Transcriptional regulators and chemoreceptors that respond to phytohormones in plant-associated bacteria

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Bacteria adapt to environmental changes through a variety of signal transduction systems. These systems include transcriptional regulators and chemoreceptors that sense signal molecules through dedicated ligand binding domains (LBDs). Indole-3-acetic acid (IAA) is the most common naturally occurring auxin and modulates plant growth and development. In addition, IAA is a ubiquitous signalling molecule produced by organisms of all kingdoms of life that has been shown to play important roles as an inter- and intra-kingdom signal molecule; especially in the interaction between plants and microorganisms. Here, we show that IAA inhibits the synthesis of the antibiotic andrimid in a rhizosphere bacterium of the *Serratia plymuthica* species. We found that this process is initiated by the specific binding of IAA to the LBD of the transcriptional regulator AdmX. Auxin binding causes conformational changes in AdmX that result in the inhibition of transcription of the andrimid biosynthetic gene cluster. Further studies reavealed that an IAA metabolizing plant-associated *Pseudomonas putida* isolate exhibits chemotaxis to IAA. This chemotactic movement was shown to be independent of auxin metabolism and mediated by the PcpI chemoreceptor. Compared to other *P. putida* chemoreceptors, *pcpI* is expressed at low levels and, in multicopy, *pcpI* increased the magnitude of IAA chemotaxis more than 10-fold compared to the wild type strain. Heterologous expression of *pcpI* conferred IAA chemotaxis to different environmental and human pathogenic isolates of the *Pseudomonas* genus. Using ligand screening, microcalorimetry and quantitative chemotaxis assays, we found that PcpI also recognizes and mediates chemoattraction to various aromatic compounds, including the phytohormone salicylic acid. To the best of our knowledge, PcpI is the first chemoreceptor that recognizes two different plant hormones and extends the range of central signal molecules that are recognized by chemoreceptors. Our work highlights the multifunctional role of IAA and salicylic acid as intra- and inter-kingdom signal molecules.

References

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Miriam Rico-Jiménez, Amalia Roca, Tino Krell and Miguel A. Matilla (2022) A bacterial chemoreceptor that mediates chemotaxis to two different plant hormones. *Environmental Microbiology*. doi: 10.1111/1462-2920.15920.

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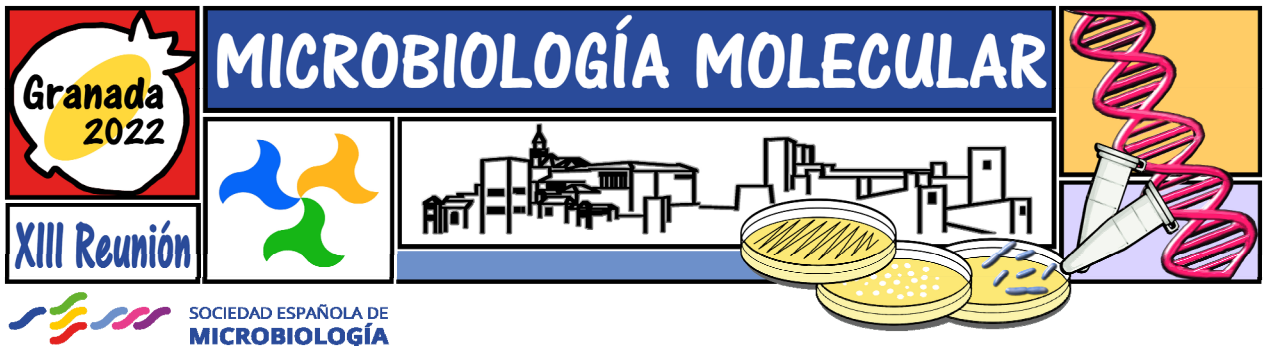

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