Table 1

Table 1. Variables of the quantitative model

Variable	Description
x_1	[free AtRGS1]
x_2	[AtRGS1:G$\alpha^{GDP}\beta\gamma$ complex]
x_3	[AtRGS1:G$\alpha^{GTP}\beta\gamma$ complex]
x_4	[AtRGS1:Gα^{GDP} complex]
x_5	[AtRGS1:Gα^{GTP} complex]
x_6	[G$\alpha^{GDP}\beta\gamma$]
x_7	[G$\alpha^{GTP}\beta\gamma$]
x_8	[Gα^{GDP}]
x_9	[Gα^{GTP}]
x_{10}	[G$\beta\gamma$]
x_{11}	[Phosphorylated AtRGS1]
x_{12}	[Internalized AtRGS1]
x_{13}	[Hypothetical D-glucose (co)receptor]
x_{14}	[Kinase 2] (not present in the one-kinase model)
x_{15}	[Kinase 1]
L	[D-glucose]

Table 2

Table 2. Ordinary Differential Equations of the quantitative model

$$\frac{dx_1}{dt} = -k_{17} \cdot x_1 \cdot x_7 - k_{18} \cdot x_1 \cdot x_9 - k_{12} \cdot x_1 + k_{24} \cdot x_5 + k_{25} \cdot x_3 + k_{27} \cdot x_{12}$$

$$\frac{dx_2}{dt} = k_4 \cdot x_3 + k_8 \cdot x_4 \cdot x_{10} - k_6 \cdot x_2 - k_{16} \cdot x_2$$

$$\frac{dx_3}{dt} = k_6 \cdot x_2 - k_4 \cdot x_3 - k_{11} \cdot x_3 \cdot \frac{x_{13}^{k_{14}}}{k_{26}^{k_{14}} + x_{13}^{k_{14}}} - k_{25} \cdot x_3 + k_{17} \cdot x_1 \cdot x_7 + k_{13} \cdot x_5 \cdot x_{10}$$

$$\frac{dx_4}{dt} = k_4 \cdot x_5 - k_6 \cdot x_4 - k_8 \cdot x_4 \cdot x_{10} + k_{16} \cdot x_2$$

$$\frac{dx_5}{dt} = k_6 \cdot x_4 + k_{11} \cdot x_3 \cdot \frac{x_{13}^{k_{14}}}{k_{26}^{k_{14}} + x_{13}^{k_{14}}} - k_4 \cdot x_5 - k_3 \cdot x_5 \cdot (x_{14} + x_{15}) + k_{30} \cdot x_{11} + k_{18} \cdot x_1 \cdot x_9 - k_2 \cdot x_5 - k_{24} \cdot x_5 - k_{13} \cdot x_5 \cdot x_{10}$$

$$\frac{dx_6}{dt} = k_5 \cdot x_7 + k_7 \cdot x_8 \cdot x_{10} - k_6 \cdot x_6 - k_{28} \cdot x_6$$

$$\frac{dx_7}{dt} = k_6 \cdot x_6 - k_5 \cdot x_7 - k_{10} \cdot x_7 - k_{17} \cdot x_1 \cdot x_7 + k_9 \cdot x_9 \cdot x_{10} + k_{25} \cdot x_3$$

$$\frac{dx_8}{dt} = k_5 \cdot x_9 + k_{28} \cdot x_6 - k_6 \cdot x_8 - k_7 \cdot x_8 \cdot x_{10}$$

$$\frac{dx_9}{dt} = k_{20} \cdot x_{11} + k_6 \cdot x_8 + k_{10} \cdot x_7 - k_5 \cdot x_9 - k_{18} \cdot x_1 \cdot x_9 - k_9 \cdot x_9 \cdot x_{10} + k_2 \cdot x_5 + k_{24} \cdot x_5$$

$$\frac{dx_{10}}{dt} = k_{10} \cdot x_7 + k_{11} \cdot x_3 \cdot \frac{x_{13}^{k_{14}}}{k_{26}^{k_{14}} + x_{13}^{k_{14}}} - k_8 \cdot x_4 \cdot x_{10} - k_7 \cdot x_8 \cdot x_{10} - k_9 \cdot x_9 \cdot x_{10} + k_{28} \cdot x_6 - k_{13} \cdot x_5 \cdot x_{10} + k_{16} \cdot x_2$$

$$\frac{dx_{11}}{dt} = k_3 \cdot x_5 \cdot (x_{14} + x_{15}) - k_{20} \cdot x_{11} - k_{30} \cdot x_{11}$$

$$\frac{dx_{12}}{dt} = k_2 \cdot x_5 + k_{12} \cdot x_1 + k_{20} \cdot x_{11} - k_{27} \cdot x_{12}$$

$$\frac{dx_{13}}{dt} = k_{15} \cdot (L - x_{13})$$

$$\frac{dx_{14}}{dt} = \begin{cases} k_1 \cdot \left(\dfrac{k_{21} \cdot x_{10}^2}{k_{22}^2 + x_{10}^2} - x_{14} \right), & \text{two-kinase model} \\ 0, & \text{one-kinase model} \end{cases}$$

$$\frac{dx_{15}}{dt} = k_{19} \cdot \left(\frac{k_{23} \cdot x_{10}^2}{k_{29}^2 + x_{10}^2} - x_{15} \right)$$

Table 3

Table 3. Parameter set values used for the one-kinase model ($Md_{1kinase}^{top50}$) and the two-kinase model ($Md_{2kinase}^{top50}$)

Parameter	Description	Values in one-kinase model ($Md_{1kinase}^{top50}$)	Values in two-kinase model ($Md_{2kinase}^{top50}$)	Source
k_1	Deactivation rate of kinase 2	--	6.21×10^{-4} min^{-1}	estimated
k_2	Phosphorylation rate of AtRGS1	2.50 min^{-1}	2.15 min^{-1}	estimated
k_3	Kinase-dependent AtRGS1 internalization rate	1.04×10^{-2} molc^{-1}min^{-1}	7.29×10^{-3} molc^{-1}min^{-1}	estimated
k_4	AtRGS1-dependent GTP hydrolysis rate	1.89 min^{-1}	1.89 min^{-1}	[1]
k_5	Intrinsic GTP hydrolysis rate	4.95×10^{-2} min^{-1}	4.95×10^{-2} min^{-1}	[2]
k_6	Intrinsic nucleotide exchange rate	8.4 min^{-1}	8.4 min^{-1}	[3]
k_7	Association rate of $G\alpha^{GDP}$ and $G\beta\gamma$	3.50×10^{-2} molc^{-1}min^{-1}	3.50×10^{-2} molc^{-1}min^{-1}	[4]
k_8	Dissociation rate of AtRGS1:$G\alpha^{GDP}\beta\gamma$	1.09×10^{-2} molc^{-1}min^{-1}	4.91×10^{-3} molc^{-1}min^{-1}	estimated
k_9	Association rate of $G\alpha^{GTP}$ and $G\beta\gamma$	1.01×10^{-6} molc^{-1}min^{-1}	4.26×10^{-6} molc^{-1}min^{-1}	estimated
k_{10}	Dissociation rate of $G\alpha^{GTP}\beta\gamma$	4.53×10^{-6} min^{-1}	4.65×10^{-5} min^{-1}	estimated
k_{11}	D-glucose-dependent dissociation rate of AtRGS1:$G\alpha^{GTP}\beta\gamma$	20.06 min^{-1}	29.38 min^{-1}	estimated
k_{12}	Constitutive AtRGS1 internalization rate	6.04 min^{-1}	5.00 min^{-1}	estimated
k_{13}	Association rate of AtRGS1:$G\alpha^{GTP}$ and $G\beta\gamma$	2.87×10^{-4} molc^{-1}min^{-1}	6.61×10^{-4} molc^{-1}min^{-1}	estimated
k_{14}	Hill coefficient on hypothetical glucose (co)receptor X	2	2	estimated
k_{15}	Deactivation rate of the hypothetical glucose (co)receptor	1.16×10^{-1} min^{-1}	2.31×10^{-1} min^{-1}	estimated
k_{16}	Association rate of AtRGS1:$G\alpha^{GDP}$ and $G\beta\gamma$	1.60×10^{-3} min^{-1}	5.44×10^{-3} min^{-1}	estimated

k_{17}	Association rate of $G\alpha^{GTP}\beta\gamma$ and free AtRGS1	2.52×10^{-4} molc^{-1}min^{-1}	5.09×10^{-4} molc^{-1}min^{-1}	estimated
k_{18}	Association rate of $G\alpha^{GTP}$ and free AtRGS1	3.90×10^{-2} molc^{-1}min^{-1}	3.21×10^{-2} molc^{-1}min^{-1}	estimated
k_{19}	Deactivation rate of Kinase 1	4.70×10^{-3} min^{-1}	1.52×10^{-2} min^{-1}	estimated
k_{20}	Internalization rate of phosphorylated AtRGS1	6.83×10^{1} min^{-1}	7.20×10^{1} min^{-1}	estimated
k_{21}	$G\beta\gamma$-dependent maximum activation of Kinase 2	--	5.53×10^{3} molc	estimated
k_{22}	K_m of kinase 2 activation	--	4.25×10^{3} molc	estimated
k_{23}	$G\beta\gamma$-dependent maximum activation of Kinase 1	9.84×10^{4} molc	5.57×10^{4} molc	estimated
k_{24}	Dissociation rate of AtRGS1:$G\alpha^{GTP}$	2.50×10^{-3} min^{-1}	3.80×10^{-3} min^{-1}	estimated
k_{25}	Dissociation rate of AtRGS1:$G\alpha^{GTP}\beta\gamma$	4.20×10^{-3} min^{-1}	3.04×10^{-3} min^{-1}	estimated
k_{26}	K_m of the hypothetical glucose (co)receptor X	1.19 (a.u.)	1.92 (a.u.)	estimated
k_{27}	Tonic recycling rate of AtRGS1	3.06×10^{-1} min^{-1}	1.84×10^{-1} min^{-1}	estimated
k_{28}	Dissociation rate of $G\alpha^{GDP}\beta\gamma$	2.36 min^{-1}	3.48 min^{-1}	estimated
k_{29}	K_m of kinase 1 activation	6.52×10^{4} molc	4.66×10^{4} molc	estimated
k_{30}	Dephosphorylation rate of AtRGS1	3.84 min^{-1}	2.41 min^{-1}	estimated

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