Cyclic-di-GMP signaling controls metabolic activity in *Pseudomonas aeruginosa*

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BACKGROUND

Biofilms are encased in matrix components and often display low metabolic activity.

Both these characteristics contribute to increased antibiotic tolerance.

Cyclic-di-GMP is a regulator of biofilm production in *P. aeruginosa.*

QUESTION

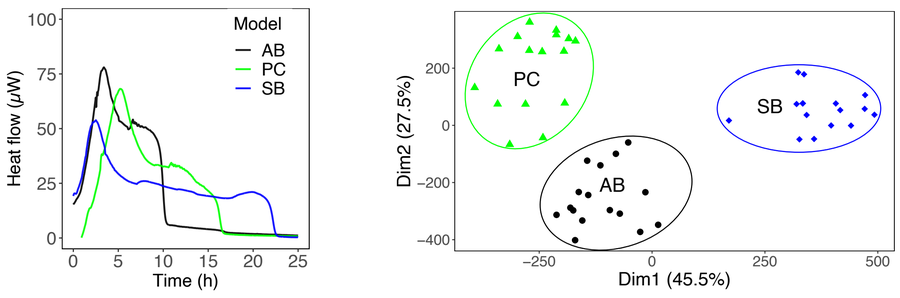
Is cyclic-di-GMP involved in regulation of metabolism of biofilms?

METHODS

We used **isothermal microcalorimetry** to measure metabolic activity of *P. aeruginosa* as **planktonic cells (PC)**, **surface biofilms (SB)**, or in **alginate beads (AB)** and engineered strains with varying levels of cyclic-di-GMP and/or ability to produce matrix components (EPS).

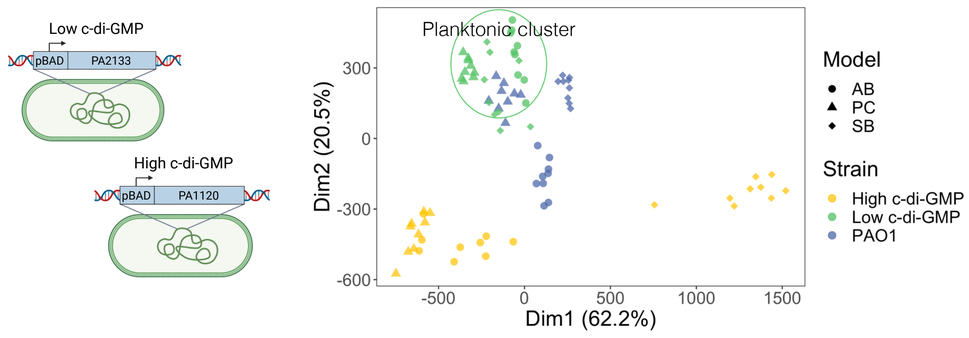
RESULTS

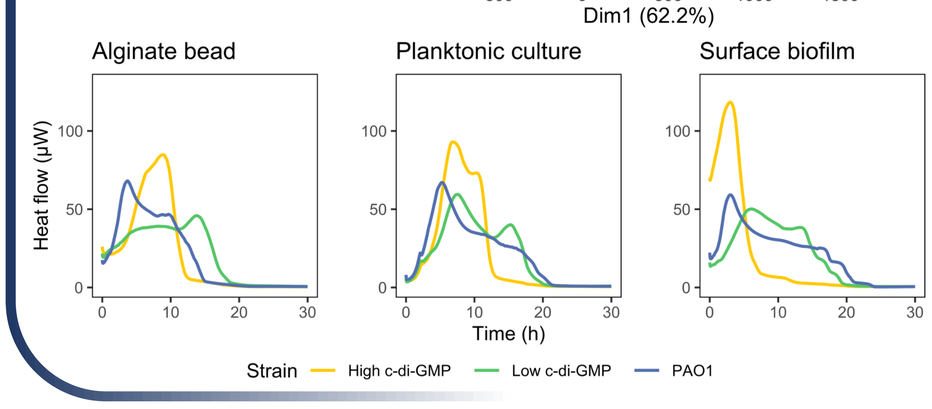
❖ Thermograms of planktonic and biofilm bacteria are different and clusters separately.

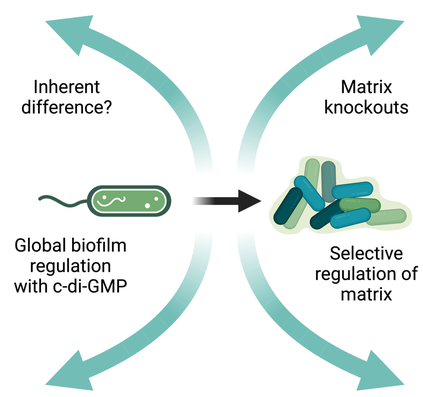


❖ C-di-GMP depleted strains display “planktonic-like” metabolic activity – even in biofilm models.

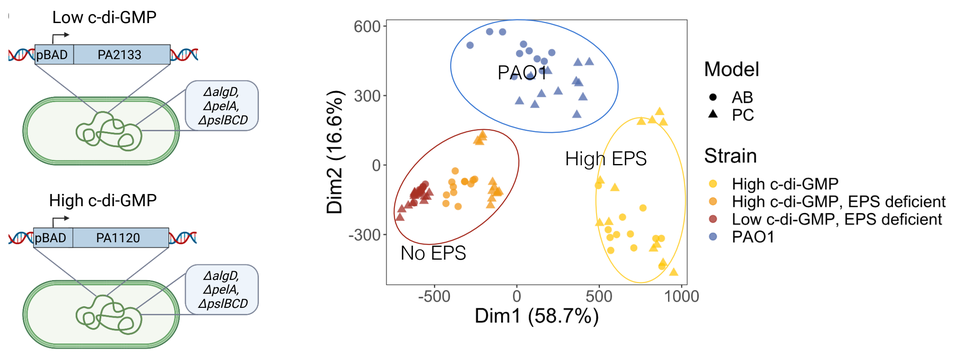
❖ High c-di-GMP results in higher metabolic activity.

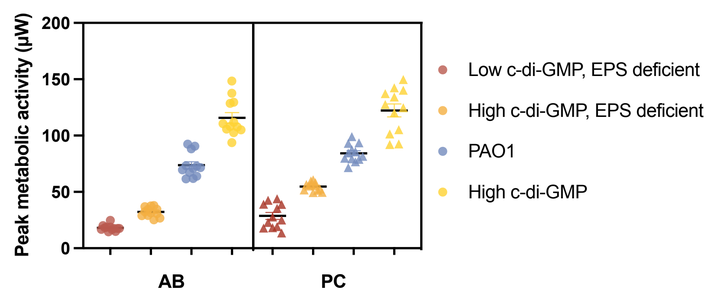






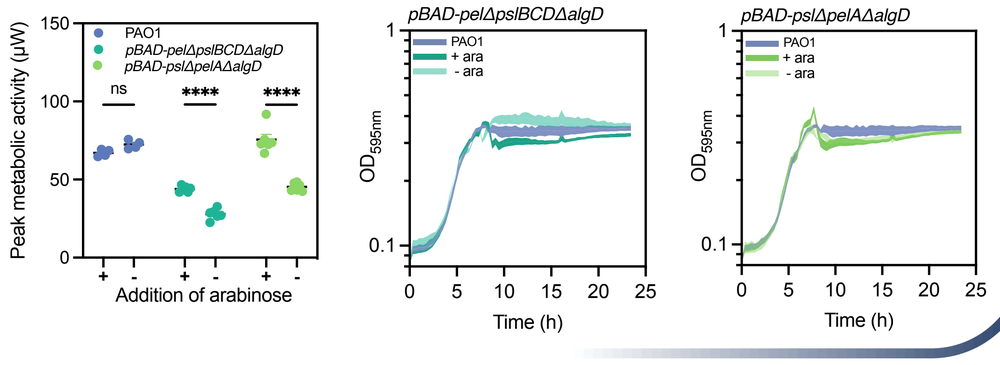
❖ EPS negative strains display lowered metabolic activity.





❖ Selective induction of both Pel and Psl result in higher metabolic activity.

❖ Production of Pel and Psl does not occur on expense of growth.



CONCLUSION

The production of matrix components appear to be energetically costly and results in higher metabolic activity.

In contrast, deletions in major exopolysaccharide genes (alg, pel and psl) results in lowered metabolic activity.

The high metabolic cost of matrix production result in substrate depletion and may, in part, explain low metabolic activity observed in mature biofilms.

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