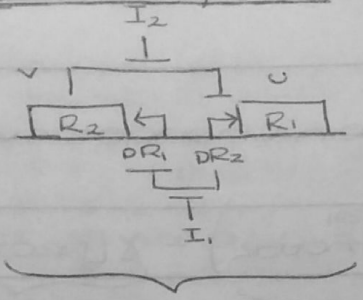
March 2nd, 2014



toggle switch

$$\frac{dU}{dt} = \frac{\alpha_1}{1+V^\beta} - U$$

$$\frac{dV}{dt} = \frac{\alpha_1}{1+U^\gamma} - V$$

$E + S \underset{k_R}{\overset{k_f}{\rightleftharpoons}} ES$ ex. $\frac{d[E]}{dt} = -k_f[E][S] + k_R[ES]$

we're interested in the steady state → change in concentration is zero

→ Ratios

* Hill functions

$$[ES_N]_{steady\text{-}state} = \frac{[S]^n_{total}}{\frac{k_R}{k_f} + [S]^n_{total}} \cdot [E]_{total}$$

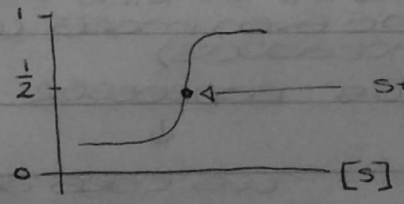
n = Hill term

when $\frac{k_R}{k_f} = [S]^n_{total}$

the steady state $= \frac{1}{2}[E]_{total} \cdot [S]^n_{total}$

→ sigmoidal curve

cooperativity



steepness is related to hill coefficient

Shift Register example

"2R" + "2" ⇌ 2R·+2

Repressor promoter

"2" → "1'R" $\frac{d[1'R]}{dt} = \alpha\left(1 - \frac{[2R]^n}{K_d + [2R]^n}\right) - \gamma[1'R]$