

Appendix I: DNA sequences

Oligonucleotides

bbfw:

TATCTGCAGTGACAGGATATATTGGCGGG

bbrev:

TATGAATTCGGGTTACACCACAATATATGGTGCC

mrfpalha1fw:

TATGAATTCCGTCTCAGGAGAGAGACCTTTACGGCTAGCTCAGTCCTAG

mrfpalha1rev:

ATACTGCAGCGTCTCATGACAGCGAGAGACCTATAAACGCAGAAAGGCCACC

mrfpalha2fw:

TATGAATTCCGTCTCAGTCAGGAGAGAGACCTTTACGGCTAGCTCAGTCCTAG

mrfpalha1rev:

ATACTGCAGCGTCTCAAGCGAGAGACCTATAAACGCAGAAAGGCCACC

VerTUfw:

GCAACCTCTCGGGCTTCTGGAT

VerTUrv:

ACAGCGACTTAGTTTACCCGCCA

Plasmids

pARK α 1:

CCTTGGCTTGTGGACAATGCGCTACGCGCACCGGCTCCGCCCGTGGACAACCGCAA
GCGGTTGCCACCGTCGAGCGCCTTTGCCACAACCCGGCGGCGCGGCCGCAACAGA
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ATAGTGCTAGCTACTAGAGATTAAGAGGAGAAATACTAGATGGCTTCCTCCGAA
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GCTGTCATGAGACGCTGCAGTGACAGGATATATTGGCGGGTAAACTAAGTCGCTG
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GTA AAAAGGCCGCGTTGCTGGCGTTTTTCCATAGGCTCCGCCCCCTGACGAGCAT
CACAAAATCGACGCTCAAGTCAGAGGTGGCGAAACCCGACAGGACTATAAAGAT
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CAATTATTGGTTCGC

pARK $\alpha 2$:

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pARKA11:

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pARKA12:

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pARKA13:

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pARKA21:

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pARKA22:

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pARSO11:

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pARSO12:

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C

Appendix II: Reactions of the designed genetic circuit model

LuxR



Where (1) is the transcription of the LuxR mRNA, (2) is the translation of LuxR, (3) is the degradation of the LuxR mRNA and (4) is the degradation of the LuxR protein.

LuxI



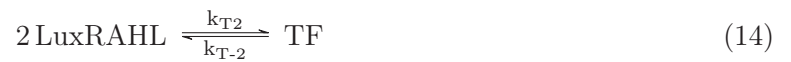
Where (5) is the transcription of the LuxI mRNA, (6) is the translation of LuxI, (7) is the degradation of the LuxI mRNA and (8) is the degradation of the LuxI protein.

AHL



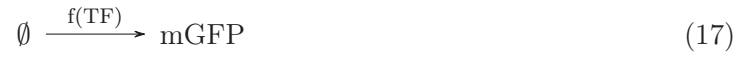
Where (9) is the synthesis of AHL by the LuxI protein, (10) is the diffusion of AHL between the cell and the medium, (11) is the degradation of the intracellular AHL and (12) is the degradation of the extracellular AHL. It is important to note that AHL_e is a species that is in the culture medium and not inside the cell, so this will have to be taken into account in the differential equation that defines its temporal evolution.

Transcription factor



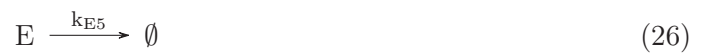
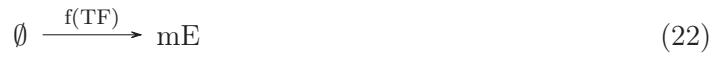
Where (13) is the association of AHL with LuxR, (14) is the dimerization of LuxRAHL, forming the transcription factor, (15) is the degradation of LuxRAHL and (16) is the degradation of the transcription factor.

GFP



Where (17) is the constitutive transcription of the GFP mRNA, (18) is the induced transcription of the GFP mRNA due to the association of the transcription factor to the DNA, (19) is the translation of the GFP, (20) is the degradation of the GFP mRNA and (21) is the degradation of the GFP.

E-lysis protein



Where (22) is the constitutive transcription of the E-lysis protein mRNA, (23) is the induced transcription of the E-lysis protein mRNA due to the association of the transcription factor to the DNA, (24) is the translation of the E-lysis protein, (25) is the degradation of the E-lysis protein mRNA and (26) is the degradation of the E-lysis protein.

Appendix III: Models used in DNA basic parts characterization

Characterization of the interaction of LuxR with the pLux promoter

$$\frac{dX}{dt} = \mu X - \frac{\mu X^2}{K_{\text{max}}} \quad (27)$$

$$\frac{d[mLuxR]}{dt} = k_{R1} - (k_{R3} + \mu)[mLuxR] \quad (28)$$

$$\frac{d[LuxR]}{dt} = k_{R2}[mLuxR] - k_{T1}[LuxR][AHL_i] + k_{T-1}[LuxRAHL] - (k_{R4} + \mu)[LuxR] \quad (29)$$

$$\frac{d[AHL_i]}{dt} = k_{A2}Vc[AHL_e] - k_{T1}[LuxR][AHL_i] + k_{T-1}[LuxRAHL] - (k_{A2} + k_{A3} + \mu)[AHL_i] \quad (30)$$

$$\frac{d[AHL_e]}{dt} = k_{A2}[AHL_i] - X(k_{A2}Vc[AHL_e]) - k_{A4}[AHL_e] \quad (31)$$

$$\frac{d[LuxRAHL]}{dt} = k_{T1}[LuxR][AHL_i] - k_{T-1}[LuxRAHL] - 2k_{T2}[LuxRAHL]^2 + 2k_{T-2}[TF] - (k_{T3} + \mu)[LuxRAHL] \quad (32)$$

$$\frac{d[TF]}{dt} = k_{T2}[LuxRAHL]^2 - k_{T-2}[TF] - (k_{T4} + \mu)[TF] \quad (33)$$

$$\frac{d[mGFP]}{dt} = k_{G1}CN_g \frac{[TF]}{[TF] + k_{G2}} + \alpha_g \frac{k_{G2}}{[TF] + k_{G2}} - (k_{G4} + \mu)[mGFP] \quad (34)$$

$$\frac{d[GFP]}{dt} = k_{G3}[mGFP] - (k_{G5} + \mu)[GFP] \quad (35)$$

Where (27) is the temporal evolution of the biomass (number of cells), (28) is the temporal evolution of the amount of the LuxR mRNA, (29) is the temporal evolution of the amount of the LuxR protein, (30) is the temporal evolution of the intracellular AHL, (31) is the temporal evolution of extracellular AHL, (32) is the temporal evolution of the heterodimer LuxR-AHL, (33) is the temporal evolution of the transcription factor, (34) is the temporal evolution of the GFP mRNA, (35) is the temporal evolution of the GFP. The concentration of all species is expressed in nM, which inside the cell is equivalent to molecules/cell (Boada Acosta, 2018).

Characterization of the lethality of E-lysis protein

$$\frac{dX}{dt} = \mu X - \frac{\mu X^2}{K_{\text{max}}} - \frac{K_{m_e}[E]^n}{\Theta^n + [E]^n} X \quad (36)$$

$$\frac{d[mLuxR]}{dt} = k_{R1} - (k_{R3} + \mu)[mLuxR] \quad (37)$$

$$\frac{d[LuxR]}{dt} = k_{R2}[mLuxR] - k_{T1}[LuxR][AHL_i] + k_{T-1}[LuxRAHL] - (k_{R4} + \mu)[LuxR] \quad (38)$$

$$\frac{d[AHL_i]}{dt} = k_{A2}Vc[AHL_e] - k_{T1}[LuxR][AHL_i] + k_{T-1}[LuxRAHL] - (k_{A2} + k_{A3} + \mu)[AHL_i] \quad (39)$$

$$\frac{d[AHL_e]}{dt} = k_{A2}[AHL_i] - X(k_{A2}Vc[AHL_e]) - k_{A4}[AHL_e] \quad (40)$$

$$\frac{d[LuxRAHL]}{dt} = k_{T1}[LuxR][AHL_i] - k_{T-1}[LuxRAHL] - 2k_{T2}[LuxRAHL]^2 + 2k_{T-2}[TF] - (k_{T3} + \mu)[LuxRAHL] \quad (41)$$

$$\frac{d[TF]}{dt} = k_{T2}[LuxRAHL]^2 - k_{T-2}[TF] - (k_{T4} + \mu)[TF] \quad (42)$$

$$\frac{d[E]}{dt} = k_{G1}CN_e \frac{[TF]}{[TF] + k_{G2}} + \alpha_g \frac{k_{G2}}{[TF] + k_{G2}} - (k_{G4} + \mu)[mE] \quad (43)$$

$$\frac{d[E]}{dt} = k_{G3}[mE] - (k_{G5} + \mu)[E] \quad (44)$$

Where (36) is the temporal evolution of the biomass (number of cells), (37) is the temporal evolution of the amount of the LuxR mRNA, (29) is the temporal evolution of the amount of the LuxR protein, (39) is the temporal evolution of the intracellular AHL, (40) is the temporal evolution of extracellular AHL, (41) is the temporal evolution of the heterodimer LuxR-AHL, (42) is the temporal evolution of the transcription factor, (43) is the temporal evolution of the E-lysis protein mRNA, (44) is the temporal evolution of the E-lysis protein. The concentration of all species is expressed in nM, which inside the cell is equivalent to molecules/cell (Boada Acosta, 2018).