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## COMMUNICATION SIGNALING SYSTEM USED IN ACIDOPHILUS STRAINS

The importance of extremophiles enhanced in recent times not only due to the pure interest, providing by the scholar community, but also because of an enormous number of applications in many fields of biotechnology and medicine. For instance, it is impossible to imagine the usage of PCR technology with the lack of thermophilic DNA polymerases. Another example is that some strains of thermophilic biofilms can be a major cause of industrial problems related to corrosion of facilities. From the point of view of the biomining process, mainly providing via bacteria species *Acidithiobacillus ferrooxidans*, *Ferroplasma acidiphilum* and *Sulfobacillus thermosulfidooxidans*, it is important to acquire a knowledge of their communication mechanisms in order to succeed the develop and research tasks; dive in the depth understanding of how they can thrive in the extreme conditions and even communicate between each other\*.

Having a high cell density, most bacteria rely on quorum sensing (QS) to coordinate gene expression. This phenomenon based on the production and detection of signaling molecules they called autoinducers of three types (AI I – III). It is widely known about mesophilic QS and their abilities to bioluminescence, cell competence and biofilm formation under certain conditions. Meanwhile, it can be seen, that the world is just about to start the journey of investigations of the QS system in extremophiles to be unfolded.

In the article dated by 2019, it is easy to find all main types of extremophile classes, but some genes and signal molecules are still unknown. Not a lot proved QS roles have been investigated by this moment. Nevertheless, most QS functions are expected now:

- 1) Extracellular polymeric substance (EPS) formation;
- 2) Enhances xylanase production;
- 3) Biofilm formation;
- 4) Free radical scavenging;
- 5) Exoenzyme, extracellular proteases and lipases synthesis;
- 6) Lowers the freezing point and cold adaptation;
- 7) Oxidative stress regulation and related gene expression;

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\* Kaur A., Capalash N., Sharma P. Communication mechanisms in extremophiles: Exploring their existence and industrial applications // Microbiol. Res. 2019. P. 15–27.

8) Iron homeostasis, sulphur and iron stress control, copper leachings.

AI – 1 based signaling system uses acylated homoserine lactones (AHLs) to overcome stress factors: sulphur and iron stress control (fig. 1). This type prevalent in Gram – negative bacteria; but also was identified in cyanobacteria and archaea as well.

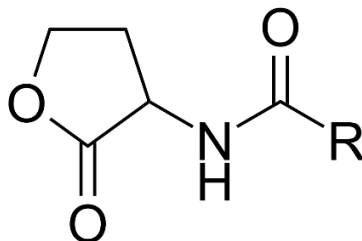


Fig. 1. General chemical structure of an N – Acyl homoserine lactones (AHLs or N – AHLs): a class of signaling molecules involved in bacterial quorum sensing enrolled in coordination of group – based behavior based on population density

*A. ferrooxidans* one of the microorganisms which thrive at low pH and can be used in industrial recovery of copper, gold and other valuable metals. The communication can be regulated by LuxI (AI – 1 synthase produces AHLs): at high cell population density, bacteria identify the nearby AHLs secreted by neighbor bacteria. LuxR is another important gene called transcriptional factor that receives the similar AHLs and leads to a gene expression of certain phenotype. This type of communication regulation was found in the phenotype and other acidophiles like *L. ferrooxidans* as well as *Acidithrix*. (fig. 2)

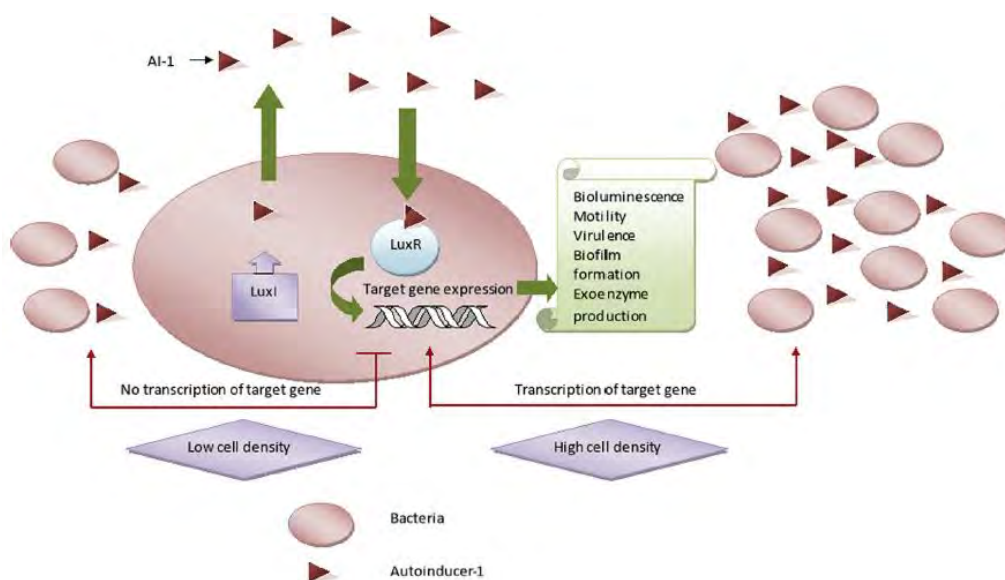


Fig. 2. Autoinducer – 1 (AI – 1) type quorum system