From strings of nucleotides to collective behavior

“Lessons from Vibrio cholerae”

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Quorum-sensing (QS), is a process of bacterial cell-to-cell communication that relies on the production, release, and population-wide detection of extracellular signal molecules. Processes controlled by QS are unproductive when undertaken by an individual bacterium but become effective when undertaken by the group. QS controls many important microbial processes including bioluminescence, secretion of virulence factors, competence and biofilm formation. In this study, we identified and characterized a novel bacterial communication system present in Vibrio cholerae. This system consists of a transcriptional regulator, VqmA and a small regulatory RNA (sRNA), VqmR. VqmR is activated by VqmA and functions as a trans-acting regulator through base-pairing with multiple target mRNAs. Among these targets are key factors for biofilm formation and virulence factor expression in V. cholerae indicating that VqmA/R could participate in the regulation of complex behaviors. Indeed, our results show that VqmA binds to and is activated by an extracellular signal, which we determined as the novel autoinducer molecule, DPO. DPO is a new molecule to biology and is produced by diverse pro- and eukaryotes. Further, we obtained evidence that the signaling molecule is produced by commensal species of the host microbiota and that VqmA/R plays an important role during V. cholerae pathogenesis and the communication with other bacteria.