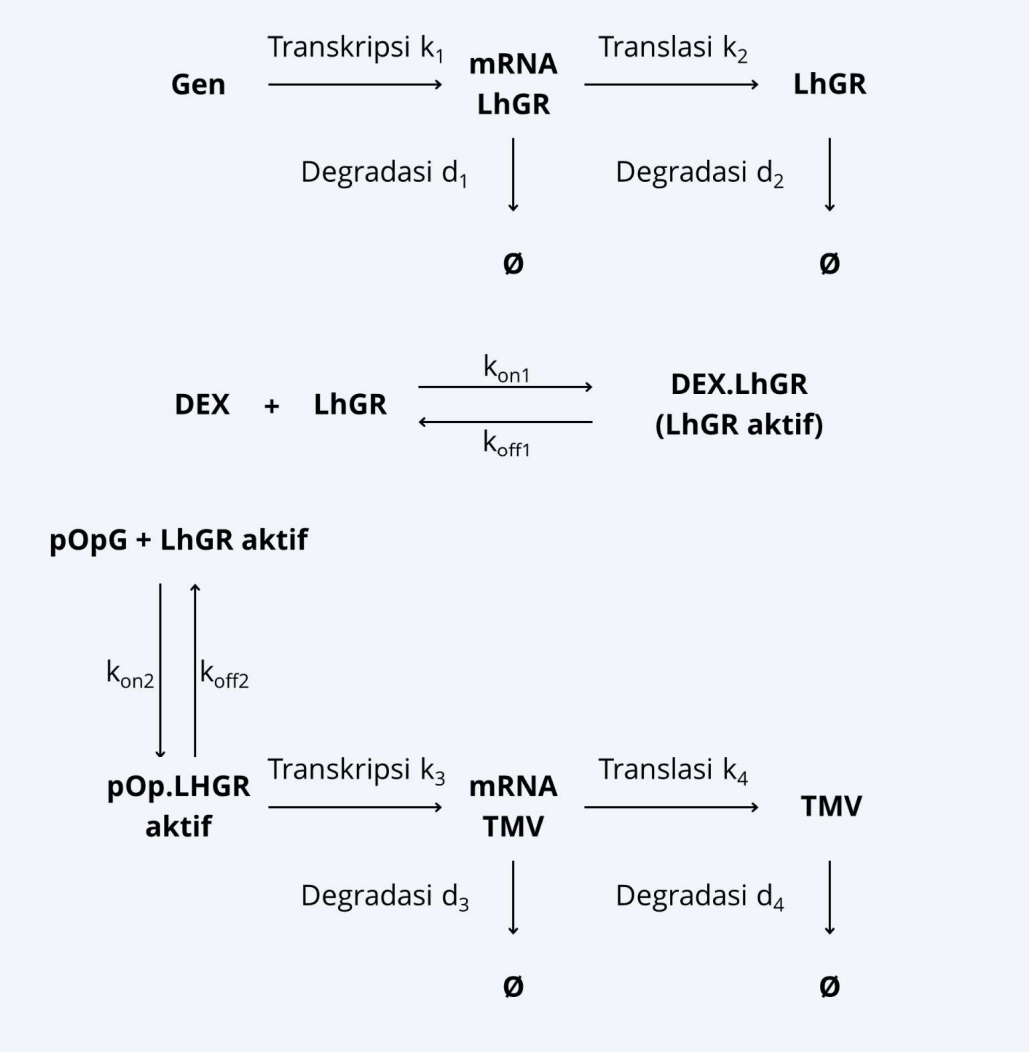
Kinetik Modelling

Skema

[Transkripsi gen LhGR -> translasi gen LhGR di sitoplasma]
↓
[Paparan dexamethasone]
↓
[Dexamethasone berikatan dengan LhGR di nucleus -> aktivasi LhGR]
↓
[LhGR aktif berikatan dengan promoter pOp6 pada gen replicase TMV]
↓
[Transkripsi gen replicase TMV -> Translasi di sitoplasma]

Reaksi



Ordinary Differential Equation

$$\frac{d[mRNA_{LhGR}]}{dt} = k_1[gene] - d_1[mRNA_{LhGR}]$$

$$\frac{d[LhGR]}{dt} = k_2[mRNA_{LhGR}] - d_2[LhGR] - k_{on}[DEX][LhGR] + k_{off}[LhGR_{active}]$$

$$\frac{d[DEX]}{dt} = -k_{on}[DEX][LhGR] + k_{off}[LhGR_{active}]$$

$$\frac{d[LhGR_{active}]}{dt} = k_{on}[DEX][LhGR] - k_{off}[LhGR_{active}]$$

$$\frac{d[TMV]}{dt} = \alpha\frac{[LhGR_{active}]^n}{K_d+[LhGR_{active}]^n} - d_4[TMV]$$

Parameter

No	Symbol	Value	Unit	Reference	Information
1	k_1	0.034	s^{-1}	[1]	General transcription rate
2	d_1	0.0005775	s^{-1}	[2]	General degradation rate
3	k_2	0.026	s^{-1}	[3]	General translation rate
4	d_2	0.0005775	s^{-1}	[2]	General degradation rate
5	k_{on}	5.1×10^3	$M^{-1}s^{-1}$	[4]	Associate rate constant
6	k_{off}	2×10^{-6}	s^{-1}	[4]	Dissociation rate constant
7	α	0.0112	s^{-1}	[5]	General maximal transcription rate
8	k_d	5.2×10^{-9}	M	[6]	Equilibrium dissociation constant
9	n	2	-	-	Hill coefficient
10	d_4	0.00027	s^{-1}	[7]	General degradation rate

Referensi

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[2] “Median mRNA half life - Budding yeast Saccharomyces ce - BNID 100205,” Bionumbers. https://bionumbers.hms.harvard.edu/bionumber.aspx?id=100205&ver=23 (accessed Nov. 06, 2024).

[3] J. F. Ross and M. Orlowski, “Growth-rate-dependent adjustment of ribosome function in chemostat-grown cells of the fungus Mucor racemosus.,” Journal of Bacteriology, vol. 149, no. 2, pp. 650–653, 1982, doi: https://doi.org/10.1128/jb.149.2.650-653.1982.

[4] W. B. Pratt, J. L. Kaine, and D. V. Pratt, “The kinetics of glucocorticoid binding to the soluble specific binding protein of mouse fibroblasts.,” Journal of Biological Chemistry, vol. 250, no. 12, pp. 4584–4591, Jun. 1975, doi: https://doi.org/10.1016/s0021-9258(19)41342-2.

[5] P. Maiuri et al., “Fast transcription rates of RNA polymerase II in human cells,” EMBO reports, vol. 12, no. 12, pp. 1280–1285, Oct. 2011, doi: https://doi.org/10.1038/embor.2011.196.

[6] “Dissociation constant of GAGA transcription f - Fruit fly Drosophila melanogas - BNID 104594,” Bionumbers, 2024. https://bionumbers.hms.harvard.edu/bionumber.aspx?id=104594&ver=9&trm=equilibrium+Dissociation&org= (accessed Nov. 06, 2024).

[7] “Average and median half life of protein - Budding yeast Saccharomyces ce - BNID 104151,” Bionumbers, 2024. https://bionumbers.hms.harvard.edu/bionumber.aspx?id=104151&ver=11&trm=102058&org= (accessed Nov. 13, 2024).