Legend

Sg = Signal,

Tr = Triger,

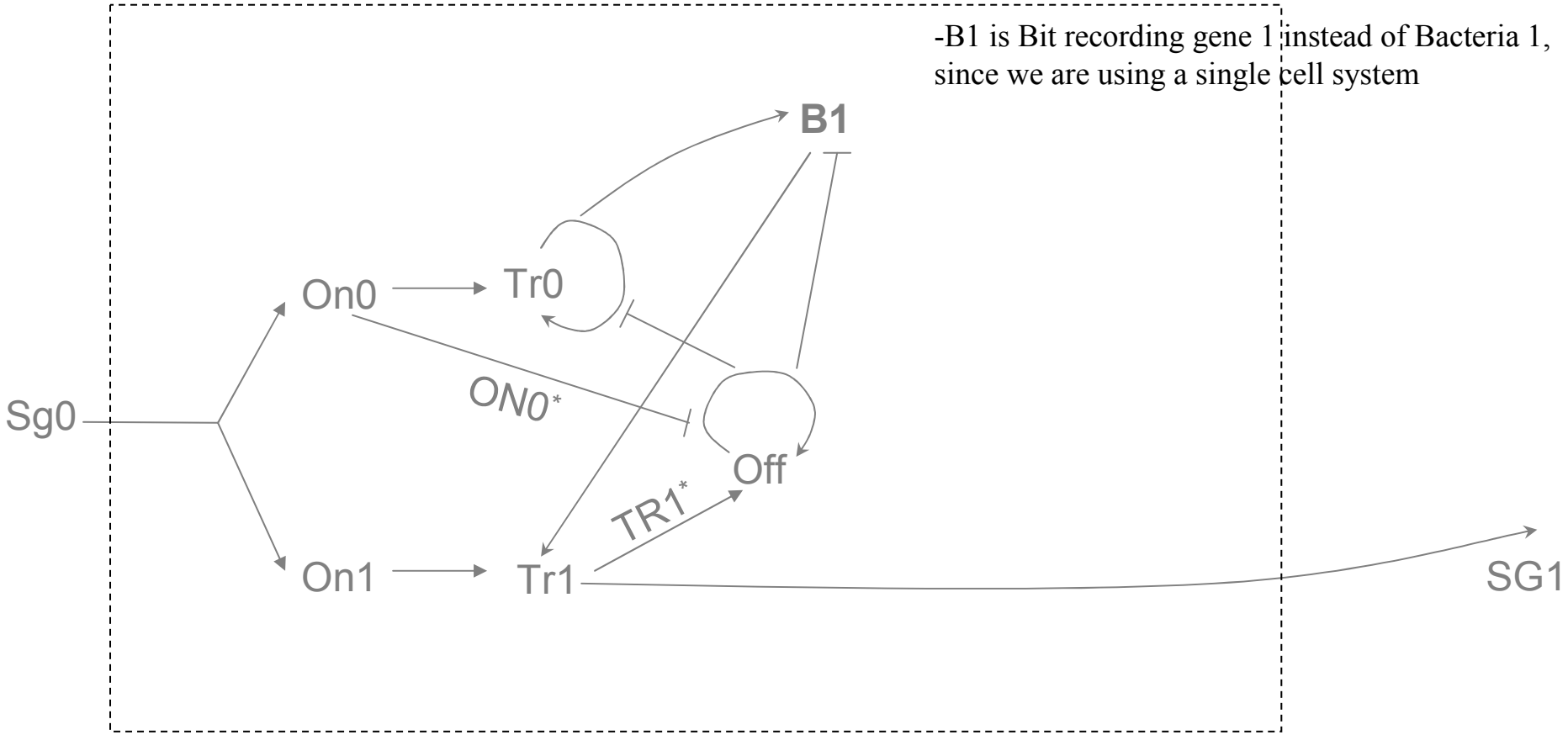
B = Bit recording gene

Implementation of Binary Gene Expression in a Single Cell System

-The dotted box represents one repeating unit of the binary series

-Initially, everything is inactive

-B1 is Bit recording gene 1 instead of Bacteria 1, since we are using a single cell system



Legend

Sg = Signal,

Tr = Triger,

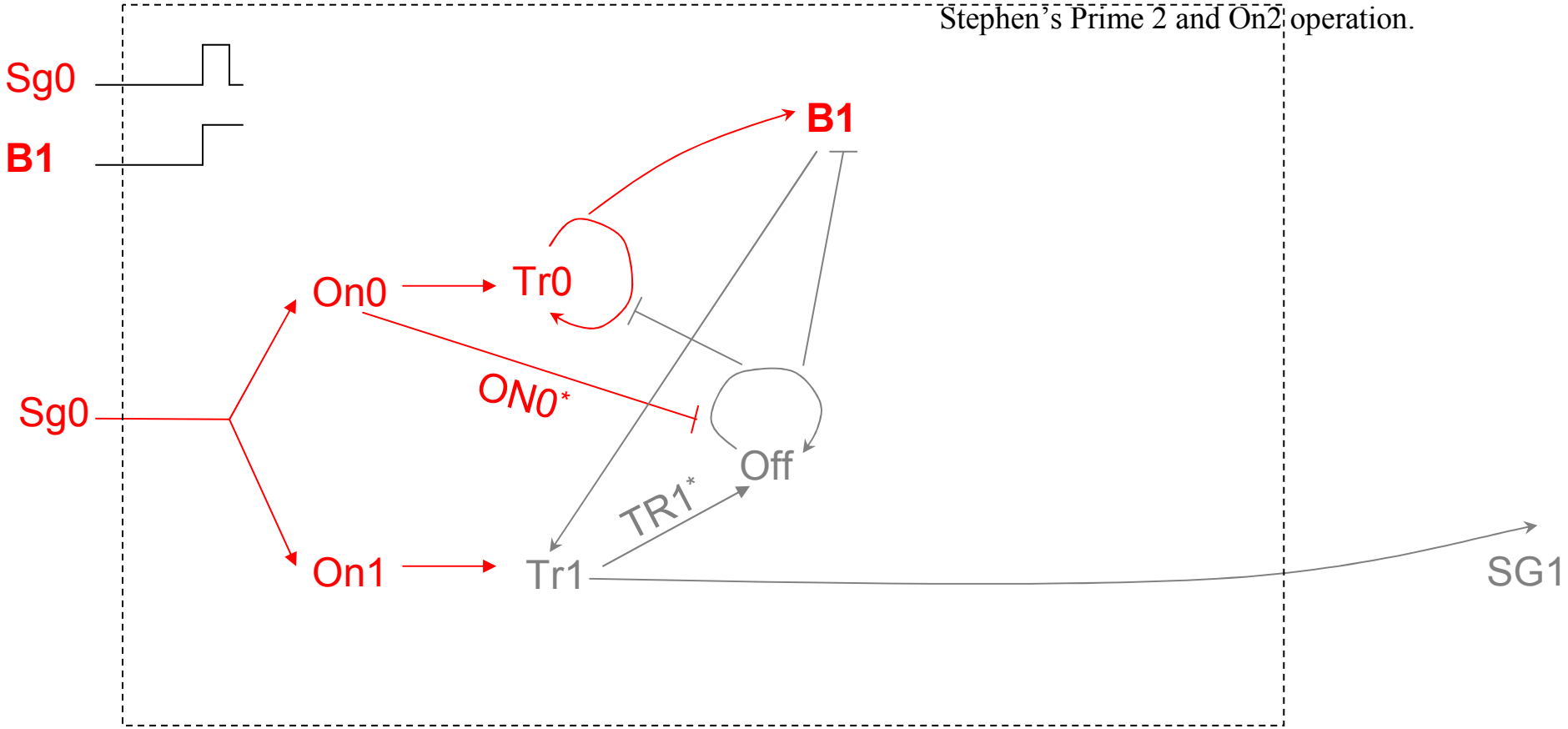
B = Bit recording gene

Pic 1

-First pulse of Sigal0 comes in

-Activates On0, On1, Tr0, **B1**

-Tr1 can't do anything yet, same idea as Stephen's Prime 2 and On2 operation.



Legend

Sg = Signal,

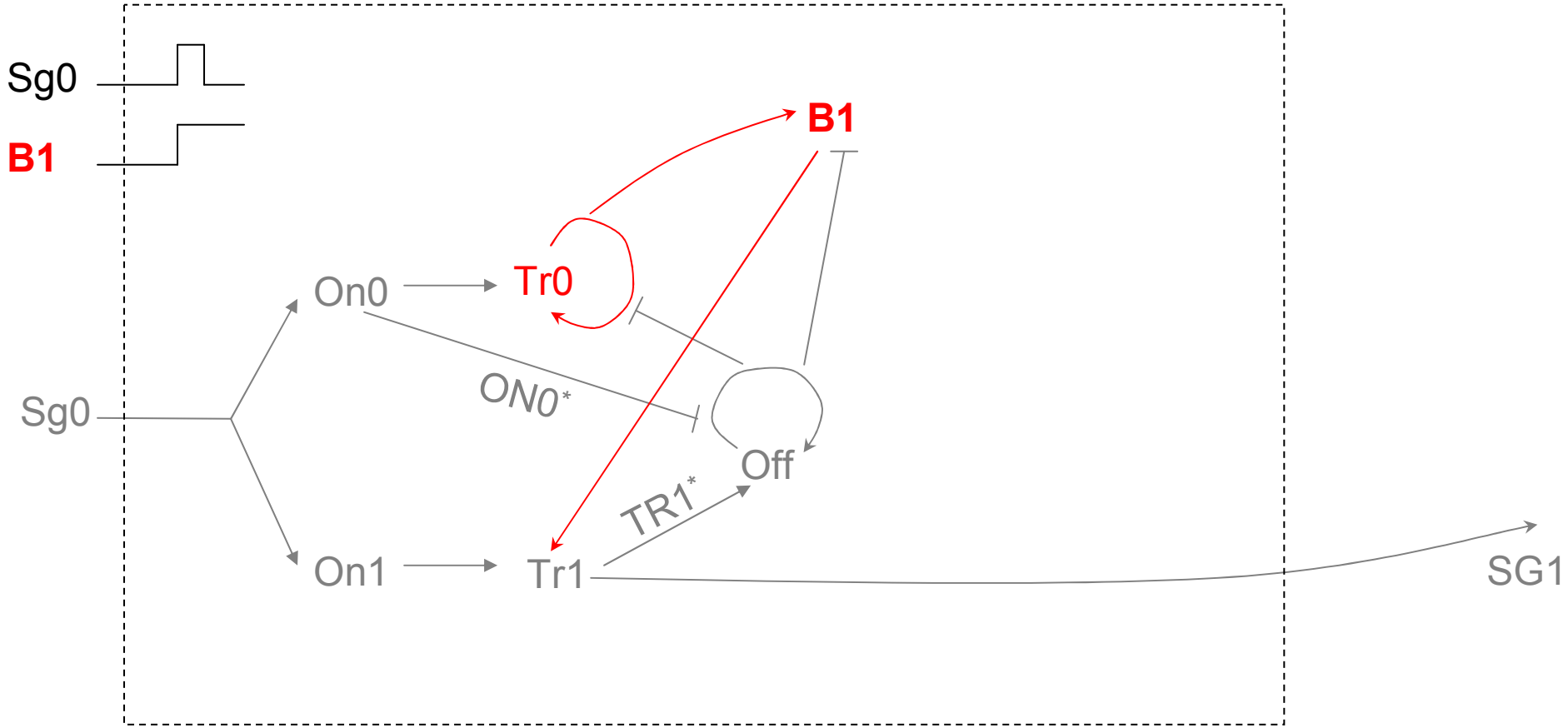
Tr = Triger,

B = Bit recording gene

Pic 2

-After a little while, On0, On1 degrade

-Tr0 remains B1 ON



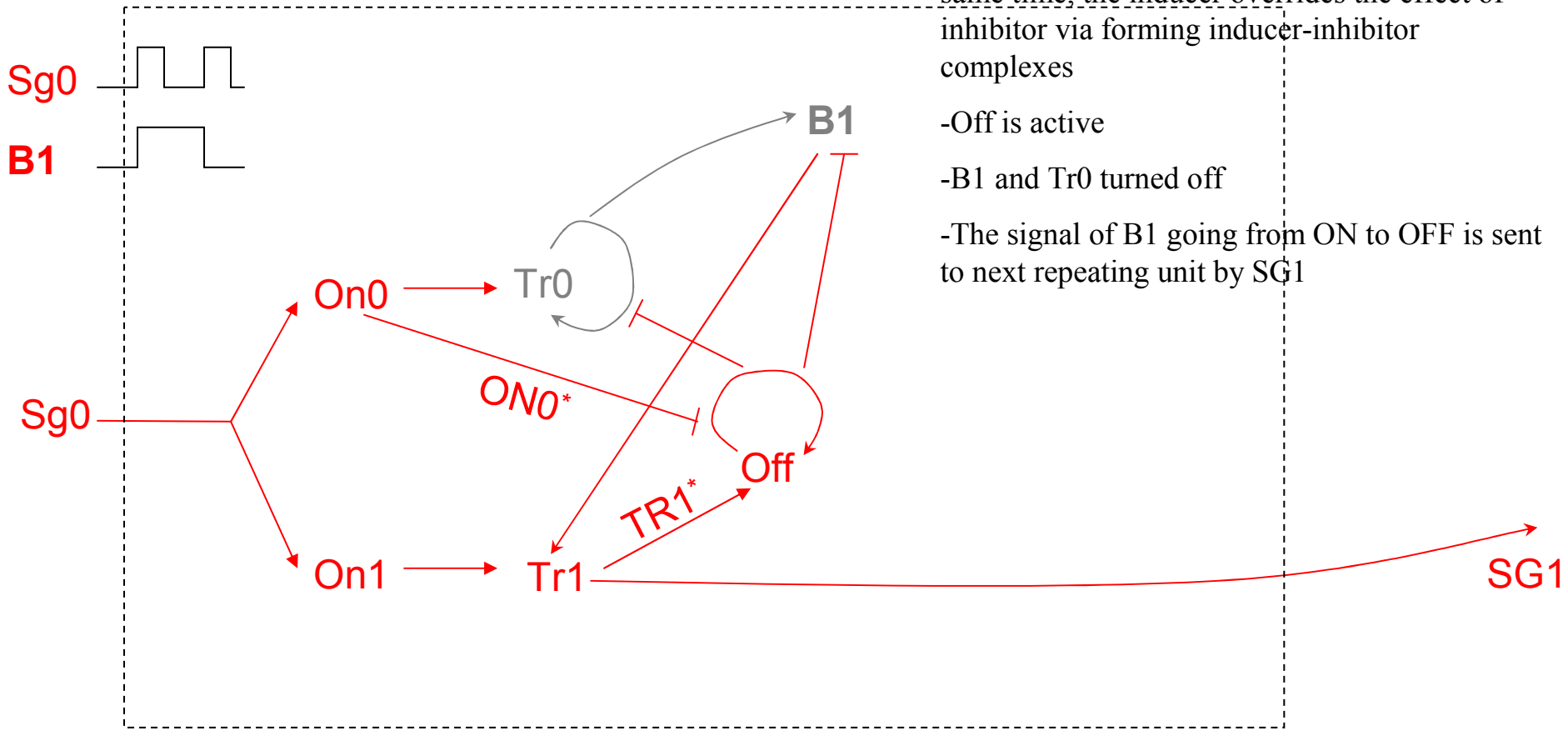
Legend

Sg = Signal,

Tr = Triger,

B = Bit recording gene

Pic 3



-Second pulse of Sg0 comes in

-Turns on Tr1 this time. Although ON0* and TR1* inhibits and induces the Off gene at the same time, the inducer overrides the effect of inhibitor via forming inducer-inhibitor complexes

-Off is active

-B1 and Tr0 turned off

-The signal of B1 going from ON to OFF is sent to next repeating unit by SG1

Legend

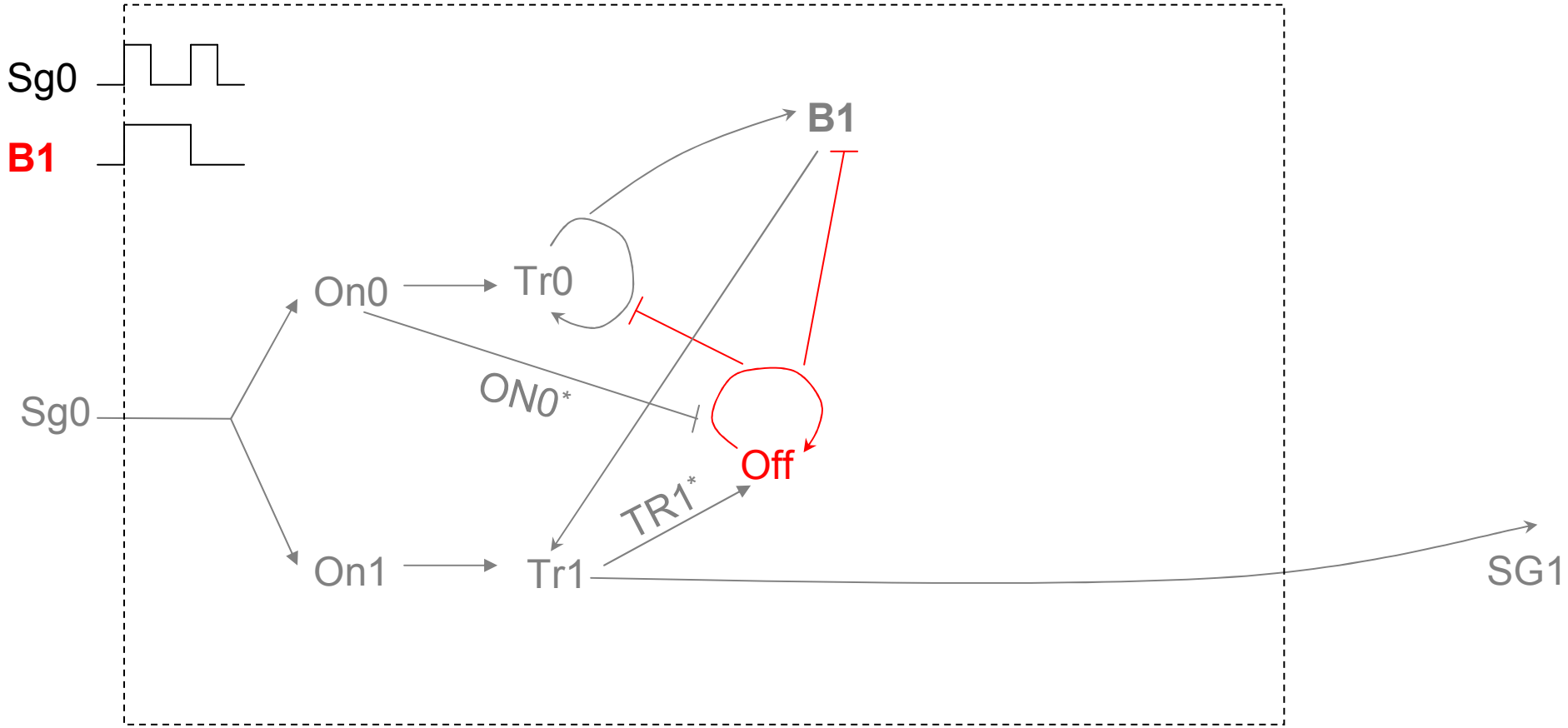
Sg = Signal,

Tr = Triger,

B = Bit recording gene

Pic 4

-Only Off gene is active, keeping B1 OFF until next Sg0 arrives



Legend

Sg = Signal,

Tr = Triger,

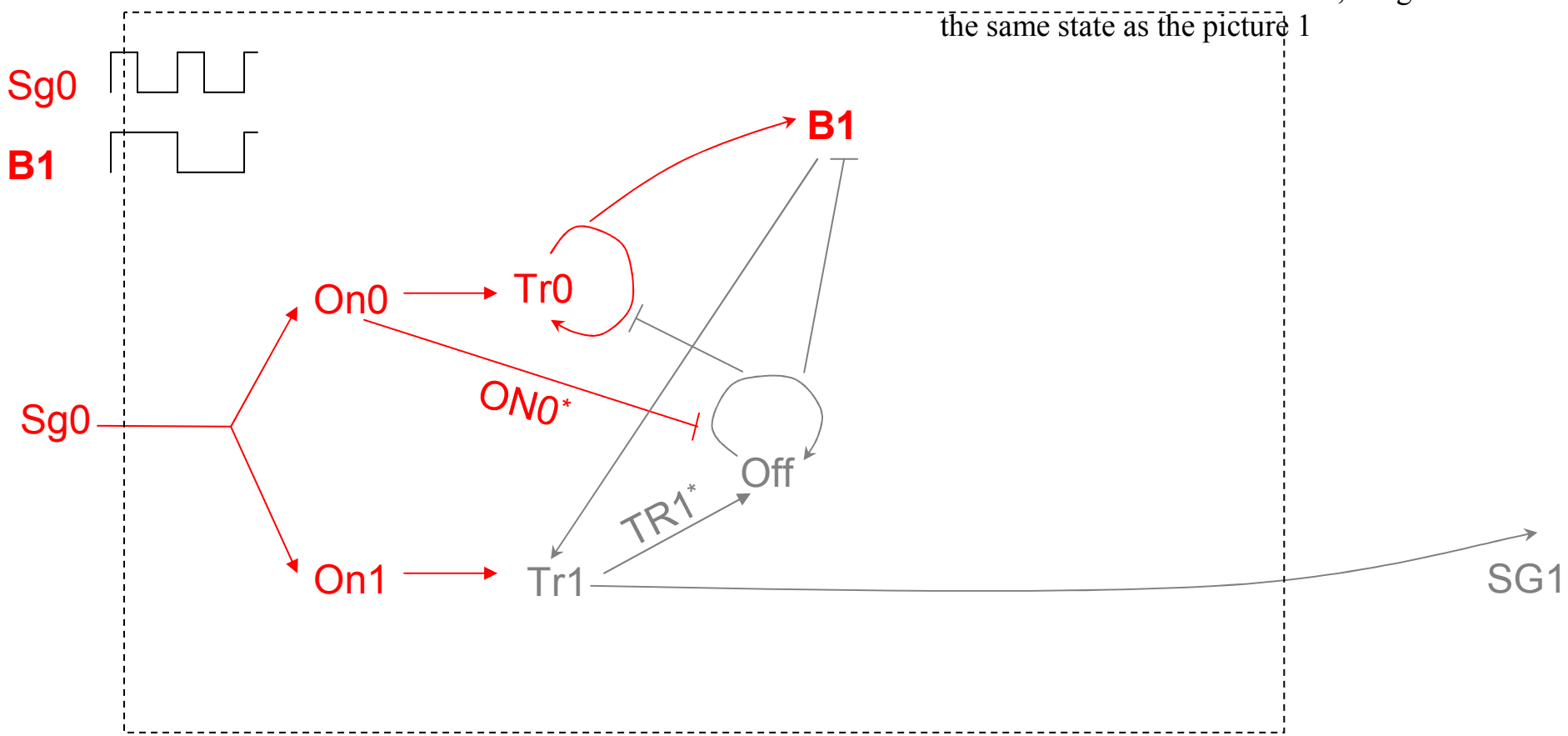
B = Bit recording gene

Pic 5

-Third Sg0 inpulse comes

-Off is inhibited by ON0*

-But there is no TR1* activation, we get back to the same state as the picture 1



Legend

Sg = Signal,

Tr = Triger,

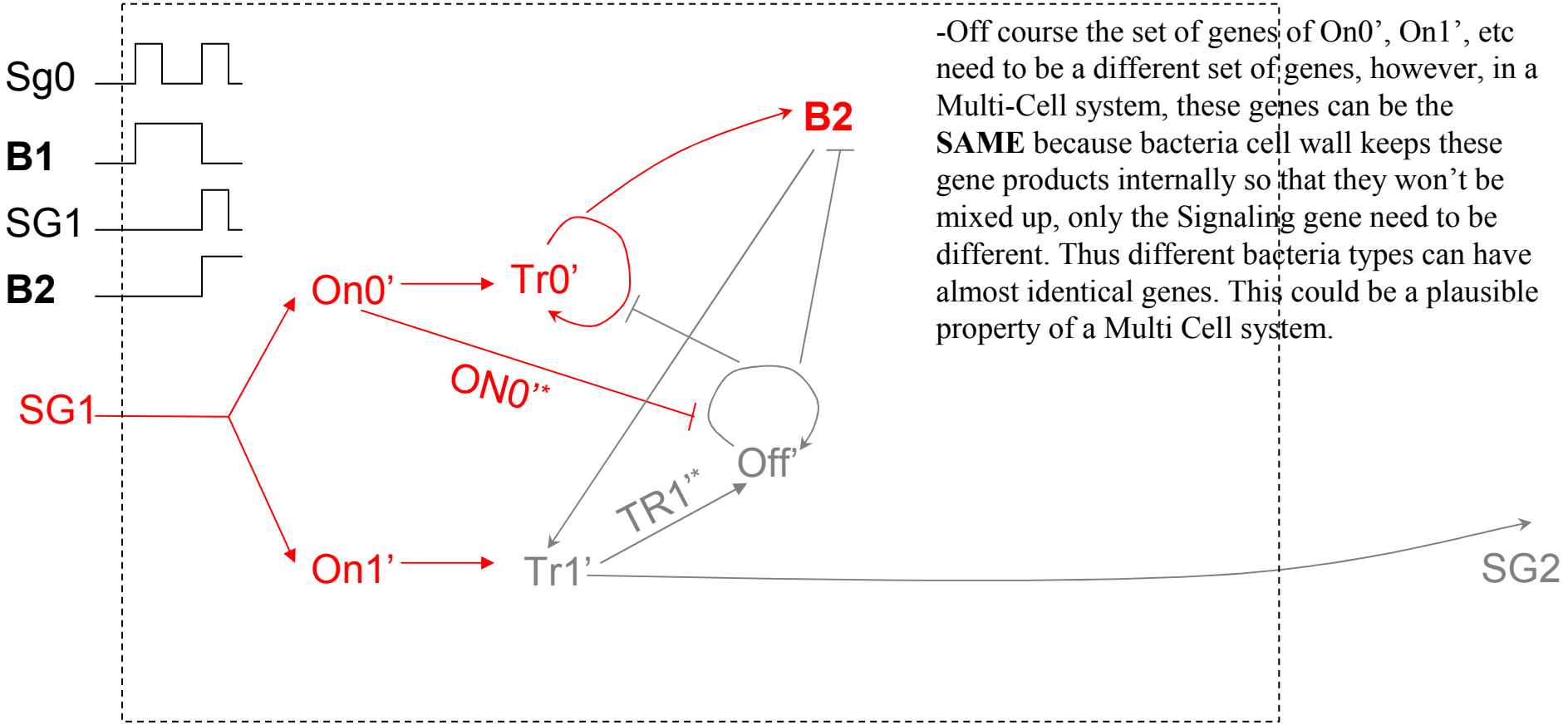
B = Bit recording gene

B2 works the same as B1

-Remember in Pic 3, SG1 is passed onto the next unit

-Pulse diagram on left shows what has happened up to Pic 3.

-Off course the set of genes of On0', On1', etc need to be a different set of genes, however, in a Multi-Cell system, these genes can be the **SAME** because bacteria cell wall keeps these gene products internally so that they won't be mixed up, only the Signaling gene need to be different. Thus different bacteria types can have almost identical genes. This could be a plausible property of a Multi Cell system.

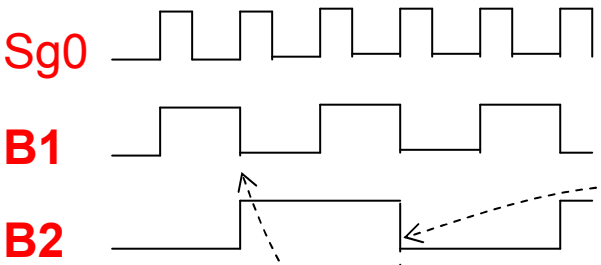


Legend

Sg = Signal,

Tr = Triger,

B = Bit recording gene



-After another two cycles of Sg0, **B2** will do what **B1** does in Pic 3, i.e. outputing SG2 to B3, and things continue on..

-By looking at the pulse diagram, B1 finishes one cycle with 2 Sg0 pulses, B2 undergoes one cycle with 4 Sg0 pulses, B3 will complete a cycle with 8 pulses … so the clock will be going in a binary logarithmic fashion