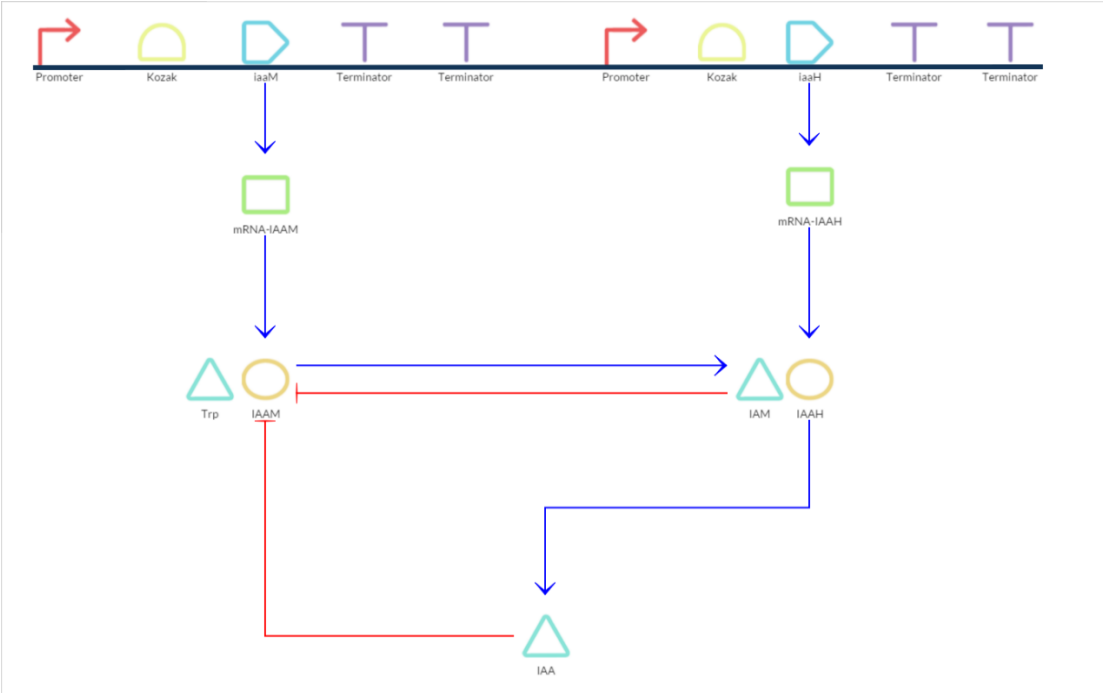
Auxin production



Formulae for two certain parts

mRNA-IAAM and iaaM:

$$\frac{d[\mathrm{mRNA-IAAM}]}{dt} = p_r \chi_{promoter1}[\mathrm{iaaM}] - \mathrm{d}_{mRNA}[\mathrm{mRNA-IAAM}]$$

mRNA -IAAH and iaaH:

$$\frac{d[\mathrm{mRNA-}IAAH]}{dt} = p_r \chi_{promoter2}[\mathrm{iaaH}] - \mathrm{d}_{mRNA}[\mathrm{mRNA-}IAAH]$$

IAAM and mRNA-IAAM:

$$\frac{d[\mathrm{IAAM}]}{dt} = k_2[\mathrm{mRNA-}IAAM] - \mathrm{d}_{protein}[\mathrm{IAAM}]$$

IAAM and IAM:

$$\frac{d[\mathrm{IAAM}]}{dt} = -\frac{\mathrm{k}_{iIAM}\mathrm{k}_{iIAA}[\mathrm{IAAM}]}{km_{IAAM}k_{iIAM}k_{iIAA} + km_{IAAM}k_{iIAM}[\mathrm{IAM}]} - d_{protein}[\mathrm{IAAM}]$$

IAAM and IAA:

$$\frac{d[\mathrm{IAAM}]}{dt} = -\frac{\mathrm{k}_{iIAM}\mathrm{k}_{iIAA}[\mathrm{IAAM}]}{km_{IAAM}k_{iIAM}k_{iIAA} + km_{IAAM}k_{iIAA}\,\mathrm{km}_{IAAH}[\mathrm{IAA}]} - d_{protein}[\mathrm{IAAM}]$$

IAAH and mRNA -IAAH

$$\frac{d[\mathrm{IAAH}]}{dt} = k_2[\mathrm{mRNA-IAAH}] - d_{protein}[\mathrm{IAAH}]$$

IAAH and IAM:

$$\frac{d[\mathrm{IAAH}]}{dt} = -\frac{k_{IAAH}[\mathrm{IAAH}][\mathrm{IAM}]}{km_{IAAH} + [\mathrm{IAM}]} - d_{protein}[\mathrm{IAAH}]$$

IAM and IAAM and IAA：

$$\frac{d[\mathrm{IAM}]}{dt} = \frac{k_{IAAM}\,\mathrm{k}_{iIAM}\,k_{iIAA}[\mathrm{IAAM}]}{km_{IAAM}k_{iIAM}k_{iIAA} + km_{IAAM}k_{iIAM}[\mathrm{IAM}]} - d_{compound}[\mathrm{IAM}]$$

$$\frac{d[\mathrm{IAM}]}{dt} = \frac{k_{IAAM}k_{iIAM}k_{iIAA}[\mathrm{IAAM}]}{km_{IAAM}k_{iIAM}k_{iIAA} + km_{IAAM}k_{iIAA}[\mathrm{IAA}]} - d_{compound}[\mathrm{IAM}]$$

IAA and IAAH:

$$\frac{d[\mathrm{IAA}]}{dt} = \frac{k_{IAAH}[\mathrm{IAAH}]}{km_{IAAH} + [\mathrm{IAAH}]} - P[\mathrm{IAA}] - d_{compound}[\mathrm{IAA}]$$

DIAA：

$$\frac{d[\mathrm{dIAA}]}{dt} = p[\mathrm{IAA}]$$

Trp1：

$$\frac{d[\mathrm{Trp}_1]}{dt} = k_{Trp_1} - d_{compound}[\mathrm{Trp}_1]$$

Formulae for numerical simulation

$$\frac{d[\mathrm{IAAM}]}{dt} = -\frac{\mathrm{k}_{iIAM}\mathrm{k}_{iIAA}[\mathrm{IAAM}][\mathrm{Trp}_1]}{km_{IAAM}k_{iIAM}k_{iIAA} + km_{IAAM}k_{iIAM}[\mathrm{IAM}] + km_{IAAM}k_{iIAA}\,\mathrm{km}_{IAAH}[\mathrm{IAA}]} - d_{protein}[\mathrm{IAAM}]$$

$$\frac{d[\mathrm{IAM}]}{dt} = \frac{k_{IAAM}\,\mathrm{k}_{iIAM}\,k_{iIAA}[\mathrm{IAAM}][\mathrm{Trp}_1]}{km_{IAAM}k_{iIAM}k_{iIAA} + km_{IAAM}k_{iIAM}[\mathrm{IAM}] + km_{IAAM}k_{iIAM}k_{iIAA} + km_{IAAM}k_{iIAA}[\mathrm{IAA}]} - d_{compound}[\mathrm{IAM}]$$

Parameter Table

Symbols	Parameters	Values	Units
P_r	Transcription rate for iaaM and iaaH	1	uM*min^-1
d_mRNA	Degradation rate of mRNA for IAAM and IAAH	0.017	min^-1
K_z	Translation rate constant for mRNA-IAAM and mRNA-IAAH	1	min^-1
d_protein	Degradation rate of IAAM and IAAH	0.0017	min^-1
d_compound	Degradation rate constant of compounds Trp, IAM and IAA	0.0013	min^-1
k_IAAM	Turnover number: the maximum number of Trp converted to IAM	0.2202	min^-1
Km_IAAM	Michaelis constant from Trp consumption to form IAM	50	uM
Ki_IAM	Enzyme inhibition equilibrium constant for IAM	7	uM
Ki_IAA	Enzyme inhibition equilibrium constant for IAM	225	uM
K_IAAH	Turnover number, the maximum of IAM converted to IAA	0.2202	min^-1
Km_IAAH	Michaelis constant from IAM consumption to form IAA	80	uM
p	Permeability of plasma membrane for IAA	6*10^-5	cm*min^-1
K_trp1	Translation rate of Trp	1	min^-1

Reference: http://2012.igem.org/Team:Evry