Synthetic Riboswitches Turn On Bacterial Genes

Bacteria regulate their metabolism using riboswitches, sequences of RNA that alter gene expression when they bind a small-molecule metabolite. Justin P. Gallivan’s laboratory at Emory University, Atlanta, Ga., creates synthetic riboswitches that tune gene expression in response to molecules that are not normally found in the cell, sort of the way light switches operate. “By providing the cell with the small molecule, we can turn on gene expression to control what the cell does,” says Gallivan. Now Gallivan et al. show that synthetic riboswitches can control gene expression in a wide variety of bacteria, including some organisms in which it is difficult to regulate gene expression in a controlled way. Currently, while such switches are available for well-studied species, such as Escherichia coli, for others, including pathogens such as Streptococcus pyogenes, the agent of strep throat, such tools are few, or entirely lacking. “We created riboswitches that function in S. pyogenes, Mycobacterium smegmatis, Acinetobacter baumannii, and several others,” says Gallivan. “We expect that these will be useful tools for the larger community to study these organisms.”


Bdellovibrio Devour Their Prey from the Inside, Breaking Rules as They Go

The predatory bacterium Bdellovibrio bacteriovorus eats its prey—larger bacteria, such as Escherichia coli, from the inside, an example of the imaginative lengths to which some prokaryotes will go to make a living. Discovered in 1962, their lifestyle has made them hard to follow with conventional tools. Now technology has caught up, with an automated microscope stage allowing fine automatic focusing that enabled Andy Fenton and Liz Sockett of the University of Nottingham to watch the diminutive protoplasm chompers grow and divide. Collaborators Machi Kanna and Chi Aizawa of the University of Hiroshima helped to show that unlike most single-celled organisms, Bdellovibrio are not tied to binary fission, but can divide into odd numbers of daughter cells, splitting into as many as nine progeny at once. These rule-breakers “may be used in the future to kill pathogens in medical or water and food security applications,” says Sockett, “but understanding how they kill prey is important.” She notes that two Bdellovibrio can invade a single prey bacterium at the same time, and grow and divide separately therein, yet even when one divides into four progeny, and the other into three, septation occurs concurrently for all. “This suggests that a diffusible signal may be received by both growing Bdellovibrio at the same time,” says Sockett. “It may be a kind of quorum or starvation sensing.”


Model for Francisella tularensis Found Wanting

Francisella tularensis is considered a select agent by the Centers for Disease Control and Prevention, due to its low infectious dose—a few as 10 organisms—via the lungs, and its potential as a biological threat agent. Now Thomas Kawula and colleagues of the University of North Carolina have found a transcriptional regulator that is required for Francisella novicida virulence, but is completely dispensable for virulence in F. tularensis subspecies. “This surprised us since the F. novicida and F. tularensis genome sequences are nearly identical,” says Kawula. “When we took the analysis a step further we found that many of the genes affected by IclR were annotated as pseudo-genes in F. tularensis, but were mostly intact in F. novicida.” The work is important, he says, because F. novicida is oft used as a model, as this avirulent sibling can be handled so much more easily than F. tularensis. But the study and other data demonstrate fundamental differences between the two with respect to pathogenic mechanisms and impact on host immune response, says Kawula. Of particular interest: one virulence attribute, controlled by IclR, is undergoing decay in the F. tularensis strains that are virulent for humans.