SBML Model Report

Model name: "FelixGarza2017 - Blue Light Treatment of Psoriasis (simplified)"

May 17, 2018

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by Matthew Grant Roberts[1] at April 23rd 2018 at 9:32 a. m. and last time modified at April 24th 2018 at 10:04 a. m. Table 1 provides an overview of the quantities of all components of this model.

Table 1: Number of components in this model, which are described in the following sections.

Element	Quantity	Element	Quantity
compartment types	0	compartments	2
species types	0	species	12
events	3	constraints	0
reactions	35	function definitions	35
global parameters	55	unit definitions	2
rules	1	initial assignments	24

Model Notes

FelixGarza2017 - Blue Light Treatment ofPsoriasis (simplified)

This model is described in the article:A Dynamic Model for Prediction of Psoriasis Management by Blue Light Irradiation.Flix Garza ZC, Liebmann J, Born M, Hilbers PA, van Riel NA.Front Physiol 2017; 8: 28

Abstract:

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Clinical investigations prove that blue light irradiation reduces the severity of psoriasis vulgaris. Nevertheless, the mechanisms involved in the management of this condition remain poorly defined. Despite the encouraging results of the clinical studies, no clear guidelines are specified in the literature for the irradiation scheme regime of blue light-based therapy for psoriasis. We investigated the underlying mechanism of blue light irradiation of psoriatic skin, and tested the hypothesis that regulation of proliferation is a key process. We implemented a mechanistic model of cellular epidermal dynamics to analyze whether a temporary decrease of keratinocytes hyper-proliferation can explain the outcome of phototherapy with blue light. Our results suggest that the main effect of blue light on keratinocytes impacts the proliferative cells. They show that the decrease in the keratinocytes proliferative capacity is sufficient to induce a transient decrease in the severity of psoriasis. To study the impact of the therapeutic regime on the efficacy of psoriasis treatment, we performed simulations for different combinations of the treatment parameters, i.e., length of treatment, fluence (also referred to as dose), and intensity. These simulations indicate that high efficacy is achieved by regimes with long duration and high fluence levels, regardless of the chosen intensity. Our modeling approach constitutes a framework for testing diverse hypotheses on the underlying mechanism of blue light-based phototherapy, and for designing effective strategies for the treatment of psoriasis.

This model is hosted on BioModels Database and identified by: BIOMD0000000695.

To cite BioModels Database, please use: Chelliah V et al. BioModels: ten-year anniversary. Nucl. Acids Res. 2015, 43(Database issue):D542-8.

2 Unit Definitions

This is an overview of five unit definitions of which three are predefined by SBML and not mentioned in the model.

2.1 Unit `time`

Name time

Definition 86400 s

2.2 Unit `substance`

Name substance

Definition mmol

2.3 Unit `volume`

Notes Litre is the predefined SBML unit for `volume`.

Definition l

2.4 Unit `area`

Notes Square metre is the predefined SBML unit for `area` since SBML Level 2 Version 1.

Definition m^2

2.5 Unit `length`

Notes Metre is the predefined SBML unit for `length` since SBML Level 2 Version 1.

Definition m

3 Compartments

This model contains two compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
`compartmentOne`	Healthy		3	1	litre	☑	
`Psoriatic`	Psoriatic		3	1	litre	☑	

3.1 Compartment `compartmentOne`

This is a three dimensional compartment with a constant size of one litre.

Name Healthy

3.2 Compartment `Psoriatic`

This is a three dimensional compartment with a constant size of one litre.

Name Psoriatic

4 Species

This model contains twelve species. Section 11 provides further details and the derived rates of change of each species.

Table 3: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
xFinal_1	Stem Cells	compartmentOne	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_2	Transit Amplifying Cells	compartmentOne	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_3	Growth Arrested Cells	compartmentOne	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_4	Spinous cells	compartmentOne	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_5	Granular Cells	compartmentOne	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_6	Corneocytes	compartmentOne	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_7	Stem Cells	Psoriatic	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_8	Transit Amplifying Cells	Psoriatic	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_9	Growth Arrested Cells	Psoriatic	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_10	Spinous cells	Psoriatic	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_11	Granular Cells	Psoriatic	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
xFinal_12	Corneocytes	Psoriatic	$\mathrm{mmol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains 55 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
AId	AId		$3.5 \cdot 10^{-4}$		☑
AIh	AIh		0.001		☑
alpha	alpha		0.071		☑
alphaps	alphaps		0.286		☑
apopFBL	apopFBL		0.000		☑
aProl	aProl		1.000		☑
beta1h	beta1		$1.97036443732479 \cdot 10^{-6}$		☑
beta2	beta2		$2.07849419303164 \cdot 10^{-5}$		☑
beta3	beta3		$2.59511413696436 \cdot 10^{-4}$		☑
beta4	beta4		$6.68001601922307 \cdot 10^{-5}$		☑
beta5	beta5		$1.33360032038446 \cdot 10^{-4}$		☑
betaps1	betaps1		$2.29680388135848 \cdot 10^{-6}$		☑
betaps2	betaps2		$2.42284799679888 \cdot 10^{-5}$		☑
betaps3	betaps3		$3.78132346321212 \cdot 10^{-4}$		☑
betaps4	betaps4		$9.73340669234232 \cdot 10^{-5}$		☑
bProl	bProl		−0.003		☑
doseBL	doseBL		52.110		⊟
gamma1h	gamma1h		0.003		☑
gamma1ps	gamma1ps		0.013		☑
gamma2	gamma2		0.014		☑
gamma2ps	gamma2ps		0.047		☑
k1ah	k1ah		0.013		☑
k1sh	k1sh		0.002		☑
k2a	k2a		0.138		☑
k2s	k2s		0.017		☑
k3	k3		0.216		☑
k4	k4		0.056		☑
k5	k5		0.111		☑
Ka	Ka		392.773		⊟
km1	km1			10^{-6}	☑
km2	km2			10^{-6}	☑
kmps1	kmps1			10^{-6}	☑
kmps2	kmps2			10^{-6}	☑
Kp	Kp		6.000		☑
kps1a	kps1a		0.052		☑
kps1s	kps1s		0.007		☑

Id	Name	SBO	Value	Unit	Constant
kps2a	kps2a		0.552		☑
kps2s	kps2s		0.069		☑
kps3	kps3		1.080		☑
kps4	kps4		0.278		☑
lambda	lambda		3.500		☑
LPSI0	LPSI0		5.340		☑
n	n		3.000		☑
omega	omega		100.000		☑
Psch	Psch		2267.675		☑
Pscmax	Pscmax		4500.000		☑
Ptah	Ptah		11184.784		☑
rhoDe	rhoDe		4.000		☑
rhoSC	rhoSC		4.000		☑
rhoTA	rhoTA		4.000		☑
rhoTr	rhoTr		5.000		☑
skinType	skinType		0.579		☑
therI	therI		84.000		☑
thetaBLprol	thetaBLprol		0.837		☑
Treatment-_Duration	Treatment-_Duration		1.000		☑

6 Initialassignments

This is an overview of 24 initialassignments.

6.1 Initialassignment alphaps

Derived unit contains undeclared units

Math $\mathrm{rhoDe} \cdot \mathrm{alpha}$

6.2 Initialassignment beta1h

Derived unit contains undeclared units

Math $\frac{\mathrm{AIh} \cdot \mathrm{k1sh}}{1 - \mathrm{AIh}}$

6.3 Initialassignment beta2

Derived unit contains undeclared units

Math $\frac{\mathrm{AIh} \cdot \mathrm{k2s}}{1 - \mathrm{AIh}}$

6.4 Initialassignment beta3

Derived unit contains undeclared units

Math $\frac{\mathrm{AIh}\cdot \mathrm{k3}}{1-\mathrm{AIh}}$

6.5 Initialassignment beta4

Derived unit contains undeclared units

Math $\frac{\mathrm{AIh}\cdot \mathrm{k4}}{1-\mathrm{AIh}}$

6.6 Initialassignment beta5

Derived unit contains undeclared units

Math $\frac{\mathrm{AIh}\cdot \mathrm{k5}}{1-\mathrm{AIh}}$

6.7 Initialassignment betaps1

Derived unit contains undeclared units

Math $\frac{\mathrm{AId}\cdot \mathrm{k1sh}\cdot \mathrm{rhoSC}}{1-\mathrm{AId}}$

6.8 Initialassignment betaps2

Derived unit contains undeclared units

Math $\frac{\mathrm{AId}\cdot \mathrm{kps2s}}{1-\mathrm{AId}}$

6.9 Initialassignment betaps3

Derived unit contains undeclared units

Math $\frac{\mathrm{AId}\cdot \mathrm{kps3}}{1-\mathrm{AId}}$

6.10 Initialassignment betaps4

Derived unit contains undeclared units

Math $\frac{\mathrm{AId}\cdot \mathrm{kps4}}{1-\mathrm{AId}}$

6.11 Initialassignment doseBL

Derived unit contains undeclared units

Math $90 \cdot \mathrm{skinType}$

6.12 Initialassignment gamma1ps

Derived unit contains undeclared units

Math rhoSC · gamma1h

6.13 Initialassignment gamma2ps

Derived unit contains undeclared units

Math rhoTA · gamma2 · thetaBLprol

6.14 Initialassignment kmps1

Derived unit contains undeclared units

Math km1

6.15 Initialassignment kmps2

Derived unit contains undeclared units

Math km2

6.16 Initialassignment kps1a

Derived unit contains undeclared units

Math rhoSC · k1ah

6.17 Initialassignment kps1s

Derived unit contains undeclared units

Math rhoSC · k1sh

6.18 Initialassignment kps2a

Derived unit contains undeclared units

Math rhoTA · k2a

6.19 Initialassignment kps2s

Derived unit contains undeclared units

Math rhoTA · k2s

6.20 Initialassignment kps3

Derived unit contains undeclared units

Math $\mathrm{rhoTr} \cdot \mathrm{k3}$

6.21 Initialassignment kps4

Derived unit contains undeclared units

Math $\mathrm{rhoTr} \cdot \mathrm{k4}$

6.22 Initialassignment Psch

Derived unit contains undeclared units

Math $\mathrm{Pscmax} \cdot \left(1 - \frac{1}{\mathrm{gamma1h}} \cdot \left(\mathrm{k1sh} + \mathrm{beta1h} - \frac{\mathrm{km1} \cdot (\mathrm{k1ah} + \mathrm{k1sh} \cdot 2)}{\mathrm{km1} + \mathrm{k2s} + \mathrm{beta2} - \mathrm{gamma2} - \frac{\mathrm{km2} \cdot (\mathrm{k2a} + 2 \cdot \mathrm{k2s})}{\mathrm{km2} + \mathrm{k3} + \mathrm{beta3}}}\right)\right)$

6.23 Initialassignment Ptah

Derived unit contains undeclared units

Math $\frac{\mathrm{k1ah} + 2 \cdot \mathrm{k1sh}}{\mathrm{km1} + \mathrm{k2s} + \mathrm{beta2} - \mathrm{gamma2} - \frac{\mathrm{km2} \cdot (\mathrm{k2a} + 2 \cdot \mathrm{k2s})}{\mathrm{km2} + \mathrm{k3} + \mathrm{beta3}}} \cdot \mathrm{Psch}$

6.24 Initialassignment thetaBLprol

Derived unit contains undeclared units

Math $\mathrm{aProl} \cdot \exp\left(\mathrm{bProl} \cdot \mathrm{doseBL}\right)$

7 Function definitions

This is an overview of 35 function definitions.

7.1 Function definition Function_for_R_7

Name Function for R_7

Arguments AId, apopFBL, vol (compartmentOne), k3, rhoTr, [xFinal_9]

Mathematical Expression

$$\frac{\mathrm{AId} \cdot \mathrm{k3} \cdot [\mathrm{xFinal\_9}] \cdot \frac{\mathrm{rhoTr}}{1 - \mathrm{AId}} + \mathrm{apopFBL} \cdot [\mathrm{xFinal\_9}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{1}$$

7.2 Function definition Function_for_R_6

Name Function for R_6

Arguments vol(compartmentOne), k2a, rhoTA, [xFinal_8]

Mathematical Expression

$$\frac{\mathrm{k2a} \cdot \mathrm{rhoTA} \cdot [\mathrm{xFinal\_8}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{2}$$

7.3 Function definition Function_for_R_10

Name Function for R_10

Arguments vol(compartmentOne), k1ah, rhoSC, [xFinal_7]

Mathematical Expression

$$\frac{\mathrm{k1ah} \cdot \mathrm{rhoSC} \cdot [\mathrm{xFinal\_7}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{3}$$

7.4 Function definition Function_for_R_3

Name Function for R_3

Arguments vol(compartmentOne), k3, rhoTr, [xFinal_9]

Mathematical Expression

$$\frac{\mathrm{k3} \cdot \mathrm{rhoTr} \cdot [\mathrm{xFinal\_9}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{4}$$

7.5 Function definition Function_for_R_1

Name Function for R_1

Arguments vol(compartmentOne), k4, rhoTr, [xFinal_10]

Mathematical Expression

$$\frac{\mathrm{k4} \cdot \mathrm{rhoTr} \cdot [\mathrm{xFinal\_10}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{5}$$

7.6 Function definition Function_for_R_2

Name Function for R_2

Arguments alpha, apopFBL, vol(compartmentOne), rhoDe, [xFinal_12]

Mathematical Expression

$$\frac{\mathrm{alpha} \cdot \mathrm{rhoDe} \cdot [\mathrm{xFinal\_12}] + \mathrm{apopFBL} \cdot [\mathrm{xFinal\_12}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{6}$$

7.7 Function definition Function_for_R_5

Name Function for R_5

Arguments vol (compartmentOne), k2s, rhoTA, [xFinal_8]

Mathematical Expression

$$\frac{\text{k2s} \cdot \text{rhoTA} \cdot [\text{xFinal\_8}]}{\text{vol}\,(\text{compartmentOne})} \tag{7}$$

7.8 Function definition Function_for_R_4

Name Function for R_4

Arguments AId, apopFBL, vol (compartmentOne), k4, rhoTr, [xFinal_10]

Mathematical Expression

$$\frac{\text{AId} \cdot \text{k4} \cdot [\text{xFinal\_10}] \cdot \frac{\text{rhoTr}}{1-\text{AId}} + \text{apopFBL} \cdot [\text{xFinal\_10}]}{\text{vol}\,(\text{compartmentOne})} \tag{8}$$

7.9 Function definition Function_for_R_12

Name Function for R_12

Arguments AId, apopFBL, vol (compartmentOne), k2s, rhoTA, [xFinal_8]

Mathematical Expression

$$\frac{\text{AId} \cdot \text{k2s} \cdot [\text{xFinal\_8}] \cdot \frac{\text{rhoTA}}{1-\text{AId}} + \text{apopFBL} \cdot [\text{xFinal\_8}]}{\text{vol}\,(\text{compartmentOne})} \tag{9}$$

7.10 Function definition Function_for_R_14

Name Function for R_14

Arguments aProl, bProl, vol (compartmentOne), doseBL, gamma1h, rhoSC, [xFinal_7]

Mathematical Expression

$$\frac{\text{aProl} \cdot \text{gamma1h} \cdot \text{rhoSC} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot [\text{xFinal\_7}]}{\text{vol}\,(\text{compartmentOne})} \tag{10}$$

7.11 Function definition Function_for_R_13

Name Function for R_13

Arguments vol(compartmentOne), km1, [xFinal_8]

Mathematical Expression

$$\frac{\mathrm{km1} \cdot [\mathrm{xFinal\_8}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{11}$$

7.12 Function definition Function_for_R_19

Name Function for R_19

Arguments vol(compartmentOne), k4, [xFinal_4]

Mathematical Expression

$$\frac{\mathrm{k4} \cdot [\mathrm{xFinal\_4}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{12}$$

7.13 Function definition Function_for_R_8

Name Function for R_8

Arguments vol(compartmentOne), km2, [xFinal_9]

Mathematical Expression

$$\frac{\mathrm{km2} \cdot [\mathrm{xFinal\_9}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{13}$$

7.14 Function definition Function_for_R_9

Name Function for R_9

Arguments vol(compartmentOne), k1sh, rhoSC, [xFinal_7]

Mathematical Expression

$$\frac{\mathrm{k1sh} \cdot \mathrm{rhoSC} \cdot [\mathrm{xFinal\_7}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{14}$$

7.15 Function definition Function_for_R_11

Name Function for R_11

Arguments aProl, bProl, vol(compartmentOne), doseBL, gamma2, rhoTA, [xFinal_8]

Mathematical Expression

$$\frac{\text{aProl} \cdot \text{aProl} \cdot \text{gamma2} \cdot \text{rhoTA} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot [\text{xFinal\_8}]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{15}$$

7.16 Function definition Function_for_R_17

Name Function for R_17

Arguments vol (compartmentOne), k5, [xFinal_5]

Mathematical Expression

$$\frac{\text{k5} \cdot [\text{xFinal\_5}]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{16}$$

7.17 Function definition Function_for_R_22

Name Function for R_22

Arguments AIh, apopFBL, vol (compartmentOne), k4, [xFinal_4]

Mathematical Expression

$$\frac{\text{k4} \cdot [\text{xFinal\_4}] \cdot \frac{\text{AIh}}{1-\text{AIh}} + \text{apopFBL} \cdot [\text{xFinal\_4}]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{17}$$

7.18 Function definition Function_for_R_15

Name Function for R_15

Arguments Pscmax, aProl, bProl, vol (compartmentOne), doseBL, gamma1h, lambda, rhoSC, [xFinal_6], [xFinal_7]

Mathematical Expression

$$\frac{\text{aProl} \cdot \text{gamma1h} \cdot \text{rhoSC} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot [\text{xFinal\_7}] \cdot \frac{[\text{xFinal\_6}]}{\text{lambda} \cdot \text{Pscmax}}}{\text{vol}\left(\text{compartmentOne}\right)} \tag{18}$$

7.19 Function definition Function_for_R_16

Name Function for R_16

Arguments AId, Ka, Kp, Pscmax, aProl, apopFBL, bProl, vol (compartmentOne), doseBL, gamma1h, k1sh, lambda, rhoSC, [xFinal_7]

Mathematical Expression

$$\frac{\text{aProl} \cdot \text{gamma1h} \cdot \text{rhoSC} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot [\text{xFinal\_7}] \cdot \frac{[\text{xFinal\_7}]}{\text{lambda} \cdot \text{Pscmax}} + \text{AId} \cdot \text{k1sh} \cdot [\text{xFinal\_7}] \cdot \frac{\text{rhoSC}}{1-\text{AId}} + \text{apopF}}{\text{vol}\left(\text{compartmentOne}\right)} \tag{19}$$

7.20 Function definition Function_for_R_18

Name Function for R_18

Arguments alpha, apopFBL, vol(compartmentOne), [xFinal_6]

Mathematical Expression

$$\frac{\text{alpha} \cdot [\text{xFinal\_6}] + \text{apopFBL} \cdot [\text{xFinal\_6}]}{\text{vol}(\text{compartmentOne})} \tag{20}$$

7.21 Function definition Function_for_R_26

Name Function for R_26

Arguments vol(compartmentOne), km2, [xFinal_3]

Mathematical Expression

$$\frac{\text{km2} \cdot [\text{xFinal\_3}]}{\text{vol}(\text{compartmentOne})} \tag{21}$$

7.22 Function definition Function_for_R_27

Name Function for R_27

Arguments Ptah, vol(compartmentOne), k1sh, n, omega, [xFinal_1], [xFinal_2], [xFinal_8]

Mathematical Expression

$$\frac{\text{omega} \cdot [\text{xFinal\_1}] \cdot \frac{\text{k1sh}}{1+(\text{omega}-1)\cdot\left(\frac{[\text{xFinal\_2}]+[\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{vol}(\text{compartmentOne})} \tag{22}$$

7.23 Function definition Function_for_R_20

Name Function for R_20

Arguments AIh, apopFBL, vol(compartmentOne), k5, [xFinal_5]

Mathematical Expression

$$\frac{\text{k5} \cdot [\text{xFinal\_5}] \cdot \frac{\text{AIh}}{1-\text{AIh}} + \text{apopFBL} \cdot [\text{xFinal\_5}]}{\text{vol}(\text{compartmentOne})} \tag{23}$$

7.24 Function definition Function_for_R_21

Name Function for R_21

Arguments vol (compartmentOne), k3, [xFinal_3]

Mathematical Expression

$$\frac{\mathrm{k3} \cdot [\mathrm{xFinal\_3}]}{\mathrm{vol}\,(\mathrm{compartmentOne})} \tag{24}$$

7.25 Function definition Function_for_R_23

Name Function for R_23

Arguments vol (compartmentOne), k2s, [xFinal_2]

Mathematical Expression

$$\frac{\mathrm{k2s} \cdot [\mathrm{xFinal\_2}]}{\mathrm{vol}\,(\mathrm{compartmentOne})} \tag{25}$$

7.26 Function definition Function_for_R_24

Name Function for R_24

Arguments vol (compartmentOne), k2a, [xFinal_2]

Mathematical Expression

$$\frac{\mathrm{k2a} \cdot [\mathrm{xFinal\_2}]}{\mathrm{vol}\,(\mathrm{compartmentOne})} \tag{26}$$

7.27 Function definition Function_for_R_25

Name Function for R_25

Arguments AIh, apopFBL, vol (compartmentOne), k3, [xFinal_3]

Mathematical Expression

$$\frac{\mathrm{k3} \cdot [\mathrm{xFinal\_3}] \cdot \frac{\mathrm{AIh}}{1-\mathrm{AIh}} + \mathrm{apopFBL} \cdot [\mathrm{xFinal\_3}]}{\mathrm{vol}\,(\mathrm{compartmentOne})} \tag{27}$$

7.28 Function definition Function_for_R_32

Name Function for R_32

Arguments Ptah, aProl, bProl, vol(compartmentOne), doseBL, gamma1h, n, omega, [xFinal_1], [xFinal_2], [xFinal_8]

Mathematical Expression

$$\frac{\text{aProl} \cdot \text{gamma1h} \cdot \exp(\text{bProl} \cdot \text{doseBL}) \cdot [\text{xFinal\_1}] \cdot \frac{\text{omega}}{1+(\text{omega}-1)\cdot\left(\frac{[\text{xFinal\_2}]+[\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{vol}(\text{compartmentOne})} \tag{28}$$

7.29 Function definition Function_for_R_35

Name Function for R_35

Arguments AIh, apopFBL, vol(compartmentOne), k1sh, [xFinal_1]

Mathematical Expression

$$\frac{\text{k1sh} \cdot [\text{xFinal\_1}] \cdot \frac{\text{AIh}}{1-\text{AIh}} + \text{apopFBL} \cdot [\text{xFinal\_1}]}{\text{vol}(\text{compartmentOne})} \tag{29}$$

7.30 Function definition Function_for_R_28

Name Function for R_28

Arguments Ptah, vol(compartmentOne), k1ah, n, omega, [xFinal_1], [xFinal_2], [xFinal_8]

Mathematical Expression

$$\frac{\text{omega} \cdot [\text{xFinal\_1}] \cdot \frac{\text{k1ah}}{1+(\text{omega}-1)\cdot\left(\frac{[\text{xFinal\_2}]+[\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{vol}(\text{compartmentOne})} \tag{30}$$

7.31 Function definition Function_for_R_29

Name Function for R_29

Arguments aProl, bProl, vol(compartmentOne), doseBL, gamma2, [xFinal_2]

Mathematical Expression

$$\frac{\text{aProl} \cdot \text{gamma2} \cdot \exp(\text{bProl} \cdot \text{doseBL}) \cdot [\text{xFinal\_2}]}{\text{vol}(\text{compartmentOne})} \tag{31}$$

7.32 Function definition Function_for_R_30

Name Function for R_30

Arguments AIh, apopFBL, vol(compartmentOne), k2s, [xFinal_2]

Mathematical Expression

$$\frac{\mathrm{k2s}\cdot[\mathrm{xFinal\_2}]\cdot\frac{\mathrm{AIh}}{1-\mathrm{AIh}}+\mathrm{apopFBL}\cdot[\mathrm{xFinal\_2}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{32}$$

7.33 Function definition Function_for_R_31

Name Function for R_31

Arguments vol(compartmentOne), km1, [xFinal_2]

Mathematical Expression

$$\frac{\mathrm{km1}\cdot[\mathrm{xFinal\_2}]}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{33}$$

7.34 Function definition Function_for_R_33

Name Function for R_33

Arguments Pscmax, Ptah, aProl, bProl, vol(compartmentOne), doseBL, gamma1h, k1sh, n, omega, [xFinal_1], [xFinal_2], [xFinal_8]

Mathematical Expression

$$\frac{\mathrm{gamma1h}\cdot\frac{\frac{\mathrm{aProl}\cdot\exp(\mathrm{bProl}\cdot\mathrm{doseBL})\cdot[\mathrm{xFinal\_1}]\cdot\mathrm{omega}\cdot[\mathrm{xFinal\_1}]}{1+(\mathrm{omega}-1)\cdot\left(\frac{[\mathrm{xFinal\_2}]+[\mathrm{xFinal\_8}]}{\mathrm{Ptah}}\right)^{\mathrm{n}}}}{\mathrm{Pscmax}}+\mathrm{k1sh}\cdot[\mathrm{xFinal\_1}]\cdot\frac{\mathrm{omega}}{1+(\mathrm{omega}-1)\cdot\left(\frac{[\mathrm{xFinal\_2}]+[\mathrm{xFinal\_8}]}{\mathrm{Ptah}}\right)^{\mathrm{n}}}}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{34}$$

7.35 Function definition Function_for_R_34

Name Function for R_34

Arguments Pscmax, Ptah, aProl, bProl, vol(compartmentOne), doseBL, gamma1h, lambda, n, omega, [xFinal_1], [xFinal_2], [xFinal_7], [xFinal_8]

Mathematical Expression

$$\frac{\mathrm{gamma1h}\cdot\frac{\frac{\mathrm{aProl}\cdot\exp(\mathrm{bProl}\cdot\mathrm{doseBL})\cdot[\mathrm{xFinal\_1}]\cdot\mathrm{omega}\cdot[\mathrm{xFinal\_7}]}{1+(\mathrm{omega}-1)\cdot\left(\frac{[\mathrm{xFinal\_2}]+[\mathrm{xFinal\_8}]}{\mathrm{Ptah}}\right)^{\mathrm{n}}}}{\frac{\mathrm{lambda}}{\mathrm{Pscmax}}}}{\mathrm{vol}(\mathrm{compartmentOne})} \tag{35}$$

8 Rule

This is an overview of one rule.

8.1 Rule `Ka`

Rule `Ka` is an assignment rule for parameter `Ka`:

$$\mathrm{Ka} = \frac{3^{\frac{1}{2}} \cdot \mathrm{Psch}}{10} \tag{36}$$

9 Events

This is an overview of three events. Each event is initiated whenever its trigger condition switches from `false` to `true`. A delay function postpones the effects of an event to a later time point. At the time of execution, an event can assign values to species, parameters or compartments if these are not set to constant.

9.1 Event `Treatment_Break_after_28_days`

Name Treatment Break after 28 days

Trigger condition

$$((\mathrm{time} > 28) \wedge (\mathrm{time} < 84)) \wedge \left(\mathrm{time} - \left\lfloor \frac{\mathrm{time}}{\frac{7}{3}} \right\rfloor \cdot \frac{7}{3} > \mathrm{Treatment\_Duration}\right) \tag{37}$$

Assignment

$$\mathrm{doseBL} = 0 \cdot 90 \cdot \mathrm{skinType} \tag{38}$$

9.2 Event `Treatment_Start_after_28_days`

Name Treatment Start after 28 days

Trigger condition

$$((\mathrm{time} > 28) \wedge (\mathrm{time} < 84)) \wedge \left(\mathrm{time} - \left\lfloor \frac{\mathrm{time}}{\frac{7}{3}} \right\rfloor \cdot \frac{7}{3} < \mathrm{Treatment\_Duration}\right) \tag{39}$$

Assignment

$$\mathrm{doseBL} = 90 \cdot \mathrm{skinType} \tag{40}$$

9.3 Event Treatment_Stopped_on_Day_84

Name Treatment Stopped on Day 84

Trigger condition

$$\text{time} > 84 \tag{41}$$

Assignment

$$\text{doseBL} = 0 \tag{42}$$

10 Reactions

This model contains 35 reactions. All reactions are listed in the following table and are subsequently described in detail. If a reaction is affected by a modifier, the identifier of this species is written above the reaction arrow.

Table 5: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	R_1	R_001	xFinal_10 $\longrightarrow$ xFinal_12	
2	R_2	R_002	xFinal_12 $\longrightarrow \emptyset$	
3	R_3	R_003	xFinal_9 $\longrightarrow$ xFinal_10	
4	R_4	R_004	xFinal_10 $\longrightarrow \emptyset$	
5	R_5	R_005	xFinal_8 $\longrightarrow 2\,$xFinal_9	
6	R_6	R_006	xFinal_8 $\longrightarrow$ xFinal_8 + xFinal_9	
7	R_7	R_007	xFinal_9 $\longrightarrow \emptyset$	
8	R_8	R_008	xFinal_9 $\longrightarrow$ xFinal_8	
9	R_9	R_009	xFinal_7 $\longrightarrow 2\,$xFinal_8	
10	R_10	R_010	xFinal_7 $\longrightarrow$ xFinal_7 + xFinal_8	
11	R_11	R_011	xFinal_8 $\longrightarrow 2\,$xFinal_8	
12	R_12	R_012	xFinal_8 $\longrightarrow \emptyset$	
13	R_13	R_013	xFinal_8 $\longrightarrow$ xFinal_7	
14	R_14	R_014	xFinal_7 $\longrightarrow 2\,$xFinal_7	
15	R_15	R_015	xFinal_6 + xFinal_7 $\longrightarrow$ xFinal_6	
16	R_16	R_016	xFinal_7 $\longrightarrow \emptyset$	
17	R_17	R_017	xFinal_5 $\longrightarrow$ xFinal_6	
18	R_18	R_018	xFinal_6 $\longrightarrow \emptyset$	
19	R_19	R_019	xFinal_4 $\longrightarrow$ xFinal_5	
20	R_20	R_020	xFinal_5 $\longrightarrow \emptyset$	
21	R_21	R_021	xFinal_3 $\longrightarrow$ xFinal_4	
22	R_22	R_022	xFinal_4 $\longrightarrow \emptyset$	

№	Id	Name	Reaction Equation	SBO
23	R_23	R_023	$\text{xFinal\_2} \longrightarrow 2\,\text{xFinal\_3}$	
24	R_24	R_024	$\text{xFinal\_2} \longrightarrow \text{xFinal\_2} + \text{xFinal\_3}$	
25	R_25	R_025	$\text{xFinal\_3} \longrightarrow \emptyset$	
26	R_26	R_026	$\text{xFinal\_3} \longrightarrow \text{xFinal\_2}$	
27	R_27	R_027	$\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_8} \longrightarrow \text{xFinal\_1} + 3\,\text{xFinal\_2} + \text{xFinal\_8}$	
28	R_28	R_028	$\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_8} \longrightarrow \text{xFinal\_1} + 2\,\text{xFinal\_2} + \text{xFinal\_8}$	
29	R_29	R_029	$\text{xFinal\_2} \longrightarrow 2\,\text{xFinal\_2}$	
30	R_30	R_030	$\text{xFinal\_2} \longrightarrow \emptyset$	
31	R_31	R_031	$\text{xFinal\_2} \longrightarrow \text{xFinal\_1}$	
32	R_32	R_032	$\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_8} \longrightarrow 2\,\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_8}$	
33	R_33	R_033	$\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_8} \longrightarrow \text{xFinal\_2} + \text{xFinal\_8}$	
34	R_34	R_034	$\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_7} + \text{xFinal\_8} \longrightarrow \text{xFinal\_2} + \text{xFinal\_7} + \text{xFinal\_8}$	
35	R_35	R_035	$\text{xFinal\_1} \longrightarrow \emptyset$	

10.1 Reaction R_1

This is an irreversible reaction of one reactant forming one product.

Name R_001

Reaction equation

$$\text{xFinal\_10} \longrightarrow \text{xFinal\_12} \tag{43}$$

Reactant

Table 6: Properties of each reactant.

Id	Name	SBO
xFinal_10	Spinous cells	

Product

Table 7: Properties of each product.

Id	Name	SBO
xFinal_12	Corneocytes	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}\left(\text{Psoriatic}\right) \cdot \text{Function\_for\_R\_1}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k4}, \text{rhoTr}, \left[\text{xFinal\_10}\right]\right) \tag{44}$$

$$\text{Function\_for\_R\_1}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k4}, \text{rhoTr}, \left[\text{xFinal\_10}\right]\right) = \frac{\text{k4} \cdot \text{rhoTr} \cdot \left[\text{xFinal\_10}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{45}$$

$$\text{Function\_for\_R\_1}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k4}, \text{rhoTr}, \left[\text{xFinal\_10}\right]\right) = \frac{\text{k4} \cdot \text{rhoTr} \cdot \left[\text{xFinal\_10}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{46}$$

10.2 Reaction R_2

This is an irreversible reaction of one reactant forming no product.

Name R_002

Reaction equation

$$\text{xFinal\_12} \longrightarrow \emptyset \tag{47}$$

Reactant

Table 8: Properties of each reactant.

Id	Name	SBO
xFinal_12	Corneocytes	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \text{vol}\left(\text{Psoriatic}\right) \cdot \text{Function\_for\_R\_2}\left(\text{alpha}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{rhoDe}, \left[\text{xFinal\_12}\right]\right) \tag{48}$$

$$\begin{aligned} &\text{Function\_for\_R\_2}\left(\text{alpha}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{rhoDe}, \left[\text{xFinal\_12}\right]\right) \\ &= \frac{\text{alpha} \cdot \text{rhoDe} \cdot \left[\text{xFinal\_12}\right] + \text{apopFBL} \cdot \left[\text{xFinal\_12}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \end{aligned} \tag{49}$$

$$\begin{aligned} &\text{Function\_for\_R\_2}\left(\text{alpha}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{rhoDe}, \left[\text{xFinal\_12}\right]\right) \\ &= \frac{\text{alpha} \cdot \text{rhoDe} \cdot \left[\text{xFinal\_12}\right] + \text{apopFBL} \cdot \left[\text{xFinal\_12}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \end{aligned} \tag{50}$$

10.3 Reaction R_3

This is an irreversible reaction of one reactant forming one product.

Name R_003

Reaction equation

$$\text{xFinal\_9} \longrightarrow \text{xFinal\_10} \tag{51}$$

Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
xFinal_9	Growth Arrested Cells	

Product

Table 10: Properties of each product.

Id	Name	SBO
xFinal_10	Spinous cells	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \mathrm{vol}\left(\mathrm{Psoriatic}\right) \cdot \mathrm{Function\_for\_R\_3}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \mathrm{rhoTr}, \left[\mathrm{xFinal\_9}\right]\right) \quad (52)$$

$$\mathrm{Function\_for\_R\_3}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \mathrm{rhoTr}, \left[\mathrm{xFinal\_9}\right]\right) = \frac{\mathrm{k3} \cdot \mathrm{rhoTr} \cdot \left[\mathrm{xFinal\_9}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \quad (53)$$

$$\mathrm{Function\_for\_R\_3}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \mathrm{rhoTr}, \left[\mathrm{xFinal\_9}\right]\right) = \frac{\mathrm{k3} \cdot \mathrm{rhoTr} \cdot \left[\mathrm{xFinal\_9}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \quad (54)$$

10.4 Reaction R_4

This is an irreversible reaction of one reactant forming no product.

Name R_004

Reaction equation

$$\mathrm{xFinal\_10} \longrightarrow \emptyset \quad (55)$$

Reactant

Table 11: Properties of each reactant.

Id	Name	SBO
xFinal_10	Spinous cells	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}\left(\mathrm{Psoriatic}\right) \cdot \mathrm{Function\_for\_R\_4}\left(\mathrm{AId}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k4}, \mathrm{rhoTr}, \left[\mathrm{xFinal\_10}\right]\right) \tag{56}$$

$$\mathrm{Function\_for\_R\_4}\left(\mathrm{AId}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k4}, \mathrm{rhoTr}, \left[\mathrm{xFinal\_10}\right]\right) = \frac{\mathrm{AId} \cdot \mathrm{k4} \cdot \left[\mathrm{xFinal\_10}\right] \cdot \frac{\mathrm{rhoTr}}{1-\mathrm{AId}} + \mathrm{apopFBL} \cdot \left[\mathrm{xFinal\_10}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{57}$$

$$\mathrm{Function\_for\_R\_4}\left(\mathrm{AId}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k4}, \mathrm{rhoTr}, \left[\mathrm{xFinal\_10}\right]\right) = \frac{\mathrm{AId} \cdot \mathrm{k4} \cdot \left[\mathrm{xFinal\_10}\right] \cdot \frac{\mathrm{rhoTr}}{1-\mathrm{AId}} + \mathrm{apopFBL} \cdot \left[\mathrm{xFinal\_10}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{58}$$

10.5 Reaction R_5

This is an irreversible reaction of one reactant forming one product.

Name R_005

Reaction equation

$$\mathrm{xFinal\_8} \longrightarrow 2\,\mathrm{xFinal\_9} \tag{59}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	

Product

Table 13: Properties of each product.

Id	Name	SBO
xFinal_9	Growth Arrested Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}\left(\mathrm{Psoriatic}\right) \cdot \mathrm{Function\_for\_R\_5}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \mathrm{rhoTA}, \left[\mathrm{xFinal\_8}\right]\right) \quad (60)$$

$$\mathrm{Function\_for\_R\_5}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \mathrm{rhoTA}, \left[\mathrm{xFinal\_8}\right]\right) = \frac{\mathrm{k2s} \cdot \mathrm{rhoTA} \cdot \left[\mathrm{xFinal\_8}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \quad (61)$$

$$\mathrm{Function\_for\_R\_5}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \mathrm{rhoTA}, \left[\mathrm{xFinal\_8}\right]\right) = \frac{\mathrm{k2s} \cdot \mathrm{rhoTA} \cdot \left[\mathrm{xFinal\_8}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \quad (62)$$

10.6 Reaction R_6

This is an irreversible reaction of one reactant forming two products.

Name R_006

Reaction equation

$$\mathrm{xFinal\_8} \longrightarrow \mathrm{xFinal\_8} + \mathrm{xFinal\_9} \quad (63)$$

Reactant

Table 14: Properties of each reactant.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	

Products

Table 15: Properties of each product.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	
xFinal_9	Growth Arrested Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \text{vol}\left(\text{Psoriatic}\right) \cdot \text{Function\_for\_R\_6}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k2a}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right) \quad (64)$$

$$\text{Function\_for\_R\_6}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k2a}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right) = \frac{\text{k2a} \cdot \text{rhoTA} \cdot \left[\text{xFinal\_8}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \quad (65)$$

$$\text{Function\_for\_R\_6}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k2a}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right) = \frac{\text{k2a} \cdot \text{rhoTA} \cdot \left[\text{xFinal\_8}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \quad (66)$$

10.7 Reaction R_7

This is an irreversible reaction of one reactant forming no product.

Name R_007

Reaction equation

$$\text{xFinal\_9} \longrightarrow \emptyset \quad (67)$$

Reactant

Table 16: Properties of each reactant.

Id	Name	SBO
xFinal_9	Growth Arrested Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \mathrm{vol}\left(\mathrm{Psoriatic}\right) \cdot \mathrm{Function\_for\_R\_7}\left(\mathrm{AId}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \mathrm{rhoTr}, [\mathrm{xFinal\_9}]\right) \tag{68}$$

$$\begin{aligned} &\mathrm{Function\_for\_R\_7}\left(\mathrm{AId}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \mathrm{rhoTr}, [\mathrm{xFinal\_9}]\right) \\ &= \frac{\mathrm{AId} \cdot \mathrm{k3} \cdot [\mathrm{xFinal\_9}] \cdot \frac{\mathrm{rhoTr}}{1-\mathrm{AId}} + \mathrm{apopFBL} \cdot [\mathrm{xFinal\_9}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \end{aligned} \tag{69}$$

$$\begin{aligned} &\mathrm{Function\_for\_R\_7}\left(\mathrm{AId}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \mathrm{rhoTr}, [\mathrm{xFinal\_9}]\right) \\ &= \frac{\mathrm{AId} \cdot \mathrm{k3} \cdot [\mathrm{xFinal\_9}] \cdot \frac{\mathrm{rhoTr}}{1-\mathrm{AId}} + \mathrm{apopFBL} \cdot [\mathrm{xFinal\_9}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \end{aligned} \tag{70}$$

10.8 Reaction R_8

This is an irreversible reaction of one reactant forming one product.

Name R_008

Reaction equation

$$\mathrm{xFinal\_9} \longrightarrow \mathrm{xFinal\_8} \tag{71}$$

Reactant

Table 17: Properties of each reactant.

Id	Name	SBO
xFinal_9	Growth Arrested Cells	

Product

Table 18: Properties of each product.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \mathrm{vol}\left(\mathrm{Psoriatic}\right) \cdot \mathrm{Function\_for\_R\_8}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{km2}, [\mathrm{xFinal\_9}]\right) \tag{72}$$

$$\text{Function\_for\_R\_8}\left(\text{vol}\left(\text{compartmentOne}\right), \text{km2}, \left[\text{xFinal\_9}\right]\right) = \frac{\text{km2} \cdot \left[\text{xFinal\_9}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \quad (73)$$

$$\text{Function\_for\_R\_8}\left(\text{vol}\left(\text{compartmentOne}\right), \text{km2}, \left[\text{xFinal\_9}\right]\right) = \frac{\text{km2} \cdot \left[\text{xFinal\_9}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \quad (74)$$

10.9 Reaction R_9

This is an irreversible reaction of one reactant forming one product.

Name R_009

Reaction equation

$$\text{xFinal\_7} \longrightarrow 2\,\text{xFinal\_8} \quad (75)$$

Reactant

Table 19: Properties of each reactant.

Id	Name	SBO
xFinal_7	Stem Cells	

Product

Table 20: Properties of each product.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \text{vol}\left(\text{Psoriatic}\right) \cdot \text{Function\_for\_R\_9}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k1sh}, \text{rhoSC}, \left[\text{xFinal\_7}\right]\right) \quad (76)$$

$$\text{Function\_for\_R\_9}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k1sh}, \text{rhoSC}, \left[\text{xFinal\_7}\right]\right) = \frac{\text{k1sh} \cdot \text{rhoSC} \cdot \left[\text{xFinal\_7}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \quad (77)$$

$$\text{Function\_for\_R\_9}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k1sh}, \text{rhoSC}, \left[\text{xFinal\_7}\right]\right) = \frac{\text{k1sh} \cdot \text{rhoSC} \cdot \left[\text{xFinal\_7}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{78}$$

10.10 Reaction R_10

This is an irreversible reaction of one reactant forming two products.

Name R_010

Reaction equation

$$\text{xFinal\_7} \longrightarrow \text{xFinal\_7} + \text{xFinal\_8} \tag{79}$$

Reactant

Table 21: Properties of each reactant.

Id	Name	SBO
xFinal_7	Stem Cells	

Products

Table 22: Properties of each product.

Id	Name	SBO
xFinal_7	Stem Cells	
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{vol}\left(\text{Psoriatic}\right) \cdot \text{Function\_for\_R\_10}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k1ah}, \text{rhoSC}, \left[\text{xFinal\_7}\right]\right) \tag{80}$$

$$\begin{aligned} &\text{Function\_for\_R\_10}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k1ah}, \text{rhoSC}, \left[\text{xFinal\_7}\right]\right) \\ &= \frac{\text{k1ah} \cdot \text{rhoSC} \cdot \left[\text{xFinal\_7}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \end{aligned} \tag{81}$$

$$\begin{aligned}&\text{Function\_for\_R\_10}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k1ah}, \text{rhoSC}, \left[\text{xFinal\_7}\right]\right)\\ &= \frac{\text{k1ah} \cdot \text{rhoSC} \cdot \left[\text{xFinal\_7}\right]}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{82}$$

10.11 Reaction R_11

This is an irreversible reaction of one reactant forming one product.

Name R_011

Reaction equation

$$\text{xFinal\_8} \longrightarrow 2\,\text{xFinal\_8} \tag{83}$$

Reactant

Table 23: Properties of each reactant.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	

Product

Table 24: Properties of each product.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned}v_{11} = \text{vol}\left(\text{Psoriatic}\right) \cdot \text{Function\_for\_R\_11}\left(\text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \text{doseBL},\right.\\ \left.\text{gamma2}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right)\end{aligned} \tag{84}$$

$$\begin{aligned}&\text{Function\_for\_R\_11}\left(\text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \text{doseBL}, \text{gamma2}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right)\\ &= \frac{\text{aProl} \cdot \text{aProl} \cdot \text{gamma2} \cdot \text{rhoTA} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot \left[\text{xFinal\_8}\right]}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{85}$$

$$\begin{aligned}&\text{Function\_for\_R\_11}\left(\text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \text{doseBL}, \text{gamma2}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right)\\ &= \frac{\text{aProl} \cdot \text{aProl} \cdot \text{gamma2} \cdot \text{rhoTA} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot \left[\text{xFinal\_8}\right]}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{86}$$

10.12 Reaction R_12

This is an irreversible reaction of one reactant forming no product.

Name R_012

Reaction equation

$$\text{xFinal\_8} \longrightarrow \emptyset \tag{87}$$

Reactant

Table 25: Properties of each reactant.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \text{vol}\left(\text{Psoriatic}\right) \cdot \text{Function\_for\_R\_12}\left(\text{AId}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k2s}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right) \tag{88}$$

$$\begin{aligned}&\text{Function\_for\_R\_12}\left(\text{AId}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k2s}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right)\\ &= \frac{\text{AId} \cdot \text{k2s} \cdot \left[\text{xFinal\_8}\right] \cdot \frac{\text{rhoTA}}{1-\text{AId}} + \text{apopFBL} \cdot \left[\text{xFinal\_8}\right]}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{89}$$

$$\begin{aligned}&\text{Function\_for\_R\_12}\left(\text{AId}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k2s}, \text{rhoTA}, \left[\text{xFinal\_8}\right]\right)\\ &= \frac{\text{AId} \cdot \text{k2s} \cdot \left[\text{xFinal\_8}\right] \cdot \frac{\text{rhoTA}}{1-\text{AId}} + \text{apopFBL} \cdot \left[\text{xFinal\_8}\right]}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{90}$$

10.13 Reaction R_13

This is an irreversible reaction of one reactant forming one product.

Name R_013

Reaction equation

$$\text{xFinal\_8} \longrightarrow \text{xFinal\_7} \tag{91}$$

Reactant

Table 26: Properties of each reactant.

Id	Name	SBO
xFinal_8	Transit Amplifying Cells	

Product

Table 27: Properties of each product.

Id	Name	SBO
xFinal_7	Stem Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \text{vol}\left(\text{Psoriatic}\right) \cdot \text{Function\_for\_R\_13}\left(\text{vol}\left(\text{compartmentOne}\right), \text{km1}, \left[\text{xFinal\_8}\right]\right) \tag{92}$$

$$\text{Function\_for\_R\_13}\left(\text{vol}\left(\text{compartmentOne}\right), \text{km1}, \left[\text{xFinal\_8}\right]\right) = \frac{\text{km1} \cdot \left[\text{xFinal\_8}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{93}$$

$$\text{Function\_for\_R\_13}\left(\text{vol}\left(\text{compartmentOne}\right), \text{km1}, \left[\text{xFinal\_8}\right]\right) = \frac{\text{km1} \cdot \left[\text{xFinal\_8}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{94}$$

10.14 Reaction R_14

This is an irreversible reaction of one reactant forming one product.

Name R_014

Reaction equation

$$\text{xFinal\_7} \longrightarrow 2\,\text{xFinal\_7} \tag{95}$$

Reactant

Table 28: Properties of each reactant.

Id	Name	SBO
xFinal_7	Stem Cells	

Product

Table 29: Properties of each product.

Id	Name	SBO
xFinal_7	Stem Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \mathrm{vol}\left(\mathrm{Psoriatic}\right) \cdot \mathrm{Function\_for\_R\_14}\left(\mathrm{aProl}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma1h}, \mathrm{rhoSC}, [\mathrm{xFinal\_7}]\right) \tag{96}$$

$$\mathrm{Function\_for\_R\_14}\left(\mathrm{aProl}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma1h}, \mathrm{rhoSC}, [\mathrm{xFinal\_7}]\right) = \frac{\mathrm{aProl} \cdot \mathrm{gamma1h} \cdot \mathrm{rhoSC} \cdot \exp\left(\mathrm{bProl} \cdot \mathrm{doseBL}\right) \cdot [\mathrm{xFinal\_7}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{97}$$

$$\mathrm{Function\_for\_R\_14}\left(\mathrm{aProl}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma1h}, \mathrm{rhoSC}, [\mathrm{xFinal\_7}]\right) = \frac{\mathrm{aProl} \cdot \mathrm{gamma1h} \cdot \mathrm{rhoSC} \cdot \exp\left(\mathrm{bProl} \cdot \mathrm{doseBL}\right) \cdot [\mathrm{xFinal\_7}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{98}$$

10.15 Reaction R_15

This is an irreversible reaction of two reactants forming one product.

Name R_015

Reaction equation

$$\mathrm{xFinal\_6} + \mathrm{xFinal\_7} \longrightarrow \mathrm{xFinal\_6} \tag{99}$$

Reactants

Table 30: Properties of each reactant.

Id	Name	SBO
xFinal_6	Corneocytes	
xFinal_7	Stem Cells	

Product

Table 31: Properties of each product.

Id	Name	SBO
xFinal_6	Corneocytes	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \text{Function\_for\_R\_15}\left(\text{Pscmax}, \text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \text{doseBL}, \text{gamma1h}, \text{lambda}, \text{rhoSC}, [\text{xFinal\_6}], [\text{xFinal\_7}]\right) \tag{100}$$

$$\begin{aligned}&\text{Function\_for\_R\_15}\left(\text{Pscmax}, \text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \right.\\ &\left.\text{doseBL}, \text{gamma1h}, \text{lambda}, \text{rhoSC}, [\text{xFinal\_6}], [\text{xFinal\_7}]\right)\\ &= \frac{\text{aProl} \cdot \text{gamma1h} \cdot \text{rhoSC} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot [\text{xFinal\_7}] \cdot \frac{[\text{xFinal\_6}]}{\text{lambda} \cdot \text{Pscmax}}}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{101}$$

10.16 Reaction R_16

This is an irreversible reaction of one reactant forming no product.

Name R_016

Reaction equation

$$\text{xFinal\_7} \longrightarrow \emptyset \tag{102}$$

Reactant

Table 32: Properties of each reactant.

Id	Name	SBO
xFinal_7	Stem Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \mathrm{vol}\left(\mathrm{Psoriatic}\right) \cdot \mathrm{Function\_for\_R\_16}\left(\mathrm{AId}, \mathrm{Ka}, \mathrm{Kp}, \mathrm{Pscmax}, \mathrm{aProl}, \mathrm{apopFBL}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma1h}, \mathrm{k1sh}, \mathrm{lambda}, \mathrm{rhoSC}, [\mathrm{xFinal\_7}]\right) \tag{103}$$

$$\mathrm{Function\_for\_R\_16}\left(\mathrm{AId}, \mathrm{Ka}, \mathrm{Kp}, \mathrm{Pscmax}, \mathrm{aProl}, \mathrm{apopFBL}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma1h}, \mathrm{k1sh}, \mathrm{lambda}, \mathrm{rhoSC}, [\mathrm{xFinal\_7}]\right) \tag{104}$$

$$= \frac{\mathrm{aProl} \cdot \mathrm{gamma1h} \cdot \mathrm{rhoSC} \cdot \exp\left(\mathrm{bProl} \cdot \mathrm{doseBL}\right) \cdot [\mathrm{xFinal\_7}] \cdot \frac{[\mathrm{xFinal\_7}]}{\mathrm{lambda} \cdot \mathrm{Pscmax}} + \mathrm{AId} \cdot \mathrm{k1sh} \cdot [\mathrm{xFinal\_7}] \cdot \frac{\mathrm{rhoSC}}{1 - \mathrm{AId}} + \mathrm{apop}}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)}$$

$$\mathrm{Function\_for\_R\_16}\left(\mathrm{AId}, \mathrm{Ka}, \mathrm{Kp}, \mathrm{Pscmax}, \mathrm{aProl}, \mathrm{apopFBL}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma1h}, \mathrm{k1sh}, \mathrm{lambda}, \mathrm{rhoSC}, [\mathrm{xFinal\_7}]\right) \tag{105}$$

$$= \frac{\mathrm{aProl} \cdot \mathrm{gamma1h} \cdot \mathrm{rhoSC} \cdot \exp\left(\mathrm{bProl} \cdot \mathrm{doseBL}\right) \cdot [\mathrm{xFinal\_7}] \cdot \frac{[\mathrm{xFinal\_7}]}{\mathrm{lambda} \cdot \mathrm{Pscmax}} + \mathrm{AId} \cdot \mathrm{k1sh} \cdot [\mathrm{xFinal\_7}] \cdot \frac{\mathrm{rhoSC}}{1 - \mathrm{AId}} + \mathrm{apop}}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)}$$

10.17 Reaction R_17

This is an irreversible reaction of one reactant forming one product.

Name R_017

Reaction equation

$$\mathrm{xFinal\_5} \longrightarrow \mathrm{xFinal\_6} \tag{106}$$

Reactant

Table 33: Properties of each reactant.

Id	Name	SBO
xFinal_5	Granular Cells	

Product

Table 34: Properties of each product.

Id	Name	SBO
xFinal_6	Corneocytes	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_17}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k5}, \left[\mathrm{xFinal\_5}\right]\right) \tag{107}$$

$$\mathrm{Function\_for\_R\_17}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k5}, \left[\mathrm{xFinal\_5}\right]\right) = \frac{\mathrm{k5} \cdot \left[\mathrm{xFinal\_5}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{108}$$

$$\mathrm{Function\_for\_R\_17}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k5}, \left[\mathrm{xFinal\_5}\right]\right) = \frac{\mathrm{k5} \cdot \left[\mathrm{xFinal\_5}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{109}$$

10.18 Reaction R_18

This is an irreversible reaction of one reactant forming no product.

Name R_018

Reaction equation

$$\mathrm{xFinal\_6} \longrightarrow \emptyset \tag{110}$$

Reactant

Table 35: Properties of each reactant.

Id	Name	SBO
xFinal_6	Corneocytes	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_18}\left(\mathrm{alpha}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \left[\mathrm{xFinal\_6}\right]\right) \tag{111}$$

$$\mathrm{Function\_for\_R\_18}\left(\mathrm{alpha}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \left[\mathrm{xFinal\_6}\right]\right) = \frac{\mathrm{alpha} \cdot \left[\mathrm{xFinal\_6}\right] + \mathrm{apopFBL} \cdot \left[\mathrm{xFinal\_6}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{112}$$

$$\mathrm{Function\_for\_R\_18}\left(\mathrm{alpha}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \left[\mathrm{xFinal\_6}\right]\right) = \frac{\mathrm{alpha} \cdot \left[\mathrm{xFinal\_6}\right] + \mathrm{apopFBL} \cdot \left[\mathrm{xFinal\_6}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{113}$$

10.19 Reaction R_19

This is an irreversible reaction of one reactant forming one product.

Name R_019

Reaction equation

$$\mathrm{xFinal\_4} \longrightarrow \mathrm{xFinal\_5} \tag{114}$$

Reactant

Table 36: Properties of each reactant.

Id	Name	SBO
xFinal_4	Spinous cells	

Product

Table 37: Properties of each product.

Id	Name	SBO
xFinal_5	Granular Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_19}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k4}, [\mathrm{xFinal\_4}]\right) \tag{115}$$

$$\mathrm{Function\_for\_R\_19}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k4}, [\mathrm{xFinal\_4}]\right) = \frac{\mathrm{k4} \cdot [\mathrm{xFinal\_4}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{116}$$

$$\mathrm{Function\_for\_R\_19}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k4}, [\mathrm{xFinal\_4}]\right) = \frac{\mathrm{k4} \cdot [\mathrm{xFinal\_4}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{117}$$

10.20 Reaction R_20

This is an irreversible reaction of one reactant forming no product.

Name R_020

Reaction equation

$$\mathrm{xFinal\_5} \longrightarrow \emptyset \tag{118}$$

Reactant

Table 38: Properties of each reactant.

Id	Name	SBO
xFinal_5	Granular Cells	

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{20} = {} & \mathrm{vol}\left(\mathrm{compartmentOne}\right) \\ & \cdot \mathrm{Function\_for\_R\_20}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k5}, [\mathrm{xFinal\_5}]\right) \end{aligned} \tag{119}$$

$$\begin{aligned} & \mathrm{Function\_for\_R\_20}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k5}, [\mathrm{xFinal\_5}]\right) \\ = {} & \frac{\mathrm{k5} \cdot [\mathrm{xFinal\_5}] \cdot \frac{\mathrm{AIh}}{1-\mathrm{AIh}} + \mathrm{apopFBL} \cdot [\mathrm{xFinal\_5}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \end{aligned} \tag{120}$$

$$\begin{aligned} & \mathrm{Function\_for\_R\_20}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k5}, [\mathrm{xFinal\_5}]\right) \\ = {} & \frac{\mathrm{k5} \cdot [\mathrm{xFinal\_5}] \cdot \frac{\mathrm{AIh}}{1-\mathrm{AIh}} + \mathrm{apopFBL} \cdot [\mathrm{xFinal\_5}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \end{aligned} \tag{121}$$

10.21 Reaction R_21

This is an irreversible reaction of one reactant forming one product.

Name R_021

Reaction equation

$$\text{xFinal\_3} \longrightarrow \text{xFinal\_4} \tag{122}$$

Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
xFinal_3	Growth Arrested Cells	

Product

Table 40: Properties of each product.

Id	Name	SBO
xFinal_4	Spinous cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \text{vol}\left(\text{compartmentOne}\right) \cdot \text{Function\_for\_R\_21}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k3}, [\text{xFinal\_3}]\right) \tag{123}$$

$$\text{Function\_for\_R\_21}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k3}, [\text{xFinal\_3}]\right) = \frac{\text{k3} \cdot [\text{xFinal\_3}]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{124}$$

$$\text{Function\_for\_R\_21}\left(\text{vol}\left(\text{compartmentOne}\right), \text{k3}, [\text{xFinal\_3}]\right) = \frac{\text{k3} \cdot [\text{xFinal\_3}]}{\text{vol}\left(\text{compartmentOne}\right)} \tag{125}$$

10.22 Reaction R_22

This is an irreversible reaction of one reactant forming no product.

Name R_022

Reaction equation

$$\text{xFinal\_4} \longrightarrow \emptyset \tag{126}$$

Reactant

Table 41: Properties of each reactant.

Id	Name	SBO
xFinal_4	Spinous cells	

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{22} = {} & \text{vol}\left(\text{compartmentOne}\right) \\ & \cdot \text{Function\_for\_R\_22}\left(\text{AIh}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k4}, \left[\text{xFinal\_4}\right]\right) \end{aligned} \tag{127}$$

$$\begin{aligned} & \text{Function\_for\_R\_22}\left(\text{AIh}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k4}, \left[\text{xFinal\_4}\right]\right) \\ = {} & \frac{\text{k4} \cdot \left[\text{xFinal\_4}\right] \cdot \frac{\text{AIh}}{1-\text{AIh}} + \text{apopFBL} \cdot \left[\text{xFinal\_4}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \end{aligned} \tag{128}$$

$$\begin{aligned} & \text{Function\_for\_R\_22}\left(\text{AIh}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k4}, \left[\text{xFinal\_4}\right]\right) \\ = {} & \frac{\text{k4} \cdot \left[\text{xFinal\_4}\right] \cdot \frac{\text{AIh}}{1-\text{AIh}} + \text{apopFBL} \cdot \left[\text{xFinal\_4}\right]}{\text{vol}\left(\text{compartmentOne}\right)} \end{aligned} \tag{129}$$

10.23 Reaction R_23

This is an irreversible reaction of one reactant forming one product.

Name R_023

Reaction equation

$$\text{xFinal\_2} \longrightarrow 2\,\text{xFinal\_3} \tag{130}$$

Reactant

Table 42: Properties of each reactant.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	

Product

Table 43: Properties of each product.

Id	Name	SBO
xFinal_3	Growth Arrested Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_23}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \left[\mathrm{xFinal\_2}\right]\right) \tag{131}$$

$$\mathrm{Function\_for\_R\_23}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \left[\mathrm{xFinal\_2}\right]\right) = \frac{\mathrm{k2s} \cdot \left[\mathrm{xFinal\_2}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{132}$$

$$\mathrm{Function\_for\_R\_23}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \left[\mathrm{xFinal\_2}\right]\right) = \frac{\mathrm{k2s} \cdot \left[\mathrm{xFinal\_2}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{133}$$

10.24 Reaction R_24

This is an irreversible reaction of one reactant forming two products.

Name R_024

Reaction equation

$$\mathrm{xFinal\_2} \longrightarrow \mathrm{xFinal\_2} + \mathrm{xFinal\_3} \tag{134}$$

Reactant

Table 44: Properties of each reactant.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	

Products

Table 45: Properties of each product.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	
xFinal_3	Growth Arrested Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_24}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2a}, [\mathrm{xFinal\_2}]\right) \tag{135}$$

$$\mathrm{Function\_for\_R\_24}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2a}, [\mathrm{xFinal\_2}]\right) = \frac{\mathrm{k2a} \cdot [\mathrm{xFinal\_2}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{136}$$

$$\mathrm{Function\_for\_R\_24}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2a}, [\mathrm{xFinal\_2}]\right) = \frac{\mathrm{k2a} \cdot [\mathrm{xFinal\_2}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{137}$$

10.25 Reaction R_25

This is an irreversible reaction of one reactant forming no product.

Name R_025

Reaction equation

$$\mathrm{xFinal\_3} \longrightarrow \emptyset \tag{138}$$

Reactant

Table 46: Properties of each reactant.

Id	Name	SBO
xFinal_3	Growth Arrested Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_25}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \left[\mathrm{xFinal\_3}\right]\right) \tag{139}$$

$$\mathrm{Function\_for\_R\_25}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \left[\mathrm{xFinal\_3}\right]\right) = \frac{\mathrm{k3} \cdot \left[\mathrm{xFinal\_3}\right] \cdot \frac{\mathrm{AIh}}{1-\mathrm{AIh}} + \mathrm{apopFBL} \cdot \left[\mathrm{xFinal\_3}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{140}$$

$$\mathrm{Function\_for\_R\_25}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k3}, \left[\mathrm{xFinal\_3}\right]\right) = \frac{\mathrm{k3} \cdot \left[\mathrm{xFinal\_3}\right] \cdot \frac{\mathrm{AIh}}{1-\mathrm{AIh}} + \mathrm{apopFBL} \cdot \left[\mathrm{xFinal\_3}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{141}$$

10.26 Reaction R_26

This is an irreversible reaction of one reactant forming one product.

Name R_026

Reaction equation

$$\mathrm{xFinal\_3} \longrightarrow \mathrm{xFinal\_2} \tag{142}$$

Reactant

Table 47: Properties of each reactant.

Id	Name	SBO
xFinal_3	Growth Arrested Cells	

Product

Table 48: Properties of each product.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_26}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{km2}, [\mathrm{xFinal\_3}]\right) \tag{143}$$

$$\mathrm{Function\_for\_R\_26}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{km2}, [\mathrm{xFinal\_3}]\right) = \frac{\mathrm{km2} \cdot [\mathrm{xFinal\_3}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{144}$$

$$\mathrm{Function\_for\_R\_26}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{km2}, [\mathrm{xFinal\_3}]\right) = \frac{\mathrm{km2} \cdot [\mathrm{xFinal\_3}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{145}$$

10.27 Reaction R_27

This is an irreversible reaction of three reactants forming three products.

Name R_027

Reaction equation

$$\mathrm{xFinal\_1} + \mathrm{xFinal\_2} + \mathrm{xFinal\_8} \longrightarrow \mathrm{xFinal\_1} + 3\,\mathrm{xFinal\_2} + \mathrm{xFinal\_8} \tag{146}$$

Reactants

Table 49: Properties of each reactant.

Id	Name	SBO
xFinal_1	Stem Cells	
xFinal_2	Transit Amplifying Cells	
xFinal_8	Transit Amplifying Cells	

Products

Table 50: Properties of each product.

Id	Name	SBO
xFinal_1	Stem Cells	
xFinal_2	Transit Amplifying Cells	
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \text{Function\_for\_R\_27}\left(\text{Ptah}, \text{vol}\left(\text{compartmentOne}\right), \text{k1sh}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_8}]\right) \tag{147}$$

$$\text{Function\_for\_R\_27}\left(\text{Ptah}, \text{vol}\left(\text{compartmentOne}\right), \text{k1sh}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_8}]\right) = \frac{\text{omega} \cdot [\text{xFinal\_1}] \cdot \frac{\text{k1sh}}{1+(\text{omega}-1)\cdot\left(\frac{[\text{xFinal\_2}]+[\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{vol}\left(\text{compartmentOne}\right)} \tag{148}$$

10.28 Reaction R_28

This is an irreversible reaction of three reactants forming three products.

Name R_028

Reaction equation

$$\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_8} \longrightarrow \text{xFinal\_1} + 2\,\text{xFinal\_2} + \text{xFinal\_8} \tag{149}$$

Reactants

Table 51: Properties of each reactant.

Id	Name	SBO
xFinal_1	Stem Cells	
xFinal_2	Transit Amplifying Cells	
xFinal_8	Transit Amplifying Cells	

Products

Table 52: Properties of each product.

Id	Name	SBO
xFinal_1	Stem Cells	
xFinal_2	Transit Amplifying Cells	
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \text{Function\_for\_R\_28}\left(\text{Ptah}, \text{vol}\left(\text{compartmentOne}\right), \text{k1ah}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_8}]\right) \tag{150}$$

$$\text{Function\_for\_R\_28}\left(\text{Ptah}, \text{vol}\left(\text{compartmentOne}\right), \text{k1ah}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_8}]\right) = \frac{\text{omega} \cdot [\text{xFinal\_1}] \cdot \frac{\text{k1ah}}{1+(\text{omega}-1)\cdot\left(\frac{[\text{xFinal\_2}]+[\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{vol}\left(\text{compartmentOne}\right)} \tag{151}$$

10.29 Reaction R_29

This is an irreversible reaction of one reactant forming one product.

Name R_029

Reaction equation

$$\text{xFinal\_2} \longrightarrow 2\,\text{xFinal\_2} \tag{152}$$

Reactant

Table 53: Properties of each reactant.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	

Product

Table 54: Properties of each product.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_29}\left(\mathrm{aProl}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma2}, [\mathrm{xFinal\_2}]\right) \tag{153}$$

$$\mathrm{Function\_for\_R\_29}\left(\mathrm{aProl}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma2}, [\mathrm{xFinal\_2}]\right) = \frac{\mathrm{aProl} \cdot \mathrm{gamma2} \cdot \exp\left(\mathrm{bProl} \cdot \mathrm{doseBL}\right) \cdot [\mathrm{xFinal\_2}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{154}$$

$$\mathrm{Function\_for\_R\_29}\left(\mathrm{aProl}, \mathrm{bProl}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{doseBL}, \mathrm{gamma2}, [\mathrm{xFinal\_2}]\right) = \frac{\mathrm{aProl} \cdot \mathrm{gamma2} \cdot \exp\left(\mathrm{bProl} \cdot \mathrm{doseBL}\right) \cdot [\mathrm{xFinal\_2}]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{155}$$

10.30 Reaction R_30

This is an irreversible reaction of one reactant forming no product.

Name R_030

Reaction equation

$$\mathrm{xFinal\_2} \longrightarrow \emptyset \tag{156}$$

Reactant

Table 55: Properties of each reactant.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_30}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \left[\mathrm{xFinal\_2}\right]\right) \tag{157}$$

$$\mathrm{Function\_for\_R\_30}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \left[\mathrm{xFinal\_2}\right]\right) = \frac{\mathrm{k2s} \cdot \left[\mathrm{xFinal\_2}\right] \cdot \frac{\mathrm{AIh}}{1-\mathrm{AIh}} + \mathrm{apopFBL} \cdot \left[\mathrm{xFinal\_2}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{158}$$

$$\mathrm{Function\_for\_R\_30}\left(\mathrm{AIh}, \mathrm{apopFBL}, \mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{k2s}, \left[\mathrm{xFinal\_2}\right]\right) = \frac{\mathrm{k2s} \cdot \left[\mathrm{xFinal\_2}\right] \cdot \frac{\mathrm{AIh}}{1-\mathrm{AIh}} + \mathrm{apopFBL} \cdot \left[\mathrm{xFinal\_2}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{159}$$

10.31 Reaction R_31

This is an irreversible reaction of one reactant forming one product.

Name R_031

Reaction equation

$$\mathrm{xFinal\_2} \longrightarrow \mathrm{xFinal\_1} \tag{160}$$

Reactant

Table 56: Properties of each reactant.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	

Product

Table 57: Properties of each product.

Id	Name	SBO
xFinal_1	Stem Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \mathrm{vol}\left(\mathrm{compartmentOne}\right) \cdot \mathrm{Function\_for\_R\_31}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{km1}, \left[\mathrm{xFinal\_2}\right]\right) \tag{161}$$

$$\mathrm{Function\_for\_R\_31}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{km1}, \left[\mathrm{xFinal\_2}\right]\right) = \frac{\mathrm{km1} \cdot \left[\mathrm{xFinal\_2}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{162}$$

$$\mathrm{Function\_for\_R\_31}\left(\mathrm{vol}\left(\mathrm{compartmentOne}\right), \mathrm{km1}, \left[\mathrm{xFinal\_2}\right]\right) = \frac{\mathrm{km1} \cdot \left[\mathrm{xFinal\_2}\right]}{\mathrm{vol}\left(\mathrm{compartmentOne}\right)} \tag{163}$$

10.32 Reaction R_32

This is an irreversible reaction of three reactants forming three products.

Name R_032

Reaction equation

$$\mathrm{xFinal\_1} + \mathrm{xFinal\_2} + \mathrm{xFinal\_8} \longrightarrow 2\,\mathrm{xFinal\_1} + \mathrm{xFinal\_2} + \mathrm{xFinal\_8} \tag{164}$$

Reactants

Table 58: Properties of each reactant.

Id	Name	SBO
xFinal_1	Stem Cells	
xFinal_2	Transit Amplifying Cells	
xFinal_8	Transit Amplifying Cells	

Products

Table 59: Properties of each product.

Id	Name	SBO
xFinal_1	Stem Cells	
xFinal_2	Transit Amplifying Cells	
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \text{Function\_for\_R\_32}\left(\text{Ptah}, \text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \text{doseBL}, \text{gamma1h}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_8}]\right) \tag{165}$$

$$\begin{aligned} &\text{Function\_for\_R\_32}\left(\text{Ptah}, \text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \right. \\ &\left. \text{doseBL}, \text{gamma1h}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_8}]\right) \\ &= \frac{\text{aProl} \cdot \text{gamma1h} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot [\text{xFinal\_1}] \cdot \frac{\text{omega}}{1+(\text{omega}-1)\cdot\left(\frac{[\text{xFinal\_2}]+[\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{vol}\left(\text{compartmentOne}\right)} \end{aligned} \tag{166}$$

10.33 Reaction R_33

This is an irreversible reaction of three reactants forming two products.

Name R_033

Reaction equation

$$\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_8} \longrightarrow \text{xFinal\_2} + \text{xFinal\_8} \tag{167}$$

Reactants

Table 60: Properties of each reactant.

Id	Name	SBO
xFinal_1	Stem Cells	
xFinal_2	Transit Amplifying Cells	
xFinal_8	Transit Amplifying Cells	

Products

Table 61: Properties of each product.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \text{Function\_for\_R\_33}\left(\text{Pscmax}, \text{Ptah}, \text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \text{doseBL}, \text{gamma1h}, \text{k1sh}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_8}]\right) \tag{168}$$

$$\begin{aligned}&\text{Function\_for\_R\_33}\left(\text{Pscmax}, \text{Ptah}, \text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \right.\\ &\left.\text{doseBL}, \text{gamma1h}, \text{k1sh}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_8}]\right)\\ &= \frac{\text{gamma1h} \cdot \frac{\frac{\text{aProl} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot [\text{xFinal\_1}] \cdot \text{omega} \cdot [\text{xFinal\_1}]}{1+(\text{omega}-1) \cdot \left(\frac{[\text{xFinal\_2}]+[\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{Pscmax}} + \text{k1sh} \cdot [\text{xFinal\_1}] \cdot \frac{\text{omega}}{1+(\text{omega}-1) \cdot \left(\frac{[\text{xFinal\_2}]+[\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{169}$$

10.34 Reaction R_34

This is an irreversible reaction of four reactants forming three products.

Name R_034

Reaction equation

$$\text{xFinal\_1} + \text{xFinal\_2} + \text{xFinal\_7} + \text{xFinal\_8} \longrightarrow \text{xFinal\_2} + \text{xFinal\_7} + \text{xFinal\_8} \tag{170}$$

Reactants

Table 62: Properties of each reactant.

Id	Name	SBO
xFinal_1	Stem Cells	
xFinal_2	Transit Amplifying Cells	
xFinal_7	Stem Cells	
xFinal_8	Transit Amplifying Cells	

Products

Table 63: Properties of each product.

Id	Name	SBO
xFinal_2	Transit Amplifying Cells	
xFinal_7	Stem Cells	
xFinal_8	Transit Amplifying Cells	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \text{Function\_for\_R\_34}\left(\text{Pscmax}, \text{Ptah}, \text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right), \text{doseBL}, \text{gamma1h}, \text{lambda}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_7}], [\text{xFinal\_8}]\right) \tag{171}$$

$$\begin{aligned}\text{Function\_for\_R\_34}&\left(\text{Pscmax}, \text{Ptah}, \text{aProl}, \text{bProl}, \text{vol}\left(\text{compartmentOne}\right),\right.\\ &\left.\text{doseBL}, \text{gamma1h}, \text{lambda}, \text{n}, \text{omega}, [\text{xFinal\_1}], [\text{xFinal\_2}], [\text{xFinal\_7}],\right.\\ &\left.[\text{xFinal\_8}]\right) = \frac{\text{gamma1h} \cdot \frac{\frac{\text{aProl} \cdot \exp\left(\text{bProl} \cdot \text{doseBL}\right) \cdot [\text{xFinal\_1}] \cdot \text{omega} \cdot [\text{xFinal\_7}]}{1 + (\text{omega} - 1) \cdot \left(\frac{[\text{xFinal\_2}] + [\text{xFinal\_8}]}{\text{Ptah}}\right)^{\text{n}}}}{\text{lambda}}}{\text{Pscmax}}}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{172}$$

10.35 Reaction R_35

This is an irreversible reaction of one reactant forming no product.

Name R_035

Reaction equation

$$\text{xFinal\_1} \longrightarrow \emptyset \tag{173}$$

Reactant

Table 64: Properties of each reactant.

Id	Name	SBO
xFinal_1	Stem Cells	

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned}v_{35} = &\text{vol}\left(\text{compartmentOne}\right)\\ &\cdot \text{Function\_for\_R\_35}\left(\text{AIh}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k1sh}, [\text{xFinal\_1}]\right)\end{aligned} \tag{174}$$

$$\begin{aligned}&\text{Function\_for\_R\_35}\left(\text{AIh}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k1sh}, [\text{xFinal\_1}]\right)\\ &= \frac{\text{k1sh} \cdot [\text{xFinal\_1}] \cdot \frac{\text{AIh}}{1 - \text{AIh}} + \text{apopFBL} \cdot [\text{xFinal\_1}]}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{175}$$

$$\begin{aligned}&\text{Function\_for\_R\_35}\left(\text{AIh}, \text{apopFBL}, \text{vol}\left(\text{compartmentOne}\right), \text{k1sh}, \left[\text{xFinal\_1}\right]\right)\\ &= \frac{\text{k1sh} \cdot \left[\text{xFinal\_1}\right] \cdot \frac{\text{AIh}}{1-\text{AIh}} + \text{apopFBL} \cdot \left[\text{xFinal\_1}\right]}{\text{vol}\left(\text{compartmentOne}\right)}\end{aligned} \tag{176}$$

11 Derived Rate Equations

When interpreted as an ordinary differential equation framework, this model implies the following set of equations for the rates of change of each species.

Identifiers for kinetic laws highlighted in gray cannot be verified to evaluate to units of SBML `substance` per `time`. As a result, some SBML interpreters may not be able to verify the consistency of the units on quantities in the model. Please check if

- parameters without an unit definition are involved or
- volume correction is necessary because the `hasOnlySubstanceUnits` flag may be set to `false` and `spacialDimensions`> 0 for certain species.

11.1 Species `xFinal_1`

Name Stem Cells

Initial concentration $362\ \text{mmol} \cdot \text{l}^{-1}$

This species takes part in ten reactions (as a reactant in R_27, R_28, R_32, R_33, R_34, R_35 and as a product in R_27, R_28, R_31, R_32).

$$\frac{\text{d}}{\text{d}t}\text{xFinal\_1} = v_{27} + v_{28} + v_{31} + 2\,v_{32} - v_{27} - v_{28} - v_{32} - v_{33} - v_{34} - v_{35} \tag{177}$$

11.2 Species `xFinal_2`

Name Transit Amplifying Cells

Initial concentration $77\ \text{mmol} \cdot \text{l}^{-1}$

This species takes part in 18 reactions (as a reactant in R_23, R_24, R_27, R_28, R_29, R_30, R_31, R_32, R_33, R_34 and as a product in R_24, R_26, R_27, R_28, R_29, R_32, R_33, R_34).

$$\begin{aligned}\frac{\text{d}}{\text{d}t}\text{xFinal\_2} = {} & v_{24} + v_{26} + 3\,v_{27} + 2\,v_{28} + 2\,v_{29} + v_{32} + v_{33} + v_{34} - v_{23}\\ & - v_{24} - v_{27} - v_{28} - v_{29} - v_{30} - v_{31} - v_{32} - v_{33} - v_{34}\end{aligned} \tag{178}$$

11.3 Species xFinal_3

Name Growth Arrested Cells

Initial concentration $61\ \mathrm{mmol}\cdot\mathrm{l}^{-1}$

This species takes part in five reactions (as a reactant in R_21, R_25, R_26 and as a product in R_23, R_24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_3} = 2\,v_{23} + v_{24} - v_{21} - v_{25} - v_{26} \tag{179}$$

11.4 Species xFinal_4

Name Spinous cells

Initial concentration $238\ \mathrm{mmol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in R_19, R_22 and as a product in R_21).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_4} = v_{21} - v_{19} - v_{22} \tag{180}$$

11.5 Species xFinal_5

Name Granular Cells

Initial concentration $119\ \mathrm{mmol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in R_17, R_20 and as a product in R_19).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_5} = v_{19} - v_{17} - v_{20} \tag{181}$$

11.6 Species xFinal_6

Name Corneocytes

Initial concentration $185\ \mathrm{mmol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a reactant in R_15, R_18 and as a product in R_15, R_17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_6} = v_{15} + v_{17} - v_{15} - v_{18} \tag{182}$$

11.7 Species xFinal_7

Name Stem Cells

Initial concentration $6459\ \mathrm{mmol}\cdot\mathrm{l}^{-1}$

This species takes part in ten reactions (as a reactant in R_9, R_10, R_14, R_15, R_16, R_34 and as a product in R_10, R_13, R_14, R_34).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_7} = v_{10} + v_{13} + 2\,v_{14} + v_{34} - v_9 - v_{10} - v_{14} - v_{15} - v_{16} - v_{34} \tag{183}$$

11.8 Species xFinal_8

Name Transit Amplifying Cells

Initial concentration $32098\ \mathrm{mmol}\cdot\mathrm{l}^{-1}$

This species takes part in 20 reactions (as a reactant in R_5, R_6, R_11, R_12, R_13, R_27, R_28, R_32, R_33, R_34 and as a product in R_6, R_8, R_9, R_10, R_11, R_27, R_28, R_32, R_33, R_34).

$$\begin{aligned}\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_8} = {} & v_6 + v_8 + 2\,v_9 + v_{10} + 2\,v_{11} + v_{27} + v_{28} + v_{32} + v_{33} + v_{34} \\ & - v_5 - v_6 - v_{11} - v_{12} - v_{13} - v_{27} - v_{28} - v_{32} - v_{33} - v_{34}\end{aligned} \tag{184}$$

11.9 Species xFinal_9

Name Growth Arrested Cells

Initial concentration $20536\ \mathrm{mmol}\cdot\mathrm{l}^{-1}$

This species takes part in five reactions (as a reactant in R_3, R_7, R_8 and as a product in R_5, R_6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_9} = 2\,v_5 + v_6 - v_3 - v_7 - v_8 \tag{185}$$

11.10 Species xFinal_10

Name Spinous cells

Initial concentration $79788\ \mathrm{mmol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in R_1, R_4 and as a product in R_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_10} = v_3 - v_1 - v_4 \tag{186}$$

11.11 Species xFinal_11

Name Granular Cells

Initial concentration $0\ \mathrm{mmol} \cdot \mathrm{l}^{-1}$

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_11} = 0 \tag{187}$$

11.12 Species xFinal_12

Name Corneocytes

Initial concentration $77633\ \mathrm{mmol} \cdot \mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in R_2 and as a product in R_1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{xFinal\_12} = v_1 - v_2 \tag{188}$$

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