Journal Highlights

New Light on Photosynthetic Iron Metabolism

Jiao and Croal

To investigate the origins of the remarkable metabolic diversity that characterizes life on Earth, it is important to understand the mechanics of different metabolisms. Phototrophic Fe(II) metabolism had not been studied because none of the known Fe(II) metabolizers were genetically tractable. Dianne K. Newman's lab at the California Institute of Technology and Howard Hughes Medical Institute has illuminated the subject, in two new papers. In one paper, Laura R. Croal sidestepped the genetic tractability problem by cloning the relevant genes from *Rhodobacter* sp. SW2 and inserting them into a genetically tractable close relative that oxidized Fe(II) more slowly, a technique Newman says could prove useful for investigating metabolic diversity in unculturable species. Croal identified the *fox* operon, a set of genes that stimulated light-dependent Fe(II) oxidation in *Rhodobacter capsulatus* SB1003. This suggested that these genes were responsible for phototrophic Fe(II) oxidation in the native strain. Concurrently, colleague Yongqin Jiao and Newman succeeded in culturing the genetically tractable *Rhodopseudomonas palustris* TIE-1, another photosynthetic Fe(II) metabolizer, which they had recently isolated, and showed, using knockout mutants, that the *pio* operon is essential for phototrophic Fe(II) oxidation. "These results are exciting because they provide the first window into the molecular basis for phototrophic Fe(II) oxidation," says Newman. "This metabolism is likely to be ancient, and an important milestone on the pathway to oxygenic photosynthesis. Our long-term hope is to understand this metabolism well enough to identify a biomarker that may be preserved in ancient rocks. To do this, we must understand the molecular signatures that particular metabolisms leave behind. The identification of the *fox* and *pio* operons is an extremely preliminary step." She also notes that "our early work hinted that there might be unique biological ligands binding the iron."

(Y. Jiao and D. K. Newman. 2007. The *pio* operon is essential for phototrophic Fe(II) oxidation in *Rhodopseudomonas palustris* TIE-1. J. Bacteriol. 189:1765–1773.) (L.R. Croal, Y. Jiao, and D.K. Newman. 2007. The *fox* operon from *Rhodobacter* strain SW2 promotes phototrophic Fe(II) oxidation in *Rhodobacter capsulatus* SB1003. J. Bacteriol. 189:1774–1782.)

Alcohol-Based Hand Rub Solutions Do Not Get Under The Skin

Grayson

Young health care workers cite many reasons why they don't use appropriate hand hygiene at work. One concern, particularly among some young health care workers who are required to have a zero serum alcohol level to legally drive automobiles while on a probationary license in Australia and some other countries, is the fear of being breathalyzed on the way home. Now M. Lindsay Grayson of the University of Melbourne, Australia, et al. show that even very intensive use of alcohol-based hand rub solutions—as much as 30 times per hour—does not result in any substantive absorption. "Nevertheless, extremely small ethanol levels were detected six to eight minutes after last use in 2 of 20 subjects," says Grayson. By comparison, serum isopropanol levels were undetectable in all 19 subjects, and isopropanol is not detectable by the routine breathalyser used by police. "Concerns about being breathalyzed are no longer valid," concludes Grayson.

(T. L. Brown, S. Gamon, P. Tester, R. Martin, K. Hosking, G. C. Bowkett, D. Gerostamoulos, and M. L. Grayson. 2007. Can alcohol-based hand-rub solutions cause you to lose your driver's license? Comparative cutaneous absorption of various alcohols. Antimicrob. Agents Chemother. 51:1107–1108.)

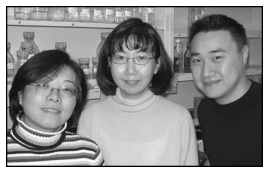
C. jejuni Lipo-Oligosaccharides Mimic Gangliosides in Nerves

(l-r) van Belkum, Godschalk, Gilbert, and Endtz

Guillain-Barré syndrome (GBS) can lead to complete neuromuscular paralysis within a few days. Many cases are preceded by infection with *Campylobacter jejuni*. This bacterium probably triggers GBS through molecular mimicry between lipooligosaccharides in the bacterial cell wall and gangliosides in peripheral nerves. Using a new mass spectrometry technique, Peggy Godschalk of Erasmus University Medical Center, Rotterdam, the Netherlands, and others characterized the ganglioside mimics in a large collection of GBS-associated *C. jejuni* strains, showing that the mimics' structure determines the specificity of the immune response and clinical spectrum of GBS. However, they also found that "a minority of the strains did not express a ganglioside mimic, which suggests that in these cases, mechanisms other than molecular mimicry may trigger GBS," says Godschalk. "We are currently developing synthetic ganglioside mimics. These novel compounds will enable us to develop sensitive innovative diagnostic tools. Immobilization of these compounds on solid supports may lead to new therapeutic modalities based on highly selective immunoadsorption of pathogenic antibodies."

(P. C. R. Godschalk, M. L. Kuijf, J. Li, F. St. Michael, C. W. Ang, B. C. Jacobs, M.-F. Karwaski, D. Brochu, A. Moterassed, H. P. Endtz, A. van Belkum, and M. Gilbert. 2007. Structural characterization of *Campylobacter jejuni* lipooligosaccharide outer cores associated with Guillain-Barré and Miller Fisher Syndromes. Infect. Immun. 75:1245–1254.)

New Insights Into Morphogenesis in *C. albicans*



(l-r) Liu, Lane, and Wang

To become pathogenic, *Candida albicans* must switch from yeast to hyphal growth. Of all the genes specifically expressed in hyphal growth form, only HGC1 affects morphogenesis. Now Haoping Liu of the University of California, Irvine, and her team show that Hgc1, a cyclin, is localized primarily in the actively dividing apical cell of hyphae. This results from enhanced transcription in the apical cell, combined with protein degradation. The cell cycle also influences HGC1 expression. "Thus, regulation of HGC1 is not as simple as on-in-hyphae and off-in-yeast form," says Wang, the paper's first author. Regulation of Hgc1 "also dictates when and where HGC1 is expressed in the hyphal growth form. Studying how HGC1 is regulated will give us insight into how this morphogenetic switch is regulated as well as provide us with clues as to the function of this cyclin," says Wang.

(A. Wang, S. Lane, Z. Tian, A. Sharon, I. Hazan, and H. Liu. 2007. Temporal and spatial control of *HGC1* expression results in Hgc1 localization to the apical cells of hyphae in *Candida albicans*. Euk. Cell 6:253–261.)

Antisense-Based Antimicrobials Show Promise Against *K. pneumoniae*

Klebsiella pneumoniae has emerged as a common cause of serious epidemic and nosocomial infections in hospitals, resulting in high morbidity and mortality. Recently, development of multidrug resistance to antibiotics has become of serious concern, catalyzing an urgent effort to develop novel therapeutic strategies. Now, Chit-Laa Poh and Prathiba Kurupati of the Yong Loo Lin School of Medicine, National University of Singapore, and coworkers show that an antisense-based antimicrobial strategy using peptide-conjugated nucleic acids (PNA) complimentary to mRNAs inhibited expression of *gyrA* and *ompA*, in a dose-dependent manner in Mueller-Hinton broth cultures and *K. pneumoniae* infected IMR90 cell cultures. Mismatched anti-sense peptide-PNAs were not bactericidal. "We plan to demonstrate the bactericidal properties of antisense peptide-PNAs targeted against genes unique to *K. pneumoniae* in mice, nonhuman primates, and eventually in humans."

(P. Kurupati, K. S. Wei Tan, G. Kumarasinghe, and C.-L. Poh. 2007. Inhibition of gene expression and growth by antisense peptide nucleic acids in a multiresistant β-lactamase-producing *Klebsiella pneumoniae* strain. Antimicrob. Agents Chemother. 51:805–811.)