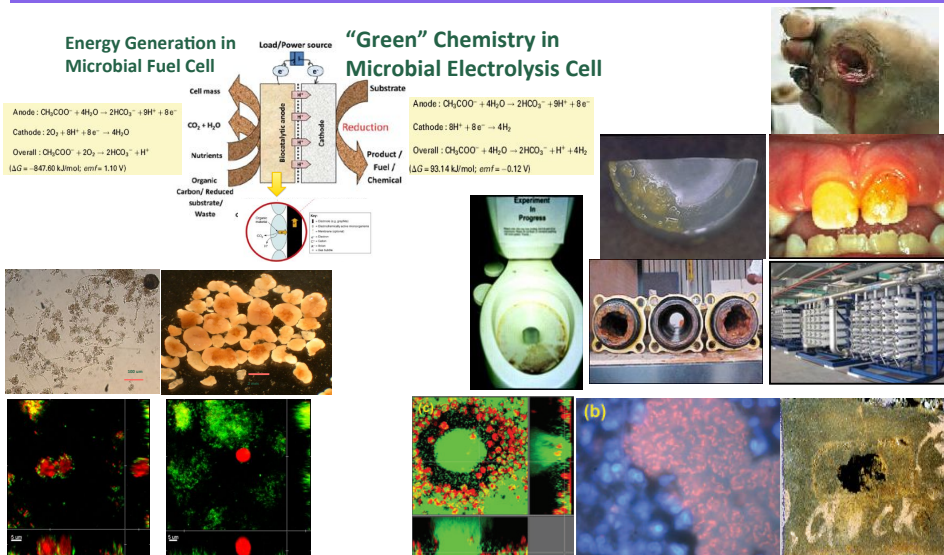


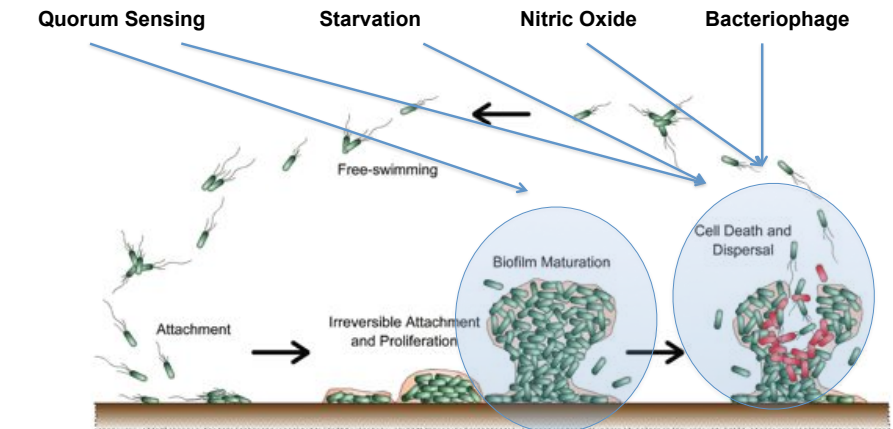
Learning from Nature, Approaches to Control Fouling

Assoc/Prof Scott A. Rice
The Singapore Centre on Environmental Life Sciences
Engineering
Nanyang Technological University

Impacts of Biofilms



Biofilm Formation is Regulated

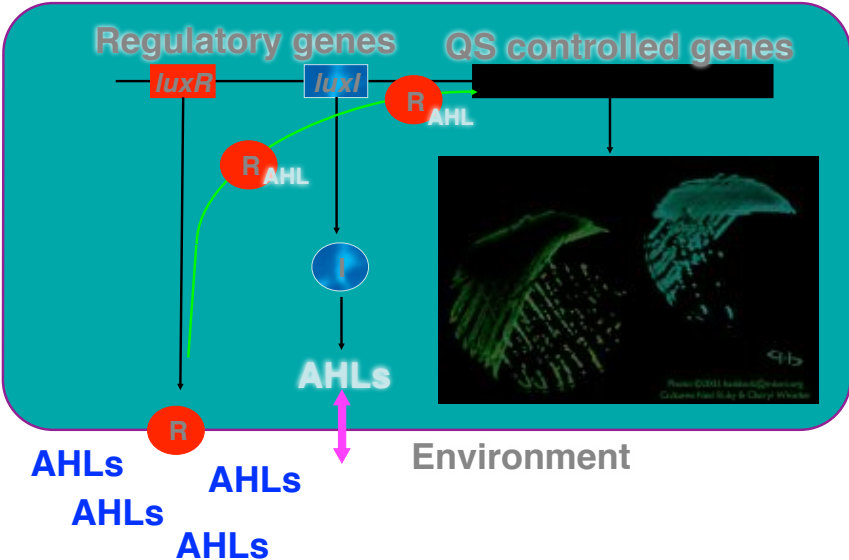


RSchindler et al. 2009. The role of quorum sensing in the formation and dispersal of biofilms. *Microbiology* 155: 1-10.

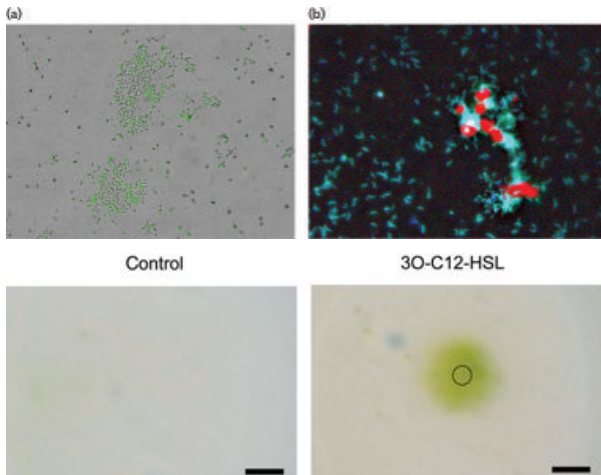
Biofilm Control Strategies

- Quorum Sensing
- Nitric Oxide
- Modification of surfaces

Quorum Sensing



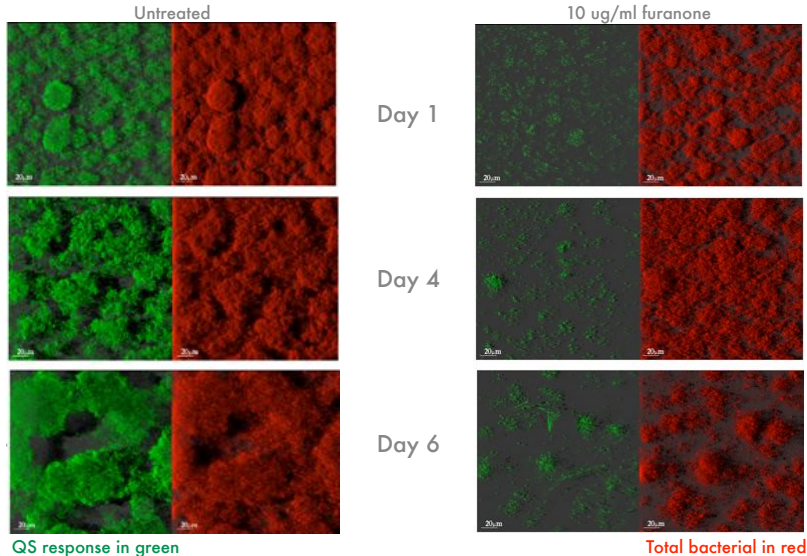
AHLs mediate larval settlement



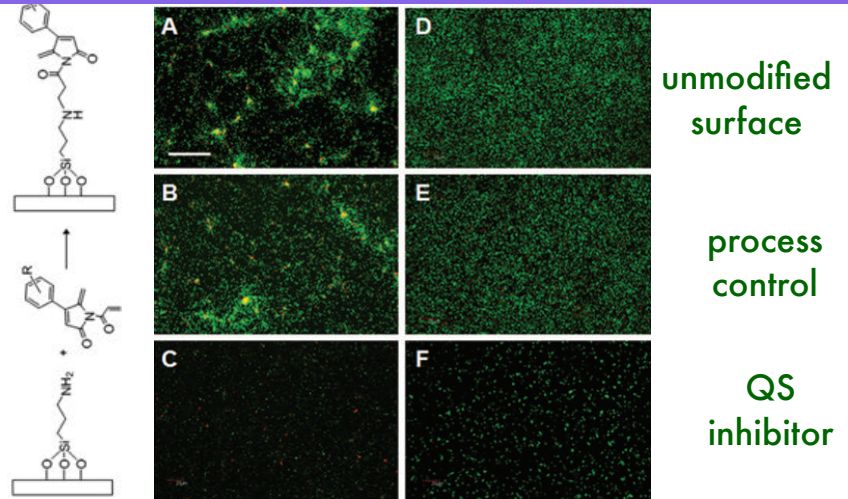
Williams, P., (2007) Quorum sensing, communication and cross-kingdom signalling in the bacterial world. *Microbiology* **153**:3923-3938

WHEELER, G.L., K. TAIT, A. TAYLOR, C. BROWNLEE, and I. JOINT, (2006) *Plant, Cell & Environment* **29**:608-618

QS Inhibitors Control Biofilm Development



Anti-QS based surfaces

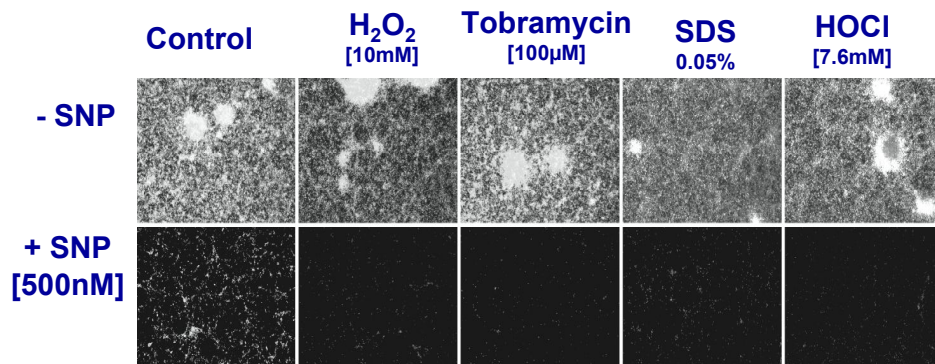


Ho, K. K. K., N. Cole, R. Chen, M. D. P. Willcox, S. A. Rice, and N. Kumar. 2010. Characterisation and *in vitro* activities of surface attached dihydropyrrrol-2-ones against Gram-negative and Gram-positive bacteria. *Biofouling: The Journal of Bioadhesion and Biofilm Research* 26:913 - 921

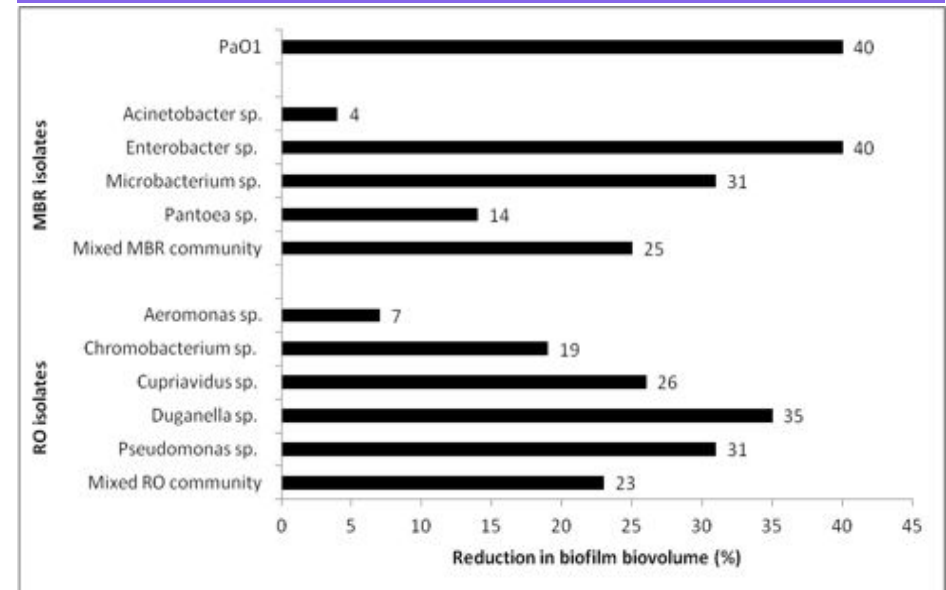
Biofilm Control Strategies

- Quorum Sensing
- Nitric Oxide
- Modification of surfaces

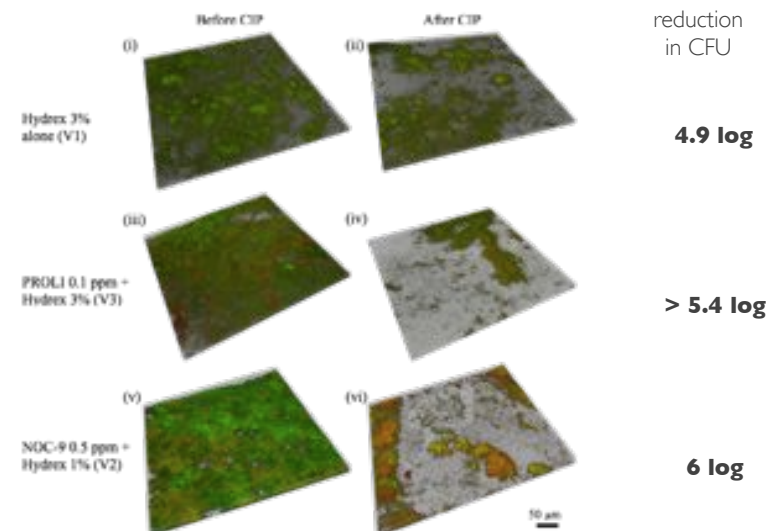
NO Reverses Biofilm Resistance



NO is effective against many bacteria



In line treatment of biofilms with NO



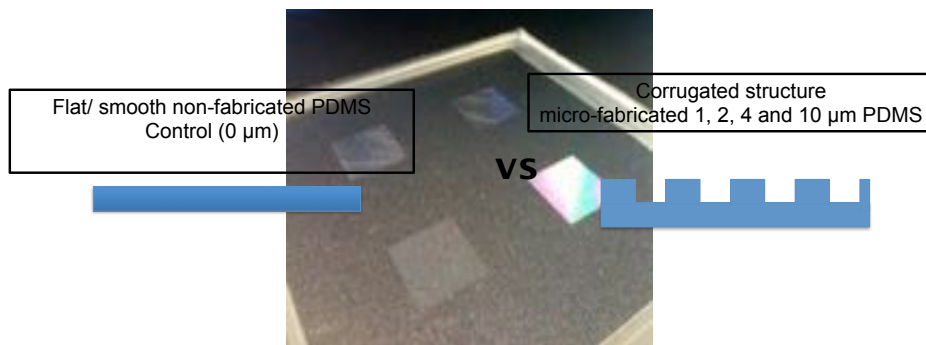
Biofilm Control Strategies

- Quorum Sensing
- Nitric Oxide
- Modification of surfaces

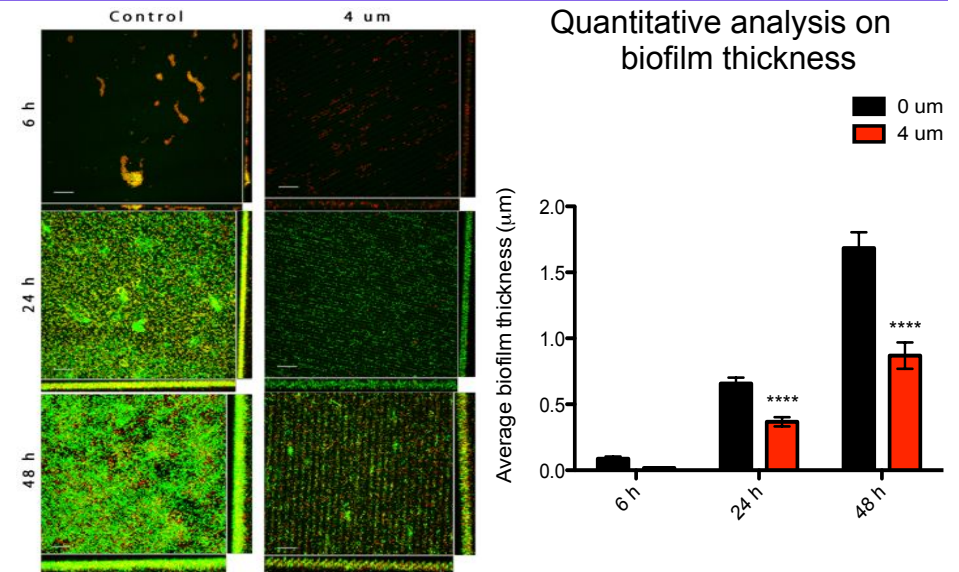
Micro-fabricated PDMS surfaces

Surface modification to control fouling

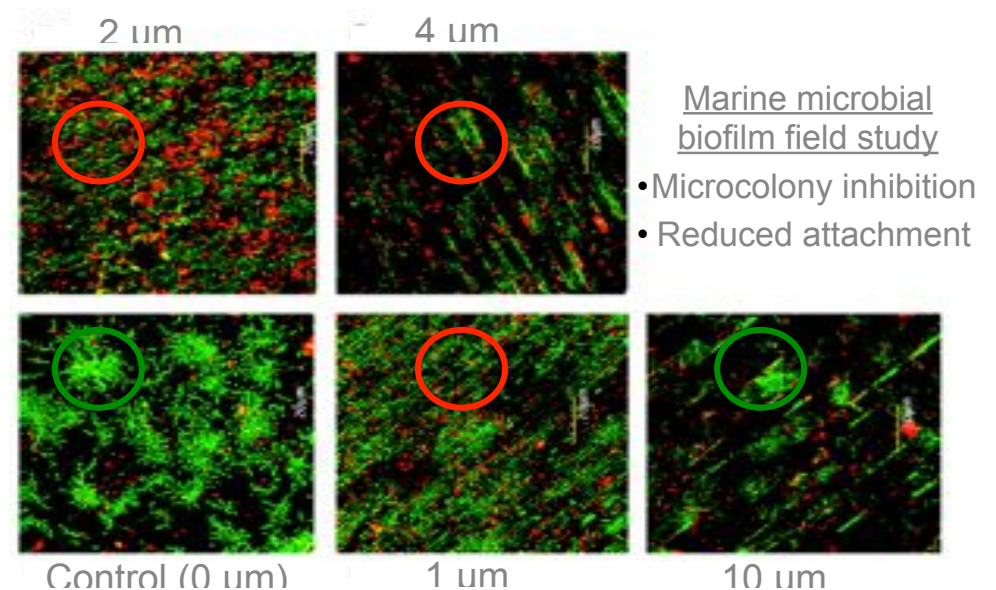
PDMS – polydimethyl siloxane, silicon based material



Confocal images of *P. aeruginosa* biofilm



Marine biofilms



Summary

- Understanding biofilm development can identify novel mechanisms for control of biofilms
- These include intra and extra-cellular signals
- Microbial physiology, structural biology and “-Omics” methods are important in these approaches
- Surface topography or surface chemistry can be modified to control biofilm formation

Acknowledgments



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Australian Government
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