

**Table A1.** Variables and constants used for modeling the *lac* operon.

Parameter	Definition	Value
$L_{(e)}$	External lactose concentration	
$X$	External IPTG or TMG	
$L$	Internal lactose concentration	
$A$	Allolactose concentration	
$R$	Active (=DNA binding) LacI concentration	
$Z$	LacZ concentration	
$Y$	LacY concentration	
$\beta_{y,z}(L)$	The regulation <i>function</i> expressing the production rate of LacZ (or LacY) as a function of external lactose (or IPTG) concentration $L$	
$R_T$	Total amount of repressor (constant)	0.01 $\mu\text{M}$ (10 molecules) [10]
$Z_T$	Maximal amount of LacZ	50 $\mu\text{M}$ ( $\sim 10^4$ molecules) [10]
$Y_T$	maximal amount of LacY	50 $\mu\text{M}$ ( $\sim 10^4$ molecules) [10]
$\tau_{\text{cell-generation}}$	Cell generation	30 minutes [17]
$\alpha, \tau_{\text{dilution}}^{-1}$	Dilution rate	$\frac{\ln 2}{\tau_{\text{cell-generation}}} = 2.26 \times 10^{-2} \text{ min}^{-1} \approx 1/(50 \text{ min})$
$\beta_z (\beta_{\text{WT}}, \beta_{\text{max}})$	Maximal production rate of LacZ	$\sim 10^2$ molecules $\text{min}^{-1}$ [16]
$\beta_y (\beta_{\text{WT}}, \beta_{\text{max}})$	Maximal production rate of LacY	$\sim 10^2$ molecules $\text{min}^{-1}$ [16]
$K_{\text{TMG-y}}$	Affinity of TMG and LacY	700 $\mu\text{M}$ [53]
$K_{L(e)-y}$	Affinity of external lactose and LacY	400 $\mu\text{M}$ [5]
$K_{L-y}$	Affinity of (internal) lactose and LacY	1.8 mM [5]
$K_{L-Z}$	Affinity of (internal) lactose and LacZ	1.4 mM [5]
$K_{A-Z}$	Affinity of Allolactose and LacZ	1.9 mM [17]
$K_{A-R}$	Affinity of Allolactose and LacI	6 $\mu\text{M}$ [17]
$K_{\text{IPTG-R}}$	Affinity of IPTG and LacI	Assumed to be 1 $\mu\text{M}$
$K_{\text{TMG-R}}$	Affinity of TMG and LacI	Assumed to be 6.3 $\mu\text{M}$
$K_{R-\text{dna}}$	Affinity of LacI and the DNA	$10^{-10}$ – $10^{-11}$ M [53]
$v_y$	Velocity of pumping by LacY	3000 molecules $\text{min}^{-1}$ [17]
$\bar{v}_y$	Velocity of efflux by LacY	$v_y/100$ [5]
$v_{z1}$	Velocity of internal lactose hydrolysis by LacZ	$v_{z1} = 0.9v_y$ [5]
$v_{z2}$	Velocity of conversion of lactose to allolactose by LacZ	20 000 molecules $\text{min}^{-1}$ [17]
$v_{z3}$	Velocity of allolactose hydrolysis by LacZ	20 000 molecules $\text{min}^{-1}$ [17]

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