Uncovering the metabolic flexibility of aerobic bacteria: from enzymes to ecosystems

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Abstract

Bacteria have an extraordinary capacity to persist in response to resource limitation. To achieve this, cells enter a dormant state in which they expend energy for maintenance rather than growth. Our research program has shown that the survival of environmental and pathogenic bacteria depends on previously unrecognized metabolic flexibility, including novel respiration, fermentation, and biodegradation pathways. During this seminar, I will discuss two of these findings. The first half of the seminar will focus on the surprising finding that aerobic bacteria are capable of ‘living on air’, i.e. scavenging atmospheric hydrogen and carbon monoxide as alternative energy sources. The second half will summarise work investigating how and why bacteria synthesize the unusual redox cofactor $F_{420}$. In both cases, we integrated genetic, biochemical, and physiological approaches to identify novel metabolic processes supporting the survival of the model bacterium *Mycobacterium smegmatis*. These findings were then extended to the ecosystem level using culture-based and culture-independent approaches. The wider environmental, medical, and biotechnological implications of these findings will also be discussed.

Biography

Chris completed a BSc/MSc in Molecular and Cellular Biochemistry (University of Oxford, 2010) and PhD in Molecular Microbiology (University of Otago, 2014). His doctoral research, completed under the supervision of Prof Gregory Cook, focused on unravelling the physiological roles of the enzymes responsible for H$_2$ metabolism in environmental mycobacteria. He subsequently gained postdoctoral experience in Microbial Ecology and Molecular Evolution at the University of Otago, CSIRO, and the Australian National University. Chris joined Monash University as a lecturer in June 2016 and was awarded an ARC DECRA Fellowship in November 2016. Chris’ research group, the Integrative Microbiology Lab, uses interdisciplinary approaches to explore the metabolic strategies through which environmental and pathogenic bacteria persist under adverse conditions.