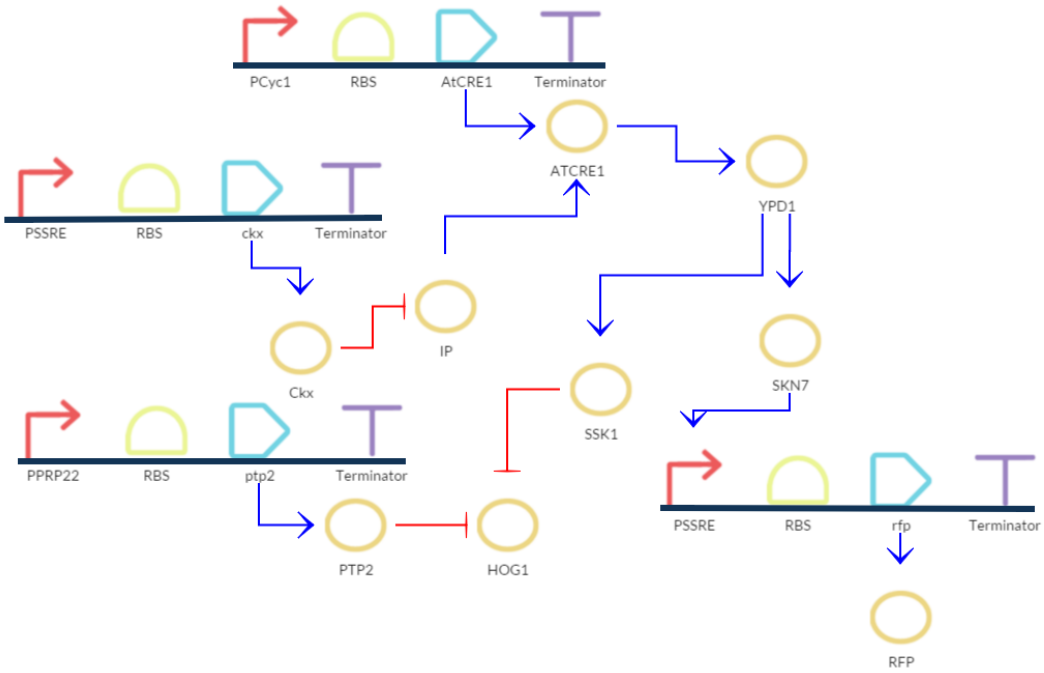
Bioreactor



Formulae for two certain parts

Ckx and ckx

$$\frac{d[\mathrm{Ckx}]}{dt} = \chi_{PSSRE}\alpha_{Ckx}[\mathrm{ckx}] - \mathrm{k}_{\deg}[\mathrm{Ckx}]$$

IP and Ckx

$$\frac{d[\mathrm{IP}]}{dt} = -\left(k_{dip} + k_{dil}\right)[\mathrm{IP}] - \mathrm{k}_{\deg}\frac{[\mathrm{Ckx}][\mathrm{IP}]}{Kd + [\mathrm{IP}]}$$

ATCRE1 and AtCRE1

$$\frac{d[\mathrm{ATCRE1}]}{dt} = \chi_{PCyc1}\alpha_{ATCRE}[\mathrm{AtCRE1}] - k_{\deg}[\mathrm{ATCRE1}]$$

ATCRE1 and IP

$$\frac{d[\mathrm{ATCRE1}]}{dt} = \alpha_{ATCRE}[\mathrm{IP}] - k_{\deg}[\mathrm{ATCRE1}]$$

YPD1 and ATCRE1

$$\frac{d[\mathrm{YPD1}]}{dt} = \alpha_{YPD1}\frac{[\mathrm{ATCRE1}]^n}{Kd + [\mathrm{ATCRE1}]^n} - k_{\deg}[\mathrm{YPD1}]$$

SSK1 and YPD1

$$\frac{d[\mathrm{SSK1}]}{dt} = \alpha_{SSK1}\frac{[\mathrm{YPD1}]^n}{Kd + [\mathrm{YPD1}]^n} - \mathrm{k}_{\deg}[\mathrm{SSK1}]$$

SKN7 and YPD1

$$\frac{d[\mathrm{SKN7}]}{dt} = \alpha_{SKN7}\frac{[\mathrm{YPD1}]^n}{Kd+[\mathrm{YPD1}]^n} - k_{\deg}[\mathrm{SKN7}]$$

RFP and SKN7

$$\frac{d[\mathrm{RFP}]}{dt} = \chi_{PSSRE}\alpha_{RFP}\frac{[\mathrm{SKN7}]^n}{Kd+[\mathrm{SKN7}]^n} - k_{\deg}[\mathrm{RFP}]$$

HOG1 and SSK1

$$\frac{d[\mathrm{HOG1}]}{dt} = \alpha_{HOG1}\frac{1}{1+\left(\frac{[\mathrm{SSK1}]}{\beta_{SSK1}}\right)^{n_{SSK1}}} - k_{\deg}[\mathrm{HOG1}]$$

HOG1 and PTP2

$$\frac{d[\mathrm{HOG1}]}{dt} = \alpha_{HOG1}\frac{1}{1+\left(\frac{[\mathrm{PTP2}]}{\beta_{PTP2}}\right)^{n_{PTP2}}} - k_{\deg}[\mathrm{HOG1}]$$

PTP2 and ptp2

$$\frac{d[\mathrm{PTP2}]}{dt} = \chi_{PPRP22}\alpha_{PTP2}[\mathrm{ptp2}] - k_{\deg}[\mathrm{PTP2}]$$

Formulae for numerical simulation

$$\frac{d[\mathrm{Ckx}]}{dt} = \chi_{PSSRE}\alpha_{Ckx}[\mathrm{ckx}] - \mathrm{k}_{\deg}[\mathrm{Ckx}]$$

$$\frac{d[\mathrm{IP}]}{dt} = -\left(k_{dip}+k_{dil}\right)[\mathrm{IP}] - \mathrm{k}_{\deg}\frac{[\mathrm{Ckx}][\mathrm{IP}]}{Kd+[\mathrm{IP}]}$$

$$\frac{d[\mathrm{ATCRE1}]}{dt} = \chi_{PCyc1}\alpha_{ATCRE1}[\mathrm{AtCRE1}] + \alpha_{ATCRE1}[\mathrm{IP}] - k_{\deg}[\mathrm{ATCRE1}]$$

$$\frac{d[\mathrm{YPD1}]}{dt} = \alpha_{YPD1}\frac{[\mathrm{ATCRE1}]^n}{Kd+[\mathrm{ATCRE1}]^n} - k_{\deg}[\mathrm{YPD1}]$$

$$\frac{d[\mathrm{SSK1}]}{dt} = \alpha_{SSK1}\frac{[\mathrm{YPD1}]^n}{Kd+[\mathrm{YPD1}]^n} - \mathrm{k}_{\deg}[\mathrm{SSK1}]$$

$$\frac{d[\mathrm{SKN7}]}{dt} = \alpha_{SKN7}\frac{[\mathrm{YPD1}]^n}{Kd+[\mathrm{YPD1}]^n} - k_{\deg}[\mathrm{SKN7}]$$

$$\frac{d[\mathrm{RFP}]}{dt} = \chi_{PSSRE}\alpha_{GFP}\frac{[\mathrm{SKN7}]^n}{Kd+[\mathrm{SKN7}]^n} - k_{\deg}[\mathrm{RFP}]$$

$$\frac{d[\mathrm{PTP\,2}]}{dt} = \chi_{PPRP22}\alpha_{PTP2}[\mathrm{ptp\,2}] - k_{\deg}[\mathrm{PTP\,2}]$$

Parameter Table

Symbols	Parameters	Values and Units
Alpha_Ckx	Production rate of Ckx	2.35umol*min^-1
Alpha_IP	Production rate of IP	2.47umol*min^-1
Alpha_ATCRE	Production rate of ATCRE	3.62umol*min^-1
Alpha_YPD1	Production rate of YPD1	2.83umol*min^-1
Alpha_PSSRE	Production rate of PSSRE	3.56umol*min^-1
Alpha_SKN7	Production rate of SKN7	2.59umol*min^-1
Alpha_SSK1	Production rate of SSK1	3.45umol*min^-1
Alpha_RFP	Production rate of RFP	2.46umol*min^-1
Alpha_PTP2	Production rate of PTP2	2.53umol*min^-1
Alpha_HOG1	Production rate of HOG1	3.74umol*min^-1
Beta_SSK1	SSK1 Repression coefficient	4.2
Beta_PTP2	PTP2 Repression coefficient	3.6
n_SSK1	SSK1 cooperativity coefficient	3
n_PTP2	PTP2 cooperativity coefficient	2
K_deg	Degradation rate of protein	0.93s^-1
n	Hill coefficient	2
Kd	Repression coefficient	2.8
K_dip	Dissipation rate of cells	1.5(umol/ul)*min^-1
K_dil	Dilution rate of cells	1.27(umol/ul)*min^-1

Reference: http://2008.igem.org/Team:University_of_Ottawa/Project