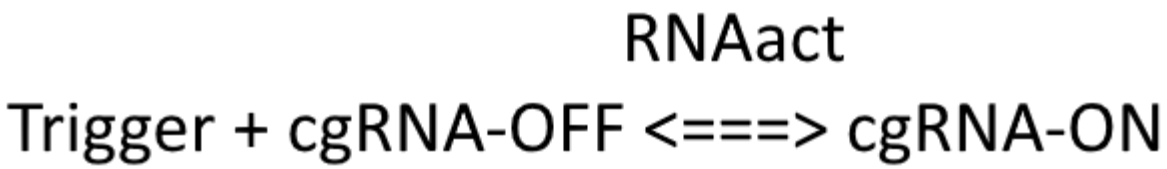
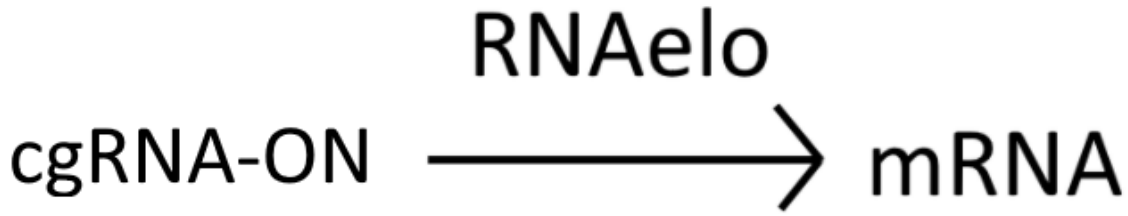
Ordinary Differential Equations for Warwick iGEM 2021 cgRNA Mass Action Kinetics Prediction

1. **Trigger induces cgRNA**



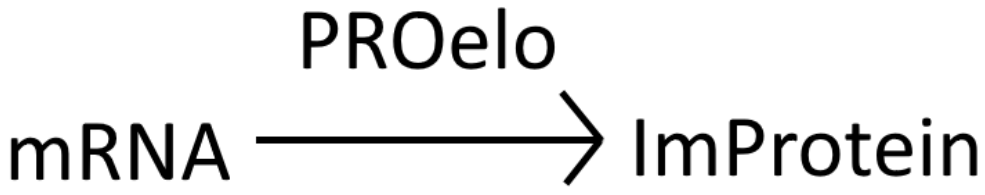
Trigger = concentration of **Trigger**
cgRNA-OFF = Concentration of inactive **cgRNA**
cgRNA-ON = Concentration of cgRNA-Trigger complex
RNAact = **RNA act**ivation rate. The rate at which Trigger and cgRNA associate.

2. **Elongation of mRNA**



cgRNA-ON = Concentration of cgRNA-Trigger complex
mRNA = Concentration of **mRNA** transcripts
RNAelo = **RNA elo**ngation rate

3. **Translation of GFP**



mRNA = Concentration of **mRNA** transcripts
ImProtein = Concentration of **Im**mature GFP **Protein**
PROelo = **Pro**tein **elo**ngation rate

4. Maturation of GFP fluorophore

ImProtein = Concentration of **Im**mature GFP **Protein**
GFP = Concentration of fluorescent **GFP**
GFPmat = **GFP mat**uration rate

Sources:

RNAact = cg**RNA act**ivation rate
(http://2017.igem.org/Team:CLSB-UK/Model#MAK - Thomas Ouldridge has previously suggested a range of 10^5 ~ 10^6 for Toehold Switches **RNA Act**ivation 6×10^5 $M^{-1}s^{-1}$ *- toehold switches are comparable to cgRNA - reverse rate k2 was* $1s^{-1}$ *whilst Promoter leakage and cgRNA Leakage rates were predicted at* 10^{-15} *and* $10^{-7}s^{-1}$ *respectively)*

RNAelo = **RNA elo**ngation rate
PROelo = **Pro**tein **elo**ngation rate
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2930199/ - table 1, ***transcription & translation rate*** *of MG1655 strain of E.coli at* ***14 and 42 nt/s*** *(or* s^{-1}*) respectively - RBS affinity is not considered in the model)*
(https://jbioleng.biomedcentral.com/articles/10.1186/1754-1611-4-9 - Trigger Degradation rate was $1.28\times10\text{-}3\ s^{-1}$*)*

GFPmat = **GFP mat**uration rate
(http://book.bionumbers.org/what-is-the-maturation-time-for-fluorescent-proteins/ - sfGFP takes 6 minutes -> $(1/(6*60))\ s^{-1}$ *=* ***GFPmat*** *=* $\sim0.0028\ s^{-1}$*)*