HOW BACTERIA TALK TO EACH OTHER

Bonnie L. Bassler

Howard Hughes Medical Institute, Princeton University.

Cell-cell communication in bacteria involves the production, release, and subsequent detection of chemical signaling molecules called autoinducers. This process, called quorum sensing, allows bacteria to regulate gene expression on a population-wide scale. Processes controlled by quorum sensing are usually ones that are unproductive when undertaken by an individual bacterium but become effective when undertaken by the group. For example, quorum sensing controls bioluminescence, secretion of virulence factors, biofilm formation, sporulation, and the exchange of DNA. Thus, quorum sensing allows bacteria to function as multi-cellular organisms. We have shown that bacteria make, detect, and integrate information from multiple autoinducers, some of which are used exclusively for intra-species communication while one autoinducer, called AI-2, appears to be a universal signal enabling inter-species communication. Structural studies of AI-2s from different bacteria show that the active signal molecules are distinct and inter-convert upon release from their respective receptors. Our recent studies combining genetics and bioinformatics show that multiple small regulatory RNAs act at the hearts of quorum sensing cascades, and function as ultrasensitive regulatory switches controlling the transition into and out of quorum sensing mode. Research is now focused on the development of therapies that interfere with quorum sensing to control bacterial virulence. Specifically, AI-2 and its detection apparatus are viewed as promising targets for novel broad-spectrum anti-microbial drug design.

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