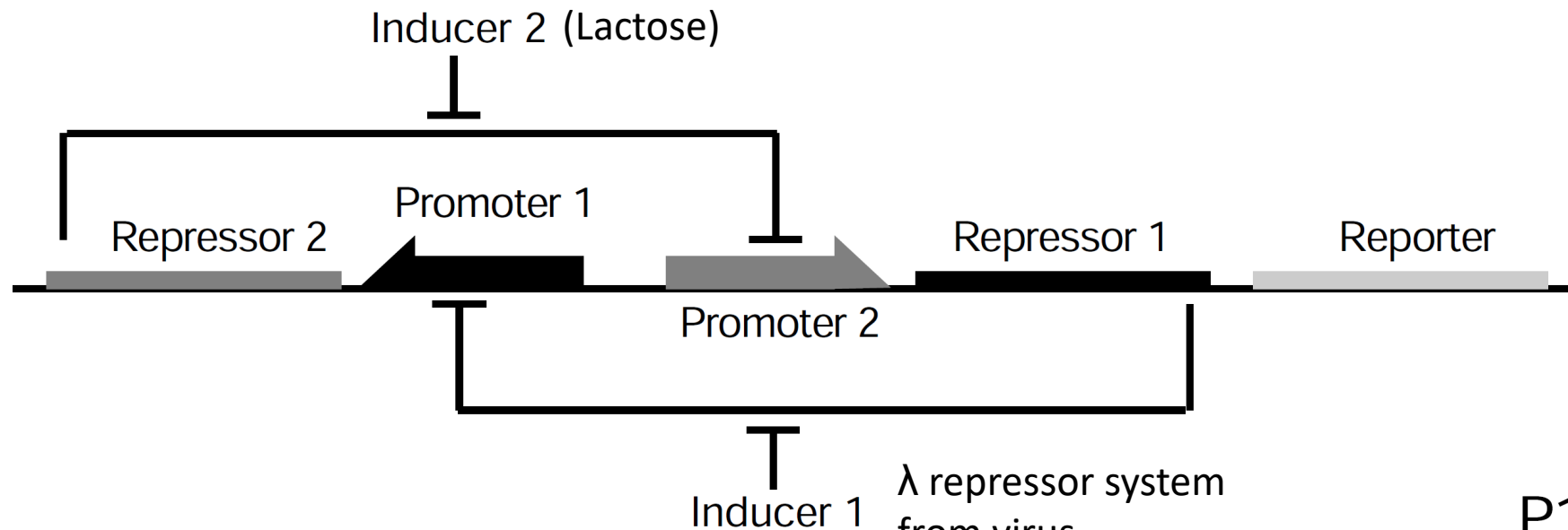


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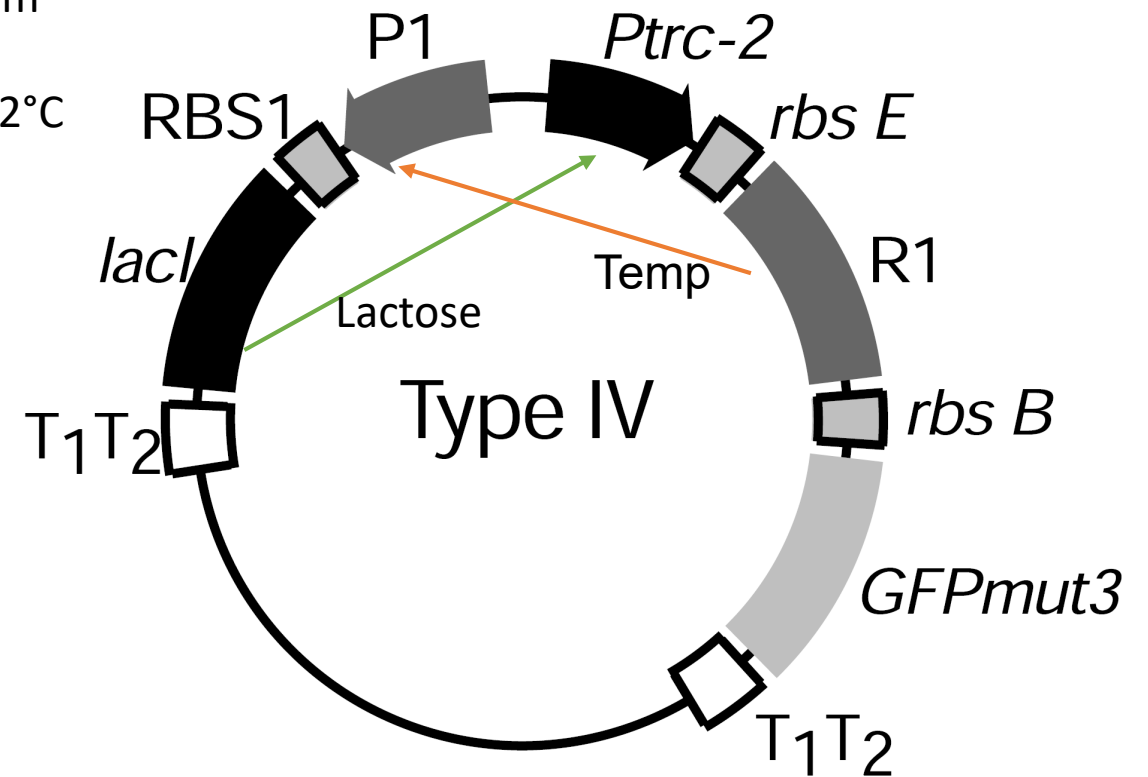
Construction of a genetic toggle switch in *Escherichia coli*

Timothy S. Gardner^{*†}, Charles R. Cantor^{*} & James J. Collins^{*†}

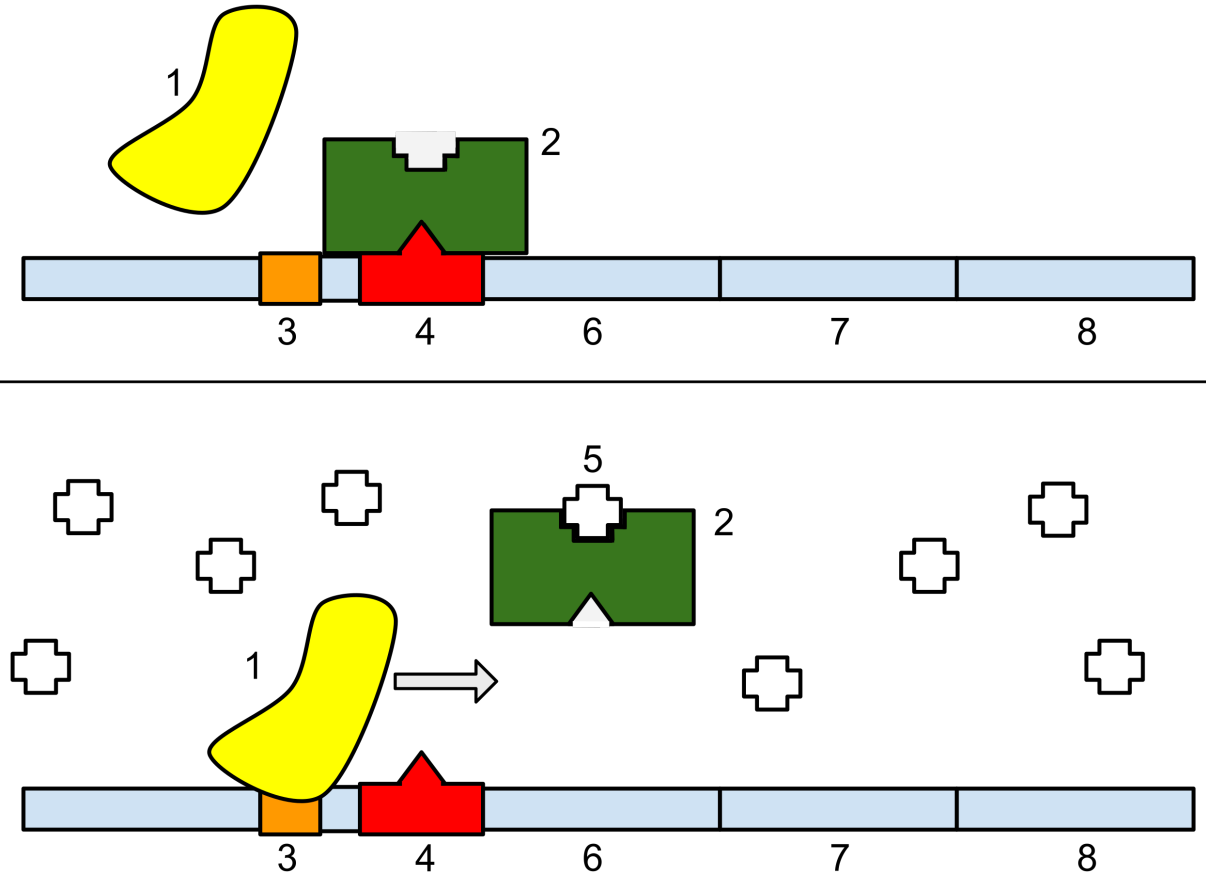
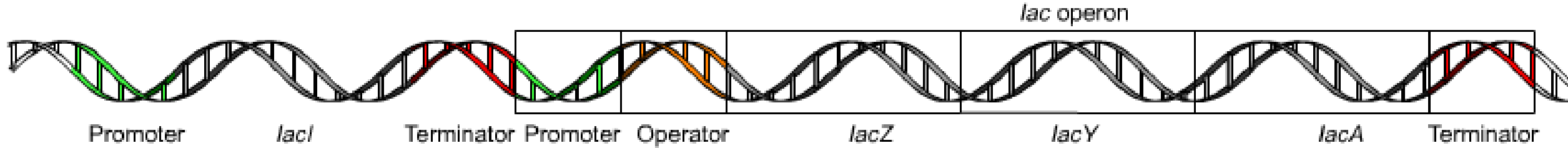
^{} Department of Biomedical Engineering, [†] Center for BioDynamics and [‡] Center for Advanced Biotechnology, Boston University, 44 Cummington Street, Boston, Massachusetts 02215, USA*



λ repressor system
from virus.
Denaturates at 42°C



The lac-operon: How to generate proteins when needed (nobel Prize Francois Jacob + Jaques Monot + 1965)



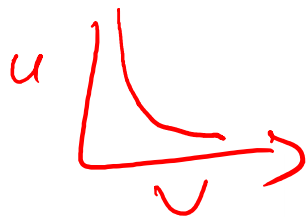
- | | |
|--------------------|------------------|
| 1: RNA polymerase, | 5: Lactose, |
| 2: Repressor, | 6: <i>lacZ</i> , |
| 3: Promoter, | 7: <i>lacY</i> , |
| 4: Operator, | 8: <i>lacA</i> . |

• *lacZ* encodes [β-galactosidase](#) (LacZ), [enzyme](#) cleaving [disaccharide lactose](#) into [glucose](#) and [galactose](#).

• *lacY* encodes [Beta-galactoside permease](#) (LacY), a transmembrane pump for [β-galactosides](#) including lactose

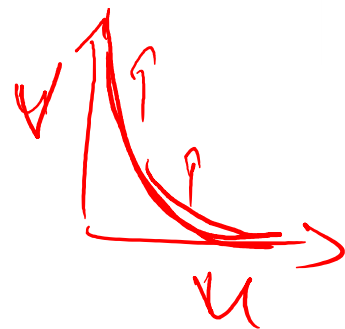
• *lacA* encodes [β-galactoside transacetylase](#) (LacA), an enzyme that transfer of [acetyl group](#) from acetyl-CoA to β-galactosides.

$$\frac{du}{dt} = \frac{\alpha_1}{1 + v^\beta} - u$$



$$\frac{dv}{dt} = \frac{\alpha_2}{1 + u^\gamma} - v$$

$$v = \frac{\alpha_2}{1 + u^\gamma}$$



$$\begin{aligned} \mathcal{L}_2 &= v(1 + u^\gamma) \\ \mathcal{L}_1 &= u(1 + v^\beta) \end{aligned}$$

