

Ecuaciones deterministas del sistema de QS de *P. aeruginosa*

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Esquema del circuito

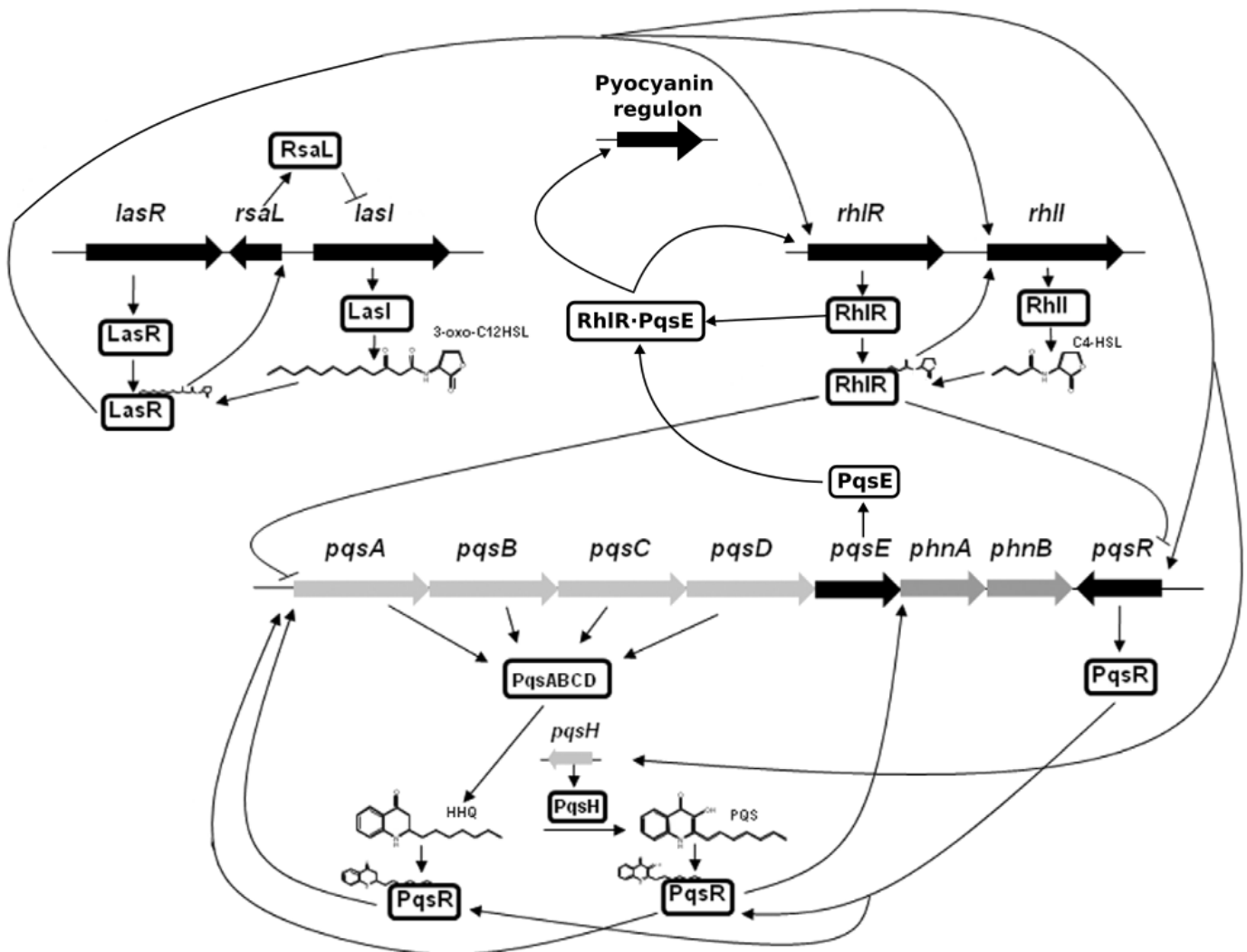


Figura 1: Representación esquemática del circuito de QS de *P. aeruginosa*.

Ecuaciones deterministas

LasR/LasI

$$[las\dot{R}] = \kappa_{lasR} - [lasR]\gamma_{lasR} \quad (1)$$

$$[Las\dot{R}] = [lasR]\kappa_{LasR} + [LasR \cdot AI_1]\sigma_{LasR \cdot AI_1} - [AI_1][LasR]\mu_{LasR \cdot AI_1} - [LasR]\gamma_{LasR} \quad (2)$$

$$[las\dot{I}] = \alpha_{lasI} + \frac{\beta_{lasI}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_1}\right)^{h_1}} - [lasI]\gamma_{lasI} \quad (3)$$

$$[Las\dot{I}] = [lasI]\kappa_{LasI} - [LasI]\gamma_{LasI} \quad (4)$$

$$[AI_1\dot{I}] = [LasI]\kappa_{AI_1} + [LasR \cdot AI_1]\sigma_{LasR \cdot AI_1} - [AI_1][LasR]\mu_{LasR \cdot AI_1} - (d(AI_1 - AI_{1ext})) - [AI_1]\gamma_{AI_1} \quad (5)$$

$$[AI_{1ext}\dot{I}] = (N \cdot d(AI_1 - AI_{1ext})) - [AI_{1ext}](\gamma_{AI_{1ext}} + d_{away}) \quad (6)$$

$$[Las\dot{R} \cdot AI_1] = [AI_1][LasR]\mu_{LasR \cdot AI_1} - [LasR \cdot AI_1](\sigma_{LasR \cdot AI_1} + \gamma_{LasR \cdot AI_1}) \quad (7)$$

LasR/LasI y RhIR/RhII

$$[\dot{lasR}] = \kappa_{lasR} - [lasR]\gamma_{lasR} \quad (1)$$

$$[\dot{LasR}] = [lasR]\kappa_{LasR} + [LasR \cdot AI_1]\sigma_{LasR \cdot AI_1} - [AI_1][LasR]\mu_{LasR \cdot AI_1} - [LasR]\gamma_{LasR} \quad (2)$$

$$[\dot{lasI}] = \alpha_{lasI} + \frac{\beta_{lasI}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_1}\right)^{h_1}} - [lasI]\gamma_{lasI} \quad (3)$$

$$[\dot{LasI}] = [lasI]\kappa_{LasI} - [LasI]\gamma_{LasI} \quad (4)$$

$$[\dot{AI_1}] = [LasI]\kappa_{AI_1} + [LasR \cdot AI_1]\sigma_{LasR \cdot AI_1} - [AI_1][LasR]\mu_{LasR \cdot AI_1} - (d(AI_1 - AI_{1ext})) - [AI_1]\gamma_{AI_1} \quad (5)$$

$$[\dot{AI_{1ext}}] = (N \cdot d(AI_1 - AI_{1ext})) - [AI_{1ext}](\gamma_{AI_{1ext}} + d_{away}) \quad (6)$$

$$[Las\dot{R} \cdot AI_1] = [AI_1][LasR]\mu_{LasR \cdot AI_1} - [LasR \cdot AI_1](\sigma_{LasR \cdot AI_1} + \gamma_{LasR \cdot AI_1}) \quad (7)$$

$$[r\dot{hlR}] = \alpha_{rhlR} + \frac{\beta_{rhlR}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_2}\right)^{h_2}} - [rhlR]\gamma_{rhlR} \quad (8)$$

$$[R\dot{hlR}] = [rhlR]\kappa_{RhlR} + [RhlR \cdot AI_2]\sigma_{RhlR \cdot AI_2} - [AI_2][RhlR]\mu_{RhlR \cdot AI_2} - [RhlR]\gamma_{RhlR} \quad (9)$$

$$[r\dot{hlI}] = \alpha_{rhlI} + \frac{\beta_{rhlI}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_3}\right)^{h_3}} + \frac{\beta_{rhlI}}{1 + \left(\frac{[RhlR \cdot AI_2]}{K_4}\right)^{h_4}} - [rhlI]\gamma_{rhlI} \quad (10)$$

$$[R\dot{hlI}] = [rhlI]\kappa_{RhlI} - [RhlI]\gamma_{RhlI} \quad (11)$$

$$[\dot{AI_2}] = [RhlI]\kappa_{AI_2} + [RhlR \cdot AI_2]\sigma_{RhlR \cdot AI_2} - [AI_2][RhlR]\mu_{RhlR \cdot AI_2} - (d(AI_2 - AI_{2ext})) - [AI_2]\gamma_{AI_2} \quad (12)$$

$$[\dot{AI_{2ext}}] = (N \cdot d(AI_2 - AI_{2ext})) - [AI_{2ext}](\gamma_{AI_{2ext}} + d_{away}) \quad (13)$$

$$[Rhl\dot{R} \cdot AI_2] = [AI_2][RhlR]\mu_{RhlR \cdot AI_2} - [RhlR \cdot AI_2](\sigma_{RhlR \cdot AI_2} + \gamma_{RhlR \cdot AI_2}) \quad (14)$$

$$[\dot{p}] = \alpha_p + \frac{\beta_p}{1 + \left(\frac{[RhlR \cdot AI_2]}{K_5}\right)^{h_5}} - [p]\gamma_p \quad (15)$$

$$[\dot{P}] = [p]\kappa_P - [P]\gamma_P \quad (16)$$

Sistema completo

$$[\dot{las}R] = \kappa_{lasR} - [lasR]\gamma_{lasR} \quad (1)$$

$$[\dot{Las}R] = [lasR]\kappa_{LasR} + [LasR \cdot AI_1]\sigma_{LasR \cdot AI_1} - [AI_1][LasR]\mu_{LasR \cdot AI_1} - [LasR]\gamma_{LasR} \quad (2)$$

$$[\dot{las}I] = \alpha_{lasI} + \frac{\beta_{lasI}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_1}\right)^{h_1}} - [lasI]\gamma_{lasI} \quad (3)$$

$$[\dot{Las}I] = [lasI]\kappa_{LasI} - [LasI]\gamma_{LasI} \quad (4)$$

$$[\dot{AI}_1] = [LasI]\kappa_{AI_1} + [LasR \cdot AI_1]\sigma_{LasR \cdot AI_1} - [AI_1][LasR]\mu_{LasR \cdot AI_1} - (d(AI_1 - AI_{1ext})) - [AI_1]\gamma_{AI_1} \quad (5)$$

$$[\dot{AI}_{1ext}] = (N \cdot d(AI_1 - AI_{1ext})) - [AI_{1ext}](\gamma_{AI_{1ext}} + d_{away}) \quad (6)$$

$$[Las\dot{R} \cdot AI_1] = [AI_1][LasR]\mu_{LasR \cdot AI_1} - [LasR \cdot AI_1](\sigma_{LasR \cdot AI_1} + \gamma_{LasR \cdot AI_1}) \quad (7)$$

$$[r\dot{hl}R] = \alpha_{rhlR} + \frac{\beta_{rhlR}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_2}\right)^{h_2}} - [rhlR]\gamma_{rhlR} \quad (8)$$

$$[R\dot{hl}R] = [rhlR]\kappa_{RhlR} + [RhlR \cdot AI_2]\sigma_{RhlR \cdot AI_2} - [AI_2][RhlR]\mu_{RhlR \cdot AI_2} - [RhlR]\gamma_{RhlR} \quad (9)$$

$$[r\dot{hl}I] = \alpha_{rhlI} + \frac{\beta_{rhlI}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_3}\right)^{h_3}} + \frac{\beta_{rhlI}}{1 + \left(\frac{[RhlR \cdot AI_2]}{K_4}\right)^{h_4}} + \frac{\beta_{rhlI}}{1 + \left(\frac{[RhlR \cdot PQS]}{K_5}\right)^{h_5}} - [rhlI]\gamma_{rhlI} \quad (10)$$

$$[R\dot{hl}I] = [rhlI]\kappa_{RhlI} - [RhlI]\gamma_{RhlI} \quad (11)$$

$$[\dot{AI}_2] = [RhlI]\kappa_{AI_2} + [RhlR \cdot AI_2]\sigma_{RhlR \cdot AI_2} - [AI_2][RhlR]\mu_{RhlR \cdot AI_2} - (d(AI_2 - AI_{2ext})) - [AI_2]\gamma_{AI_2} \quad (12)$$

$$[\dot{AI}_{2ext}] = (N \cdot d(AI_2 - AI_{2ext})) - [AI_{2ext}](\gamma_{AI_{2ext}} + d_{away}) \quad (13)$$

$$[Rhl\dot{R} \cdot AI_2] = [AI_2][RhlR]\mu_{RhlR \cdot AI_2} - [RhlR \cdot AI_2](\sigma_{RhlR \cdot AI_2} + \gamma_{RhlR \cdot AI_2}) \quad (14)$$

$$[p\dot{qs}R] = \alpha_{pqsR} + \frac{\beta_{pqsR}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_6}\right)^{h_6}} + \frac{\beta_{pqsR}}{1 + \left(\frac{[RhlR \cdot AI_2]}{K_7}\right)^{h_7}} - [pqsR]\gamma_{pqsR} \quad (15)$$

$$[P\dot{qs}R] = [pqsR]\kappa_{PqsR} + [PqsR \cdot PQS]\sigma_{PqsR \cdot PQS} - [PQS][PqsR]\mu_{PqsR \cdot PQS} - [PqsR]\gamma_{PqsR} \quad (16)$$

$$[pq s A \dot{B} C D E] = \alpha_{pq s A B C D E} + \frac{\beta_{pq s A B C D E}}{1 + \left(\frac{[R h l R \cdot A I_2]}{K_8} \right)^{h_8}} + \frac{\beta_{pq s A B C D E}}{1 + \left(\frac{[P q s R \cdot P Q S]}{K_9} \right)^{h_9}} - [pq s A B C D E] \gamma_{pq s A B C D E} \quad (17)$$

$$[P q s A \dot{B} C D] = [pq s A B C D E] \kappa_{P q s A B C D} - [P q s A B C D] \gamma_{P q s A B C D} \quad (18)$$

$$[P \dot{q} s E] = [pq s A B C D E] \kappa_{P q s E} + [R h l R \cdot P q s E] \sigma_{R h l R \cdot P q s E} - [P q s E] [R h l R] \mu_{R h l R \cdot P q s E} - [P q s E] \gamma_{P q s E} \quad (19)$$

$$[P \dot{Q} S] = [P q s A B C D] \kappa_{P Q S} + [P q s R \cdot P Q S] \sigma_{P q s R \cdot P Q S} - [P Q S] [P q s R] \mu_{P q s R \cdot P Q S} - (d(P Q S - P Q S_{ext})) - [P Q S] \gamma_{P Q S} \quad (20)$$

$$[P \dot{Q} S_{ext}] = (N \cdot d(P Q S - P Q S_{ext})) - [P Q S_{ext}] (\gamma_{P Q S_{ext}} + d_{away}) \quad (21)$$

$$[P q s \dot{R} \cdot P Q S] = [P Q S] [P q s R] \mu_{P q s R \cdot P Q S} - [P q s R \cdot P Q S] (\sigma_{P q s R \cdot P Q S} + \gamma_{P q s R \cdot P Q S}) \quad (22)$$

$$[R h l R \cdot \dot{P} q s E] = [P q s E] [R h l R] \mu_{R h l R \cdot P q s E} - [R h l R \cdot P q s E] (\sigma_{R h l R \cdot P q s E} + \gamma_{R h l R \cdot P q s E}) \quad (23)$$

$$[\dot{p}] = \alpha_p + \frac{\beta_p}{1 + \left(\frac{[R h l R \cdot A I_2]}{K_{10}} \right)^{h_{10}}} - [p] \gamma_p \quad (24)$$

$$[\dot{P}] = [p] \kappa_P - [P] \gamma_P \quad (25)$$

LasR/LasI & RsaL

$$[las\dot{R}] = \kappa_{lasR} - [lasR]\gamma_{lasR} \quad (1)$$

$$[Las\dot{R}] = [lasR]\kappa_{LasR} + [LasR \cdot AI_1]\sigma_{LasR \cdot AI_1} - [AI_1][LasR]\mu_{LasR \cdot AI_1} - [LasR]\gamma_{LasR} \quad (2)$$

$$[rsa\dot{L}] = \alpha_{rsaL} + \frac{\beta_{rsaL}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_1}\right)^{h_1}} - [rsaL]\gamma_{rsaL} \quad (3)$$

$$[Rsa\dot{L}] = [rsaL]\kappa_{RsaL} - [RsaL]\gamma_{RsaL} \quad (4)$$

$$[las\dot{I}] = \alpha_{lasI} + \frac{\beta_{lasI}}{1 + \left(\frac{[LasR \cdot AI_1]}{K_2}\right)^{h_2}} + \frac{\beta_{lasI}}{1 + \left(\frac{[RsaL]}{K_3}\right)^{h_3}} - [lasI]\gamma_{lasI} \quad (5)$$

$$[Las\dot{I}] = [lasI]\kappa_{LasI} - [LasI]\gamma_{LasI} \quad (6)$$

$$[AI_1\dot{I}] = [LasI]\kappa_{AI_1} + [LasR \cdot AI_1]\sigma_{LasR \cdot AI_1} - [AI_1][LasR]\mu_{LasR \cdot AI_1} - (d(AI_1 - AI_{1ext})) - [AI_1]\gamma_{AI_1} \quad (7)$$

$$[AI_{1ext}\dot{I}] = (N \cdot d(AI_1 - AI_{1ext})) - [AI_{1ext}](\gamma_{AI_{1ext}} + d_{away}) \quad (8)$$

$$[Las\dot{R} \cdot AI_1] = [AI_1][LasR]\mu_{LasR \cdot AI_1} - [LasR \cdot AI_1](\sigma_{LasR \cdot AI_1} + \gamma_{LasR \cdot AI_1}) \quad (9)$$