Interactions of *Pseudomonas aeruginosa* and *Staphylococcus aureus* in Biofilm-Related Infections: Insights Through Network Reconstruction and Creation of a New Online Database

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Polymicrobial Biofilms

Biofilms are a **critical concern** for many biomedical applications. Their natural **polymicrobial nature** is characterized by **complex communities**, where **pathogen interactions** promote disease progression and severity. **Inter-species communication** within biofilms is majorly regulated by **quorum-sensing**, making it a promising target for new therapies.

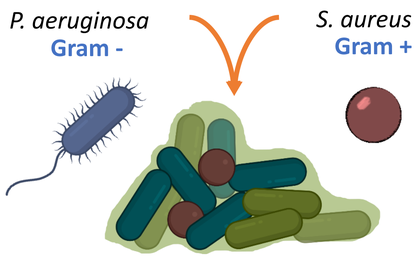
Goal

- **Understand the implications of *P. aeruginosa* - *S. aureus* interactions on infection progression and find key mechanisms to be explored for antimicrobial therapy.**

Objectives

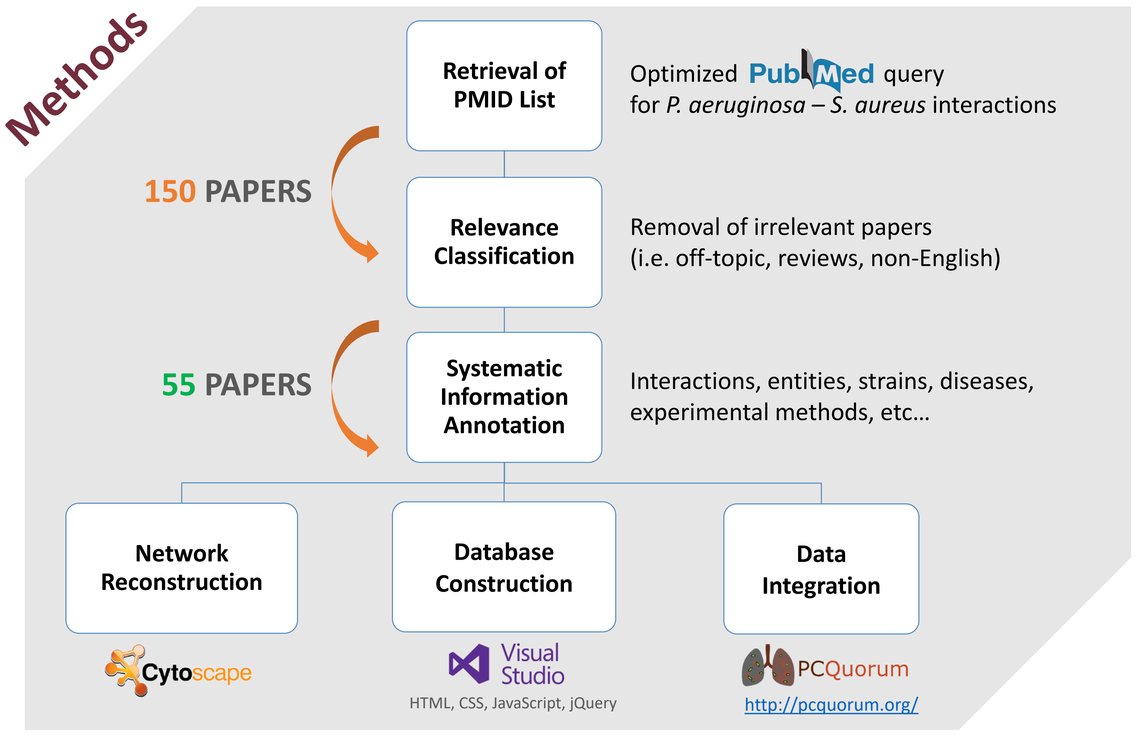
- **Retrieve and analyse all available experimental data on *P. aeruginosa* - *S. aureus* interactions.**
- **Map interaction mechanisms and make them available online.**
- **Integrate the retrieved data with other databases to check for possible antimicrobials.**

P. aeruginosa and *S. aureus* Interactions



P. aeruginosa and ***S. aureus*** are two major pathogens that co-occur in many biofilm infections (e.g. respiratory infections) and whose **competitive interaction** is highly related to **infection resilience.**

Methods



Results

1st Publically Online Database on Microbial Communication

INTER- SPECIES CROSSTALK DATABASE

www.ceb.uminho.pt/ISCTD

STEP 1 Choose Interaction Direction: * ALL * / -- Please Select -- / * ALL * / P. aeruginosa → S. aureus / S. aureus → P. aeruginosa

STEP 2 Choose Source Entity Category: -- Please Select -- / -- Please Select -- / * ALL * / Cell / Gene / Other / QS Molecule / QS System / Virulence Factor / Virulence Mechanism

STEP 3 Choose Target Entity Category: -- Please Select -- / -- Please Select -- / * ALL * / Cell / Gene / Other / QS Molecule / Virulence Factor / Virulence Mechanism

SEARCH

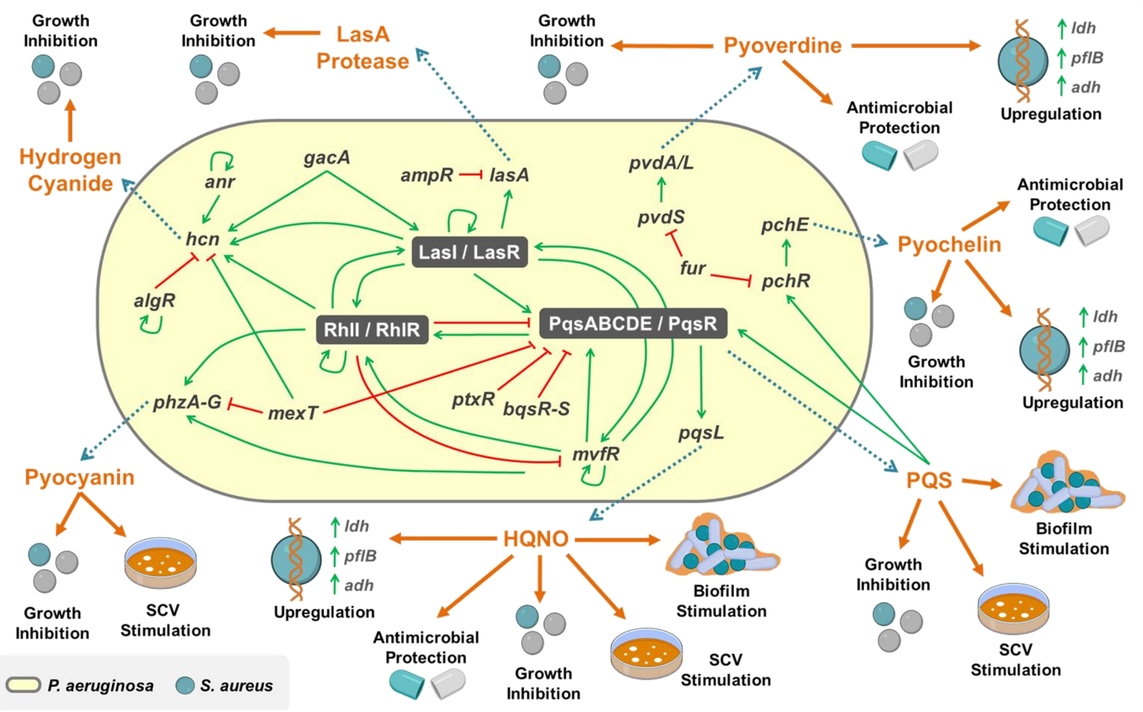
Type keywords below to further narrow down your search!

Search table (such as: type of interaction (eg. downregulation), disease (eg. cystic fibrosis), etc...)

Year	PMID	Source	Source Entity	Source Type	Interaction	Target	Target Entity	Target Type	Method	Disease	Strain
2014	24466207	P. aeruginosa	2-alkyl-4-(1H)-quinolones (AQs)	QS Molecule	Stimulation	S. aureus	Biofilm	Virulence Mechanism	Crystal violet stain	Cystic Fibrosis	P. ae
2015	25917911	P. aeruginosa	2-alkyl-4-(1H)-quinolones (AQs)	QS Molecule	Inhibition	S. aureus	Cell	Cell	RT-PCR; UPLC-MS/MS	Cystic Fibrosis	P. ae isolat MRS
2014	25182495	S. aureus	agr QS system	QS System	Protection	P. aeruginosa	Cell	Cell	Flow cytometry	Cystic Fibrosis	P. ae JE2

✓ Successful **retrieval** and **organization** of all **current data** on ***P. aeruginosa-S. aureus* interactions** in searchable format in a **new online database**.

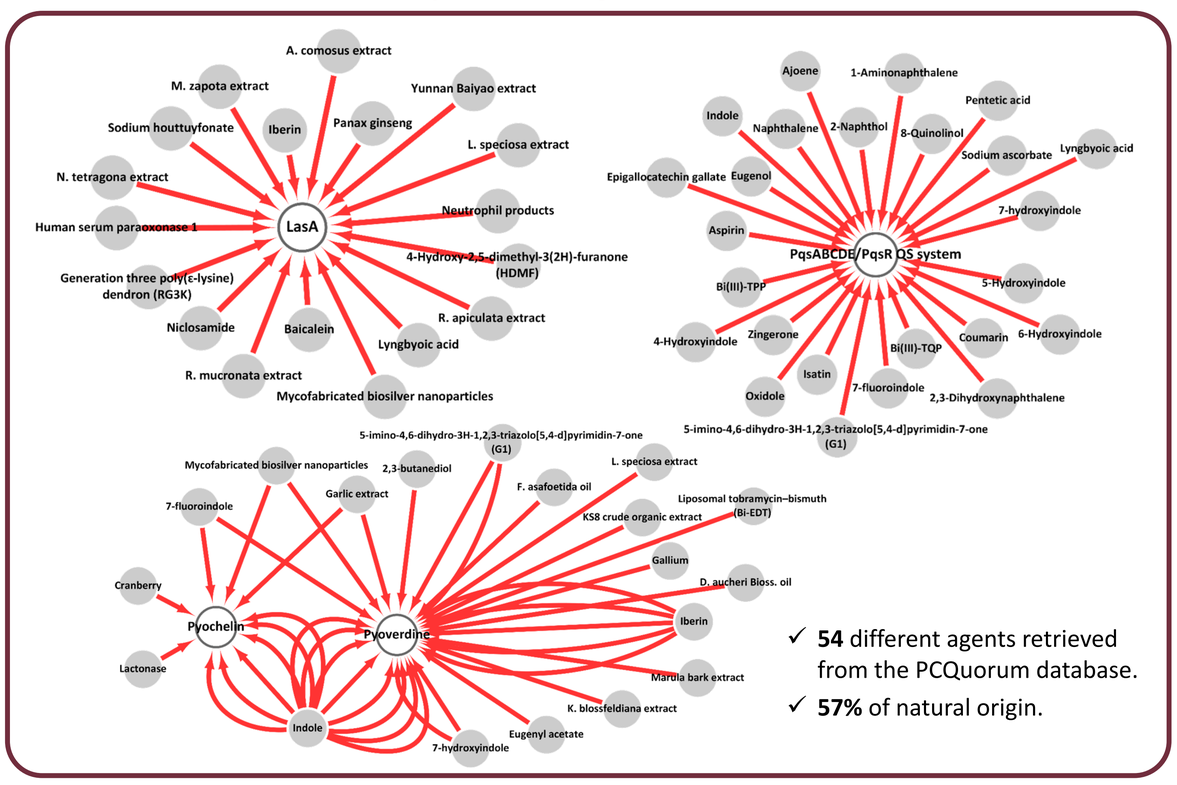
Effect of *P. aeruginosa* on *S. aureus*



✓ **Identification of major molecular players** in *P. aeruginosa-S. aureus* communication (e.g. PQS system)

Legend: upregulation; downregulation; synthesis process; effect on *S. aureus.*

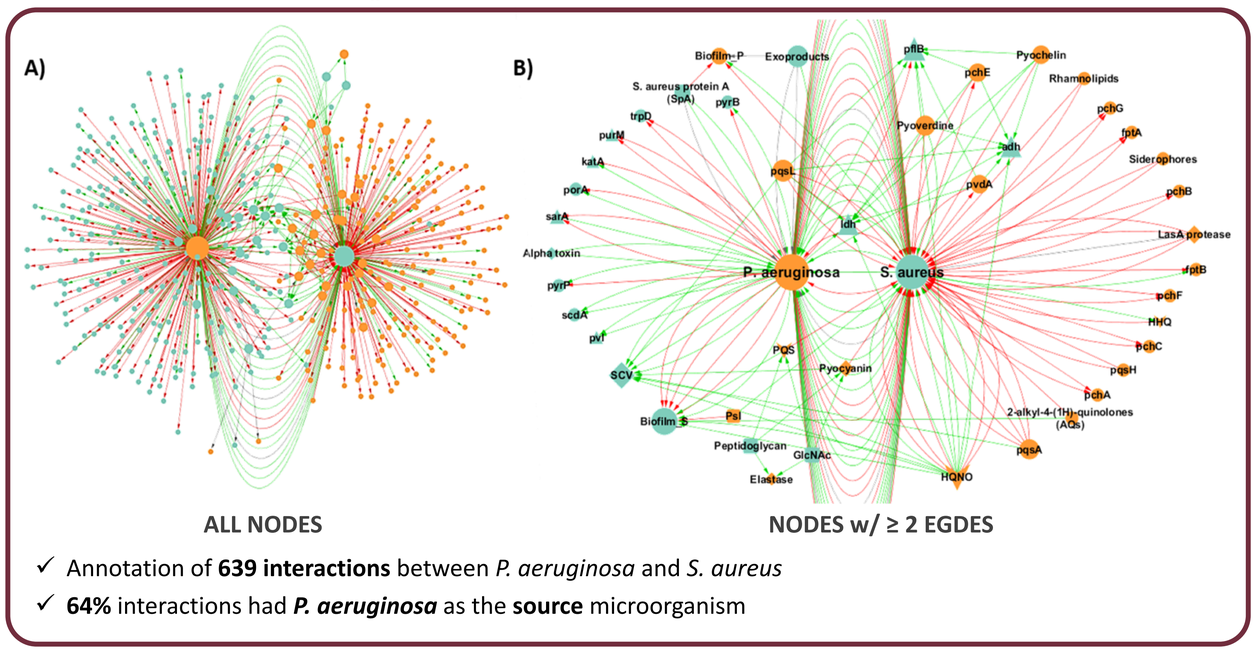
Inhibitors of Major *P. aeruginosa* Virulence Factors



✓ **54** different agents retrieved from the PCQuorum database.

✓ **57%** of natural origin.

P. aeruginosa – *S. aureus* Interaction Network



ALL NODES — NODES w/ ≥ 2 EGDES

✓ Annotation of **639 interactions** between *P. aeruginosa* and *S. aureus*

✓ **64%** interactions had ***P. aeruginosa*** as the **source** microorganism

Conclusions

✓ This work **successfully and comprehensively analyzed** all current data on ***P. aeruginosa* – *S. aureus* interactions**.

✓ The **first online database on bacterial communication** was created and **key molecular players** were pointed out as promising targets for therapy.

Acknowledgements

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