Task1: Model building and simulation

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In model1 (fig. 1) A is produced from outside the scope of the model by constant, 0 order mass action kinetics. A is at steady state because A also undergoes degradation. Without stimulation by S, A will simply find a steady state. In the presence of S (i.e. stimulus), A is reversibly converted to B. B stimulates the production of C which both undergoes spontaneous first order degradation. C induces the degradation of B, thereby completing a negative feedback.

1. Write the model equations with pen and paper
2. Reproduce the simulation output in fig. 2 using Copasi
3. Reproduce the simulation output using tellurium and antimony. The documentation is here (http://tellurium.analogmachine.org/) and there are also some examples in the PyCoTools documentation (https://pycotools3.readthedocs.io/en/latest/)
4. Change the rate law for the reaction where A gets converted to B by S to michaelis-menten kinetics using both Copasi and Antimony
5. Change the rate law for the reaction where B is degraded by C to competitive inhibition kinetics using both Copasi and Antimony

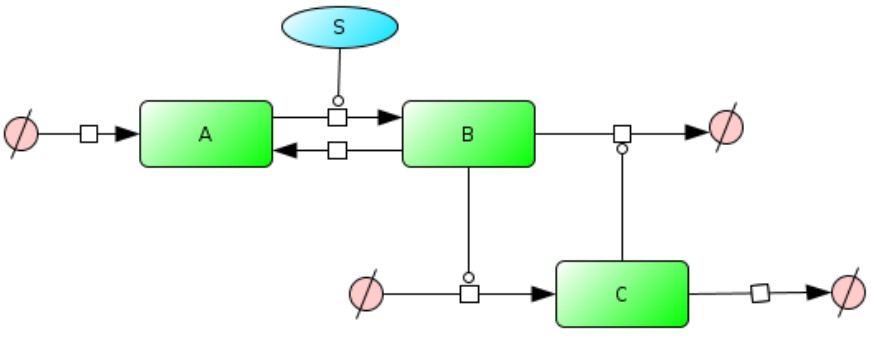

Figure 1: Topology diagram of model 1.

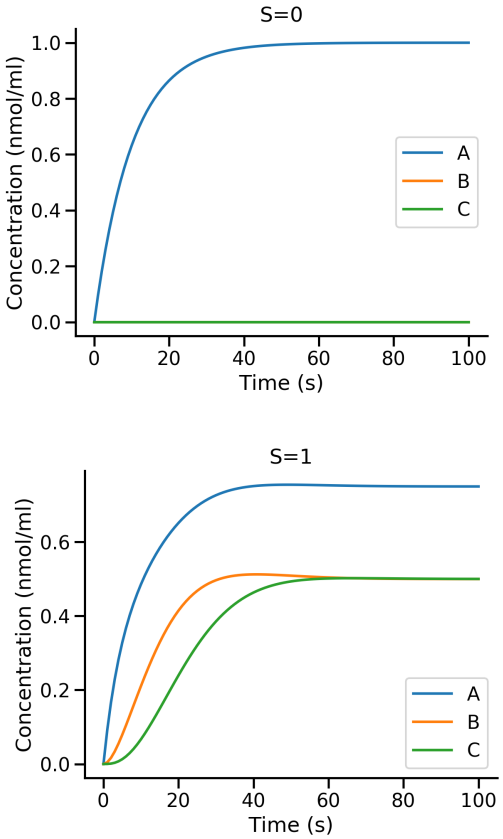

Figure 2: Simulation of (a) model 1 with (b) $S_0 = 0$ and (c) $S_0 = 1$. Initial concentrations: $A = B = C = 0$ and all kinetic parameters $k_1, ..., k_7 = 0.1$

6. Investigate the role of the ki parameter of the competitive inhibition reaction you've just added using both parameter sliders and parameter scans in Copasi

7. Run a sensitivity analysis in Copasi and try to interpret the results.