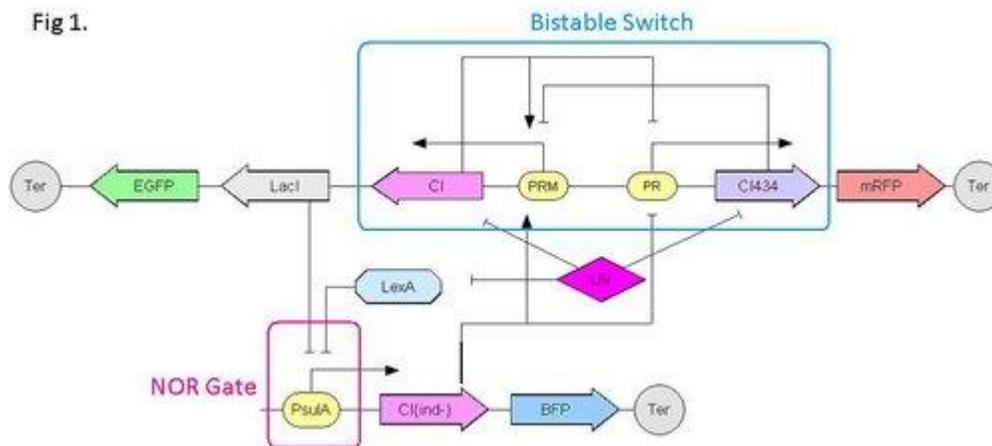


NOTES (From http://parts.mit.edu/igem07/index.php/Peking_Push-on-push-off)

Gene Circuit Components:

Fig.1 shows the scheme of the gene circuit. The **Bistable Switch** is composed of CI and CI434 which repress each other in transcription. The **NOR Gate** is a promoter repressed by both LacI and LexA. These two parts are connected by LacI and CI(ind-). UV irradiation induces SOS response in *E. coli*, causing rapid degradation of LexA, CI and CI434. CI(ind-) is a mutation of CI which functions the same as CI but is not readily degraded in SOS response.



Mathematical model

A set of ordinary differential equations (ODEs) are used to describe the dynamic behavior of this circuit after UV irradiation. As shown in Fig 2, initially the cell is expressing CI-GFP-LacI. CI434-RFP is repressed by CI, and CI(ind-) is repressed by both LexA and LacI. We call this **state 1**. When the cell is exposed to UV irradiation, LexA and CI are degraded. In the absence of CI, LacI transcription attenuates. Meanwhile, LacI concentration decreases gradually owing to the cell growth. At the same time, as the DNA damage produced by UV being repaired, LexA, CI, and CI434 tend to re-accumulate. As a result, during the SOS response and thereafter, CI(ind-) is always repressed, firstly by LacI and then by LexA. At this moment, because the promoter PR is stronger than PRM, CI434 accumulates faster and represses CI expression. The cell turns to **state 2**, in which CI434-RFP is high and CI-GFP-LacI is low.

When the cell is exposed to UV irradiation again, LexA is degraded, and in the absence of both LexA and LacI, CI(ind-) is expressed. Before CI(ind-) is turned off by LacI and LexA, it helps to repress CI434, and induce the expression of CI, turning the cell back to **state 1**.

According to the simulation result, the circuit does have the potential to behave like a push-on push-off switch.

