

## Panorama on camp sensation of Bacteria

Since the first six decades of the twentieth century, the autonomous unicellular organisms, bacteria with unimaginable computational and evolutionary capabilities along with collective behavior has been running. Do not consider them to be small, simple and stupid because they possess the generic term quorum sensing adopted to describe the cell communication process which coordinate gene expression, when the population has reached a high cell density. Bacteria release diffusible signal molecules known as autoinducers or quorum sensing molecules (QSMs).

To pen down the chemical compounds, acyl homoserine lactone and quinolone are the two responsible for quorum sensing mediation in gram negative bacteria. On the other, modified oligopeptides or autoinducing peptides (pheromones) mediated quorum sensing in gram positive bacteria. Simultaneously, both types of mediation for quorum sensing is controlled by LuxR–LuxI system. The dependent regulation of gene expression involves the luxR gene encodes the transcription factor LuxR, the luxICDABEG operon encodes the LuxI enzyme as well as components necessary for synthesis of the luciferase (light producing enzyme) and production of its substrates.

Many researches predicted experimentally the direction for activating or deactivating nature of a wave of gene expression control bacterial populations subject to a diffusing autoinducer signal. On the other hand, it has been observed that the accumulation of the quorum sensing molecules leads to a negative diffusion coefficient in the solution of governing differential equation.

The recent work on the quorum sensing mechanism found an important observation, we got a negative diffusion coefficient in the proposed mathematical model which shows that anti diffusion plays an important role in the quorum sensing system. Due to the negative diffusion coefficient, the bacterial population density continuously rises to a certain level. The diffusible quorum sensing molecules are released, then they accumulate and increase the population density until the threshold concentration is reached. If all the molecules are diffused, then quorum never occurs. So anti diffusion is an important cause of quorum sensing. The chemical diffusion occurs in a presence of the concentration (or the chemical potential) gradient and it results in net transport of mass. This is the process described by the diffusion equation. This diffusion is always a non-equilibrium process, increases the system entropy, and brings the system closer to equilibrium. The thermodynamic factor is related to the Gibbs free energy. A negative diffusion coefficient means that the flux of concentration diffuses up against the concentration gradient (though still along the chemical potential or free energy gradient). This is known as uphill diffusion, which is important for a special phase transformation, called Spinodal Decomposition (Majumdar 2016).

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## Publication

[Conversation game: talking bacteria.](#)

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