

Quorum Sensing

Many gram-negative and gram-positive are able to **sense their own population density, communicate with each other by way of secreted factors, and behave as a population rather than as individual bacteria**. This is referred to as **cell-to-cell signaling** or **quorum sensing** and most likely plays an important role in pathogenicity for many bacteria.

Quorum sensing involves the production, release, and community-wide sensing of molecules called autoinducers that modulate gene expression in response to the density of a bacterial population. When autoinducers produced by one bacterium cross the membrane of another, they bind to receptors in the cytoplasm. This autoinducer/receptor complex is then able to bind to DNA promoters and activate the transcription of quorum sensing-controlled genes.

For example, *Pseudomonas aeruginosa* causes severe nosocomial infections, chronic infections in people with cystic fibrosis, and potentially fatal infections in those who are immunocompromised. Its virulence depends on the secretion of a variety of harmful exotoxins and enzymes as mentioned above. If there was an isolated production of these virulence toxins and enzymes by a small number of *Pseudomonas*, the body's immune responses would most likely be able effectively neutralize these harmful agents with antibodies. However, through **a coordination of the expression of the genes coding for these toxins and enzymes by the entire population of bacteria, *P. aeruginosa* appears to only secrete these extracellular virulence factors when the density of bacteria is large enough that they can be produced at high enough levels to overcome body defenses.**

Other quorum sensing-controlled processes in bacteria include **biofilm formation, sporulation, antibiotic production, and bioluminescence.**

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Go to either one of the two web sites listed below.

[YouTube - Bonnie Bassler: The secret, social lives of bacteria](#)

[Natural History Magazine - Bonnie Bassler: The secret, social lives of bacteria](#)

Watch the video and answer the following questions:

1. How many bacteria typically live in you and on you?
2. Approximately how much of your body “mass” is composed of bacteria?
3. When do the *Vibrio fischeri* make light (bioluminescence)?
4. What type of symbiotic relationship exists between the bacteria and the bobtail squid? (You should figure this out)
 - a. How do the bacteria benefit?
 - b. How does the squid benefit?

