

# Toy Model Exercises (Draft)

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## Objectives:

1. Learn to create a BioNetGen model of a generic signaling pathway, using RuleBuilder.
2. Learn to run the model
  - a. Using a differential equation solver
  - b. Using a stochastic simulation
3. Learn to modify a BioNetGen model by changing parameters and reaction rules.

## Exercises:

1. Use RuleBuilder to define the model for the Ligand-Receptor-Acceptor-Kinase pathway, using the following values for reaction rates:

<i>Reaction</i>	<i>Direction</i>	<i>Parameter</i>	<i>Rate</i>
Ligand binding	forward	kpL	0.1
	reverse	kmL	0.1
Receptor aggregation	forward	kpD	1
	reverse	kmD	0.1
Receptor-adaptor binding	Forward	kpA	0.1
	reverse	kmA	0.1
Adaptor binding kinase	forward	kpK	0.1
	reverse	kmK	0.1
Kinase transphosphorylation by inactive kinase		pK	1
Kinase transphosphorylation by active kinase		pKs	10
Dephosphorylation of kinase in membrane complex		dM	1
Dephosphorylation of kinase in cytosol		dC	10

2. Run the model in RuleBuilder, using the following initial values for species:

<i>Species</i>	<i>Parameter</i>	<i>Concentration</i>
Ligand	L_tot	1
Receptor	R_tot	10
Adaptor	A_tot	1
Kinase	K_tot	1

3. Try increasing the ligand binding rate until more ligand has no additional effect.
4. Use BNEditor to compute a dose/response curve for ligand stimulation.