Full Grammer

Tags and meanings:
_exc: extracellular;
_c: intracellular;
METABOLITE: metabolite;
PROTEIN: protein;
MRNA: mRNA;
GENE: gene.

Nomenclature for model generation:
reaction name:
reactant(s)<rnx type:catalyst(s)>product(s)
e.g. 1.0*p_MAPK_c<catalyze:p_Her2_ph_2_c>1.0*p_MAPK_act_c
Monod affinity constant in reactions:
MonodK~reaction#~Substrate
e.g. MonodK~rnx4~met_Testosterone_c
Weight value in transcriptional control term:
W~actor~target mRNA
e.g. W~p_MAPK_act_c~m_AP1_c
dissociation constant in transfer function:
KD~species name
e.g. KD~p_AR_ph_2_c

Kinetic equations specification:
Michaelis–Menten Kinetics.

Sentence Specification
Logic AND can be denoted by “and” or comma “,” or “&”;
Logic OR can be denoted by “or” or “||”.
For clearness and simplicity, the following notations are used:
DS10: a single biological symbol;
E.g. m_A_c
DS11: multiple biological symbols linked by logic AND;
E.g. m_A_c, m_D_C and m_B_c
DS1: DS10 or DS11;
DS20: multiple biological symbols linked by logic OR;
E.g. m_A_c or m_D_C or m_B_c

DS21: multiple biological symbol groups linked by logic AND or OR, with each group inside a pair of parentheses if contains multiple biological symbols, only one logic outside parentheses and different logics between inside/outside of parentheses.

E.g. m_A_c or m_D_C or (m_B_c & m_F_c)

m_A_c & m_D_C & (m_B_c or m_F_c)

DS22: multiple biological symbol groups linked by logic AND or OR, with every group contains multiple biological symbols, only one logic outside parentheses and different logics between inside/outside of parentheses.

E.g. (m_A_c and m_E_c) or (m_G_c and m_D_C) or (m_B_c & m_F_c)

(m_A_c || m_E_c) & (m_G_c or m_D_C) and (m_B_c || m_F_c)

DS2: DS20 or DS21 or DS22;

Is:
DS10 is/was DS10
DS11 are/were DS11

React:
In default it is reversible, add "irreversibly" to change it.
DS1 reacts/ reacted/ reacting/ react into []
[] reacts/ reacted/ reacting/ react into DS1

Uptake:
In default it is irreversible, add "reversibly" to change it.
The cell uptake/ uptakes/ uptaking/ uptook DS10
The cell uptake/ uptakes/ uptaking/ uptook DS11
The cell uptake/ uptakes/ uptaking/ uptook DS10 via/through DS10
The cell uptake/ uptakes/ uptaking/ uptook DS10 via/through DS11

Secrete:
In default it is irreversible, add "reversibly" to change it.
The cell secrete/ secretes/ secreted/ secreting DS10
The cell secrete/ secretes/ secreted/ secreting DS11
The cell secrete/ secretes/ secreted/ secreting DS10 via/through DS10
The cell secrete/ secretes/ secreted/ secreting DS10 via/through DS11

Bind:
In default it is reversible, add "irreversibly" to change it.
DS1 bind/ binding/ bound/ binds
DS1 associate/ associates/ associated/ associating
DS1 complex/ complexes/ complexed/ complexing
DS1 bind/ binding/ bound/ binds into DS10

DS1 associate/ associates/ associated/ associating into DS10
DS1 complex/ complexes/ complexed/ complexing into DS10

Unbind:
In default it is reversible, add “irreversibly” to change it.
DS10 unbind/ unbinds/ unbound/ unbinding/ dissociate/ dissociates/ dissociated/ dissociating
DS10 unbind/ unbinds/ unbound/ unbinding/ dissociate/ dissociates/ dissociated/ dissociating into DS1

Phosphorylation:
In default it is irreversible, add “reversibly” to change it.
DS1 phosphorylate/ phosphorylates/ phosphorylated/ phosphorylating DS10
DS2 phosphorylate/ phosphorylates/ phosphorylated/ phosphorylating DS10
DS1 phosphorylate/ phosphorylates/ phosphorylated/ phosphorylating DS10 at site DS10
DS2 phosphorylate/ phosphorylates/ phosphorylated/ phosphorylating DS10 at site DS10

Dephosphorylation:
In default it is irreversible, add “reversibly” to change it.
DS1 dephosphorylate/ dephosphorylates/ dephosphorylated/ dephosphorylating DS10
DS2 dephosphorylate/ dephosphorylates/ dephosphorylated/ dephosphorylating DS10
DS1 dephosphorylate/ dephosphorylates/ dephosphorylated/ dephosphorylating DS10 at site DS10
DS2 dephosphorylate/ dephosphorylates/ dephosphorylated/ dephosphorylating DS10 at site DS10

Activation:
In default it is irreversible, add “reversibly” to change it.
DS1 activate/ activates/ activating/ activated the expression/ transcription/ translation of DS1
DS1 promote/ promotes/ promoting/ promoted the expression/ transcription/ translation of DS1
DS1 induce/ induces/ inducing/ induced the expression/ transcription/ translation of DS1
DS1 upregulate/ upregulates/ upregulated/ upregulating the expression/ transcription/ translation of DS1
DS2 activate/ activates/ activating/ activated the expression/ transcription/ translation of DS1
DS2 promote/ promotes/ promoting/ promoted the expression/ transcription/ translation of DS1
DS2 induce/ induces/ inducing/ induced the expression/ transcription/ translation of DS1

DS2 upregulate/ upregulates/ upregulated/ upregulating the expression/ transcription/ translation of DS1
Note: **induce** acts on GENE, and **activate** on enzyme.

Inhibition:
In default it is irreversible, add "reversibly" to change it.
DS1 inhibit/ inhibits/ inhibiting/ inhibited the expression/ transcription/ translation of DS1
DS1 repress/ represses/ repressing/ repressed the expression/ transcription/ translation of DS1
DS1 downregulate/ downregulates/ downregulated/ downregulating the expression/ transcription/ translation of DS1
DS2 inhibit/ inhibits/ inhibiting/ inhibited the expression/ transcription/ translation of DS1
DS2 repress/ represses/ repressing/ repressed the expression/ transcription/ translation of DS1
DS2 downregulate/ downregulates/ downregulated/ downregulating the expression/ transcription/ translation of DS1
Note: **repress** acts on GENE, and **inhibit** on enzyme.

Catalyze:
In default it is irreversible, add "reversibly" to change it.
DS1 catalyze/ catalyzes/ catalyzed/ catalyzing the (reversible) conversion of DS1 into DS1
DS1 catalyse/ catalyses/ catalysed/ catalysing the (reversible) conversion of DS1 into DS1
DS2 catalyze/ catalyzes/ catalyzed/ catalyzing the (reversible) conversion of DS1 into DS1
DS2 catalyse/ catalyses/ catalysed/ catalysing the (reversible) conversion of DS1 into DS1

Semantic error checking:
In "react" type, one of two symbols should be "[]".
In "uptake" type, membrane transporters can only be of type "PROTEIN".
In "secrete" type, the cell can only secrete species of type "METABOLITE" or "PROTEIN", and membrane transporters can only be of type "PROTEIN".
In "bind" type, "GENE" can not bind with "GENE", and the binding complex can't be "GENE".
In "unbind" type, a complex of "GENE" type is not allowed.
In "phosphorylation" type, the enzyme is of type "PROTEIN" or is "[]" if no enzyme participates in the reaction. Only "PROTEIN" can be phosphorylated.

In “dephosphorylation” type, the enzyme is of type “PROTEIN” or is “[]” if no enzyme participates in the reaction. Only “PROTEIN” can be dephosphorylated.
In “catalyze” type, enzymes are “PROTEIN”, reactants/products can be “METABOLITE” and/or “PROTEIN” and/or “GENE”.
In “activation” type, regulators can only be “PROTEIN” and/or “METABOLITE”.
In “inhibition” type, regulators can only be “PROTEIN” and/or “METABOLITE”.

“#” is reserved for inline comments.