

Comparator Rxn Network Model: Try #1

Sketched Network Reactions:

λ CI DNA w/ TetR promoter \rightarrow λ CI mRNA \rightarrow λ CI repressor protein

*Repressed by TetR protein (constitutively produced in DH5alphaPro)

p22 mnt DNA w/ LacI promoter \rightarrow p22 mnt mRNA \rightarrow p22 mnt repressor protein

*Repressed by LacI protein (constitutively produced in DH5alphaPro)

GFP DNA w/ λ CI:LacI promoter \rightarrow GFP mRNA \rightarrow GFP reporter protein

*Doubly repressed by λ CI and LacI

YFP DNA w/ p22mnt:TetR promoter \rightarrow YFP mRNA \rightarrow YFP reporter protein

*Doubly repressed by p22 mnt and TetR

Single Network Elements:

1. λ CI DNA \rightarrow λ CI protein

Reaction	K	Source
$\text{RNAP} + \text{tetR2P}:\text{tetR2O1}:\text{tetR2O2} \rightarrow \text{RNAP}:\text{tetR2P}:\text{tetR2O1}:\text{tetR2O2}$	8.6e5	2
$\text{RNAP}:\text{tetR2P} \rightarrow \text{RNAP}:\text{tetR2P}^*$	0.13	2
$\text{RNAP}:\text{tetR2P}:\text{tetR2O1}:\text{tetR2O2} \rightarrow \text{RNAP} + \text{tetR2P}:\text{tetR2O1}:\text{tetR2O2}$	.1	2
$\text{RNAP}:\text{tetR2P}^* \rightarrow \text{RNAP}:\lambda\text{CIcodeDNA} + \text{tetR2P}:\text{tetR2O1}:\text{tetR2O2}$	30 nt/s	2
$\text{RNAP}:\lambda\text{CIcodeDNA} \rightarrow \text{RNAP} + \lambda\text{CI mRNA}$	30 nt/s, 708 nt	2
$\lambda\text{CI mRNA RBS} + \text{rib} \rightarrow \text{rib}:\lambda\text{CI mRNA RBS}$	1.0e5	2
$\text{rib}:\lambda\text{CI mRNA RBS} \rightarrow \text{rib}:\lambda\text{CI mRNA}_1 + \text{RBS}$	33 aa/s	2
$\text{rib}:\lambda\text{CI mRNA}_1 \rightarrow \text{rib} + \lambda\text{CI} + \text{D}\lambda\text{CI}$	33 aa/s, 236 aa	2
Repression at O1		
$\text{tetR2} + \text{aTc} \rightarrow \text{tetR2}:\text{aTc}$	100000000	1
$\text{tetR2}:\text{aTc} \rightarrow \text{tetR2} + \text{aTc}$	0.001	1
$\text{tetR2}:\text{aTc} + \text{aTc} \rightarrow \text{tetR2}:\text{aTc2}$	100000000	1
$\text{tetR2}:\text{aTc2} \rightarrow \text{tetR2}:\text{aTc} + \text{aTc}$	0.001	1
$\text{tetR2} + \text{tetO1} \rightarrow \text{tetR2}:\text{tetO1}$	100000000	1
$\text{tetR2}:\text{tetO1} \rightarrow \text{tetR2} + \text{tetO1}$	.001	1
$\text{tetR2}:\text{aTc} + \text{tetO1} \rightarrow \text{tetR2}:\text{tetO1}:\text{aTc}$	100000000	1
$\text{tetR2}:\text{tetO1}:\text{aTc} \rightarrow \text{tetR2}:\text{aTc} + \text{tetO1}$	1	1
$\text{tetR2}:\text{aTc2} + \text{tetO1} \rightarrow \text{tetR2}:\text{tetO1}:\text{aTc2}$	100000000	1
$\text{tetR2}:\text{tetO1}:\text{aTc2} \rightarrow \text{tetR2}:\text{aTc2} + \text{tetO1}$	100000	1
$\text{tetR2}:\text{tetO1} + \text{aTc} \rightarrow \text{tetR2}:\text{tetO1}:\text{aTc}$	100000000	1
$\text{tetR2}:\text{tetO1}:\text{aTc} \rightarrow \text{tetR2}:\text{tetO1} + \text{aTc}$	.001	1
$\text{tetR2}:\text{tetO1}:\text{aTc} + \text{aTc} \rightarrow \text{tetR2}:\text{tetO1}:\text{aTc2}$	100000000	1
$\text{tetR2}:\text{tetO1}:\text{aTc2} \rightarrow \text{tetR2}:\text{tetO1}:\text{aTc} + \text{aTc}$	.001	1
Repression at O2		
$\text{tetR2} + \text{tetO2} \rightarrow \text{tetR2}:\text{tetO2}$	100000000	1

tetR2:tetO2 → tetR2 tetO2	.001	1
tetR2:aTc + tetO2 → tetR2:tetO2:aTc	100000000	1
tetR2:tetO2:aTc → tetR2:aTc + tetO2	1	1
tetR2:aTc2 + tetO2 → tetR2:tetO2:aTc2	100000000	1
tetR2:tetO2:aTc2 → tetR2:aTc2 + tetO2	100000	1
tetR2:tetO2 + aTc → tetR2:tetO2:aTc	100000000	1
tetR2:tetO2:aTc → tetR2:tetO2 + aTc	.001	1
tetR2:tetO2:aTc + aTc → tetR2:tetO2:aTc2	100000000	1
tetR2:tetO2:aTc2 → tetR2:tetO2:aTc + aTc	.001	1

2. p22 mnt DNA → p22 mnt Protein

Reaction	K	Source
RNAp + lacIP:lacIO1 → RNAp:lacIP:lacIO1	2e6	2
RNAp:lacIP → RNAp:lacIP*	.01	2
RNAp:lacIP:lacIO1 → RNAp + lacIP:lacIO1	.06	2
RNAp:lacIP* → RNAp: p22mnt_codeDNA + lacIP:lacIO1	30 nt/s	2
RNAp: p22mnt_codeDNA → RNAp + p22mnt mRNA	30 nt/s, 249 nt	2
p22mnt mRNA_RBS + rib → rib: p22mnt mRNA_RBS	1.0e5	2
rib: p22mnt mRNA_RBS → rib: p22mnt mRNA_1 + RBS	33 aa/s	2
rib: p22mnt mRNA_1 → rib + p22mnt + Dp22mnt	33 aa/s, 83 aa	2
Repression at LacO1		
lacI4 + lacO1 → lacI4:lacO1	2E+09	1
lacI4:lacO1 → lacI4 + lacO1	4.00E-04	1
lacI4 + IPTG → lacI4:IPTG	4.60E+06	1
lacI4:IPTG → lacI4 + IPTG	0.2	1
lacI4:lacO1 + IPTG → lacI4:lacO1:IPTG	1.00E+06	1
lacI4:lacO1:IPTG → lacI4:lacO1 + IPTG	0.8	1
lacI4:IPTG + lacO1 → lacI4:lacO1:IPTG	2E+09	1
lacI4:lacO1:IPTG → lacI4:IPTG + lacO1	0.4	1

3. GFP DNA → GFP Protein (E- Reporter)

Reaction	K	Source
RNAp + λcI/LacIP: λcIO1: λcIO2:lacIO1_1 → RNAp:λcI/LacIP: λcIO1:λcIO2:lacIO1_1	1e6	2
RNAp: λcI/lacIP → RNAp: λcI/lacIP*	.075	2
RNAp:λcI/LacIP:λcIO1:λcIO2:lacIO1_1 → RNAp + λcI/LacIP: λcIO1:λcIO2:lacIO1_1	.075	2
RNAp: λcI/lacIP* → RNAp:GFP_codeDNA + λcI/LacIP: λcIO1: λcIO2:lacIO1_1	30 nt/s	2
RNAp:GFP_codeDNA → RNAp + GFP mRNA	30 nt/s, 720 nt	2
GFP mRNA_RBS + rib → rib:GFP mRNA_RBS	1.0e5	2
rib:GFP mRNA_RBS → rib:GFP mRNA_1 + RBS	33 aa/s	2
rib:GFP mRNA_1 → rib + GFP + DGFP	33 aa/s, 240 aa	2
Repression at λcIO1		
λcI2 + λcIO1 → λcI2: λcIO1	1.2e7	Vershon

$\lambda cI2: \lambda cI01 \rightarrow \lambda cI2 + \lambda cI01$	2.4e-4	Vershon
Repression at $\lambda cI02$		
$\lambda cI2 + \lambda cI02 \rightarrow \lambda cI2: \lambda cI02$	1.2e7	Vershon
$\lambda cI2: \lambda cI02 \rightarrow \lambda cI2 + \lambda cI02$	2.4e-4	Vershon
Repression at $lacI01_2$		
$lacI4 + lacO1_2 \rightarrow lacI4: lacO1_2$	2E+09	1
$lacI4: lacO1_2 \rightarrow lacI4 + lacO1_2$	4.00E-04	1
$lacI4 + IPTG \rightarrow lacI4: IPTG$	4.60E+06	1
$lacI4: IPTG \rightarrow lacI4 + IPTG$	0.2	1
$lacI4: lacO1_2 + IPTG \rightarrow lacI4: lacO1_2: IPTG$	1.00E+06	1
$lacI4: lacO1_2: IPTG \rightarrow lacI4: lacO1_2 + IPTG$	0.8	1
$lacI4: IPTG + lacO1_2 \rightarrow lacI4: lacO1_2: IPTG$	2E+09	1
$lacI4: lacO1_2: IPTG \rightarrow lacI4: IPTG + lacO1_2$	0.4	1

4. RFP DNA \rightarrow RFP Protein (E+ reporter)

Reaction	K	Source
$RNAp + p22mnt/tetRP: tetRO1: p22mntO1 \rightarrow RNAp: p22mnt/ tetRP: tetRO1: p22mntO1$	1e6	2
$RNAp: p22mnt/ tetRP \rightarrow RNAp: p22mnt/ tetRP *$	.075	2
$RNAp: p22mnt/ tetRP: tetRO1: p22mntO1 \rightarrow RNAp + p22mnt/ tetRP: tetRO1: p22mntO1$	.075	2
$RNAp: p22mnt/ tetRP * \rightarrow RNAp: RFP_codeDNA + p22mnt/tetRP: tetRO1: p22mntO1$	30 nt/s	2
$RNAp: RFP_codeDNA \rightarrow RNAp + RFP_mRNA$	30 nt/s, 711 nt	2
$RFP_mRNA_RBS + rib \rightarrow rib: RFP_mRNA_RBS$	1.0e5	2
$rib: RFP_mRNA_RBS \rightarrow rib: RFP_mRNA_1 + RBS$	33 aa/s	2
$rib: RFP_mRNA_1 \rightarrow rib + RFP + DRFP$	33 aa/s, 237 aa	2
Repression at $tetRO1_2$		
$tetR2 + aTc \rightarrow tetR2: aTc$	100000000	1
$tetR2: aTc \rightarrow tetR2 + aTc$	0.001	1
$tetR2: aTc + aTc \rightarrow tetR2: aTc2$	100000000	1
$tetR2: aTc2 \rightarrow tetR2: aTc + aTc$	0.001	1
$tetR2 + tetO1_2 \rightarrow tetR2: tetO1_2$	100000000	1
$tetR2: tetO1_2 \rightarrow tetR2 + tetO1_2$	.001	1
$tetR2: aTc + tetO1_2 \rightarrow tetR2: tetO1_2: aTc$	100000000	1
$tetR2: tetO1_2: aTc \rightarrow tetR2: aTc + tetO1_2$	1	1
$tetR2: aTc2 + tetO1_2 \rightarrow tetR2: tetO1_2: aTc2$	100000000	1
$tetR2: tetO1_2: aTc2 \rightarrow tetR2: aTc2 + tetO1_2$	100000	1
$tetR2: tetO1_2 + aTc \rightarrow tetR2: tetO1_2: aTc$	100000000	1
$tetR2: tetO1_2: aTc \rightarrow tetR2: tetO1_2 + aTc$	.001	1
$tetR2: tetO1_2: aTc + aTc \rightarrow tetR2: tetO1_2: aTc2$	100000000	1
$tetR2: tetO1_2: aTc2 \rightarrow tetR2: tetO1_2: aTc + aTc$	.001	1
Repression at $p22mntO1$		
$p22mnt2 + p22mntO1 \rightarrow p22mnt2: p22mntO1$	1.2e7	Vershon
$p22mnt2: p22mntO1 \rightarrow p22mnt2 + p22mntO1$	2.4e-4	Vershon

5. Dimerization

Reaction	K	Source
Dimerization of λcI		
$2 \lambda cI \rightarrow \lambda cI_2$	1.0e9 X?	2
$\lambda cI_2 \rightarrow 2 \lambda cI$	10 X?	2
Dimerization of p22 mnt		
$2 p22mnt \rightarrow p22mnt_2$	1.0e9 X?	2
$p22mnt_2 \rightarrow 2 p22mnt$	10 X?	2

6. Degradation

Reaction	K	Source
$\lambda cI \text{ mRNA} \rightarrow$	2.0e-03	2
$p22mnt \text{ mRNA} \rightarrow$	2.0e-03	1
$GFP \text{ mRNA} \rightarrow$	1.16e-03	1
$RFP \text{ mRNA} \rightarrow$	1.16e-03	1
$\lambda cI \rightarrow$	X?	
$p22mnt \rightarrow$	X?	
$GFP \rightarrow$	3.21E-05	1
$RFP \rightarrow$	3.21E-05	1
$\lambda cI_2 \rightarrow$	3e-04	2
$p22mnt_2 \rightarrow$	3e-04	2