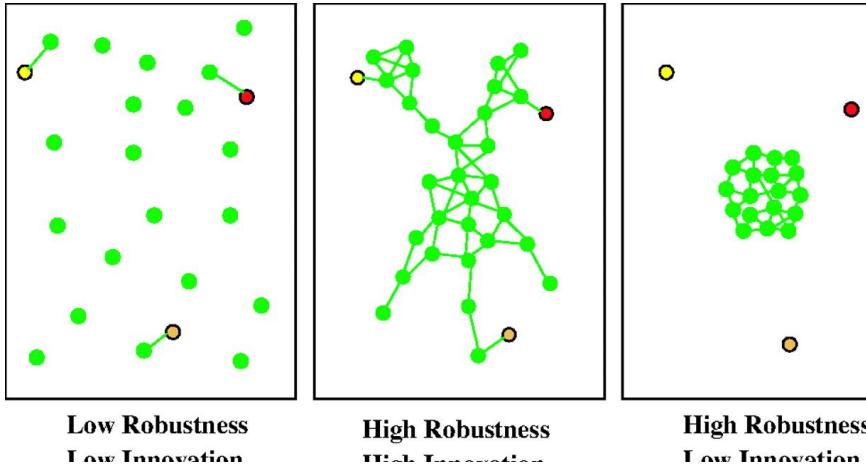


Робастность и способность к эволюции в живых системах #2

Грешнова Александра, 22.04.2020

Robustness

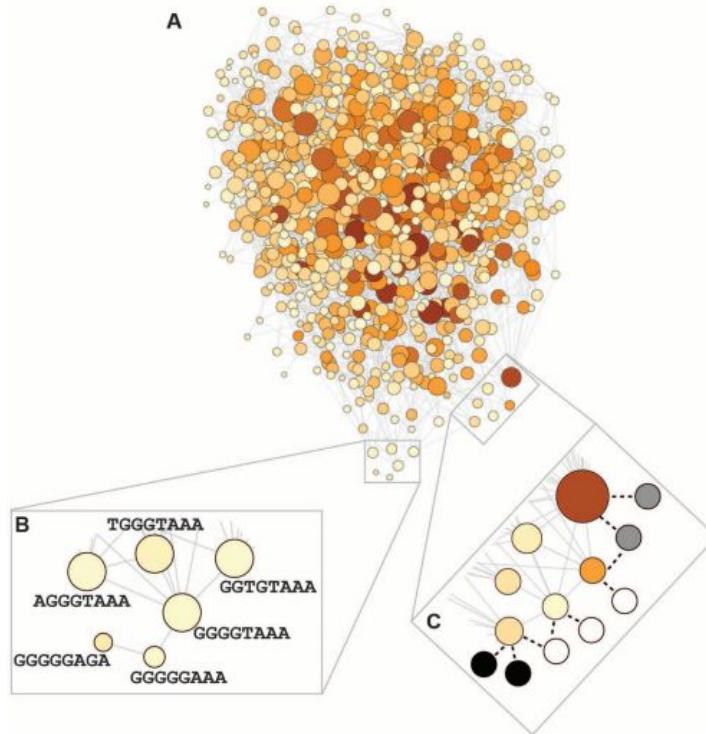


- Each rectangle shows a hypothetical genotype space
- Individual genotypes with identical phenotypes are shown as circles in this space
- Nodes of the neutral network are green. Other colors indicate novel phenotypes
- Lines connect genotypes that are nearest neighbors in this space, corresponding in our case to networks that differ in one regulatory interaction

"We note that this visualization is for expository purposes only"

Wagner, 2006

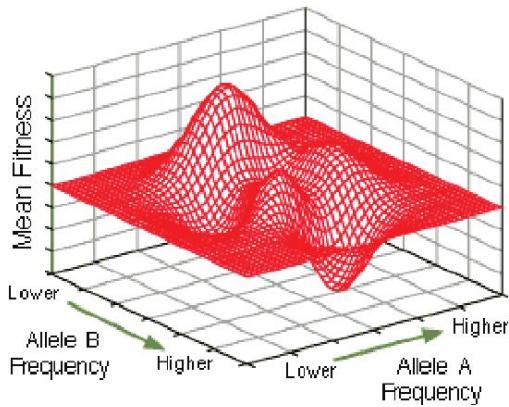
Calculating the distance



*"We used the
Smith-Waterman algorithm
to calculate the mutational
distance between pairs of
binding sites"*

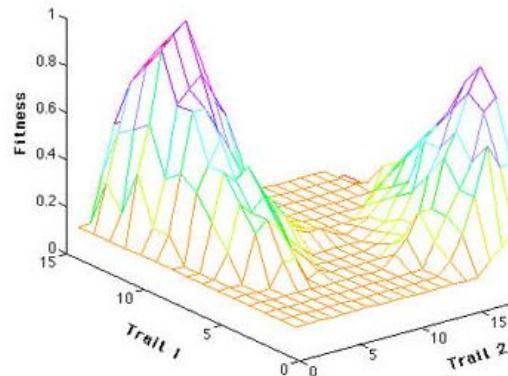
Adaptive Landscape

Allele frequency to fitness landscapes [1]



Allele Freq

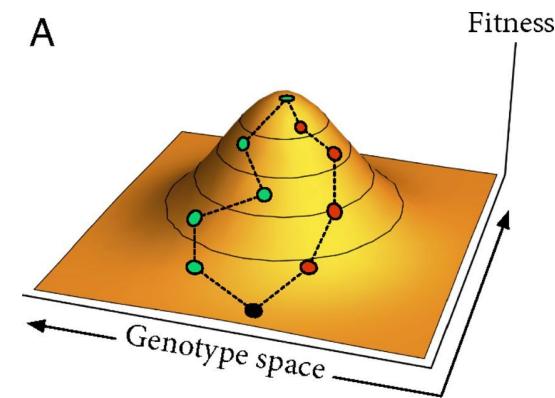
Phenotype to fitness landscapes [2]



Trait

Genotype to fitness landscapes [3]

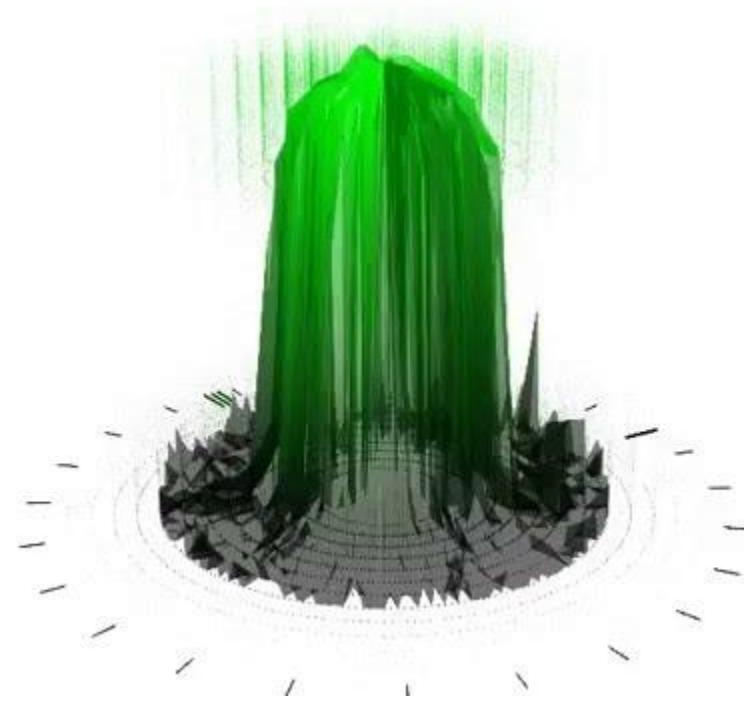
A



Abstraction

[Wikipedia](#)

Local fitness landscape of the green fluorescent protein

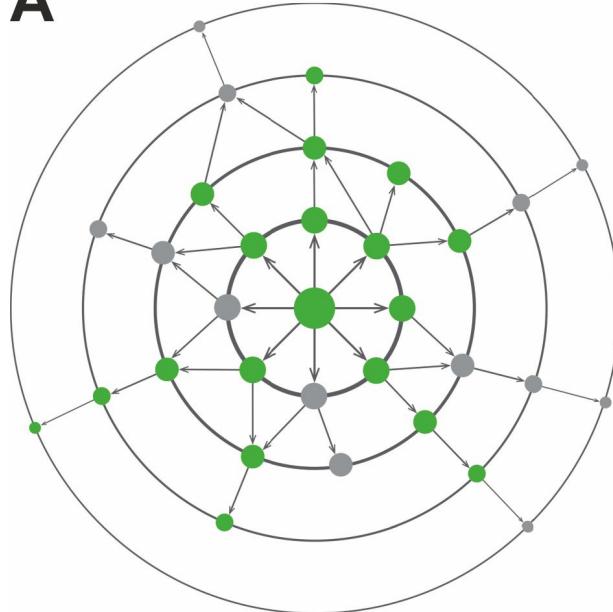


Sarkisyan, Bolotin, Meer, et al., Nature, (2016)

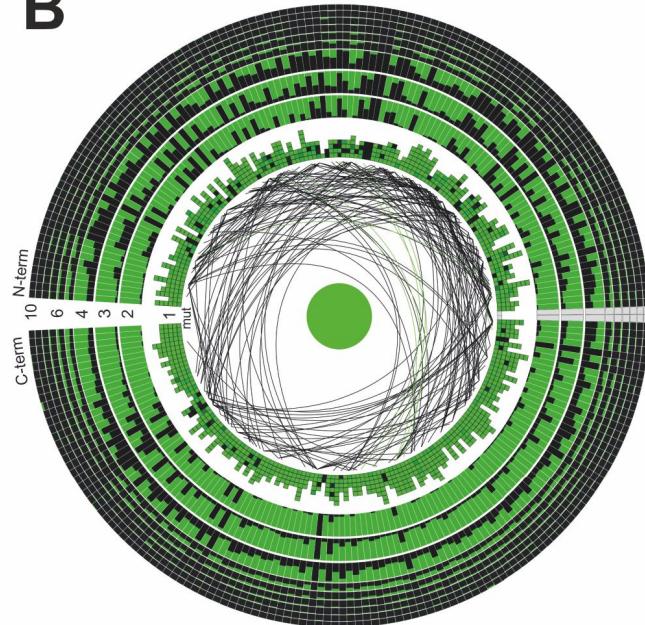
[Биомолекула](#)

Local fitness landscape of the green fluorescent protein

A



B



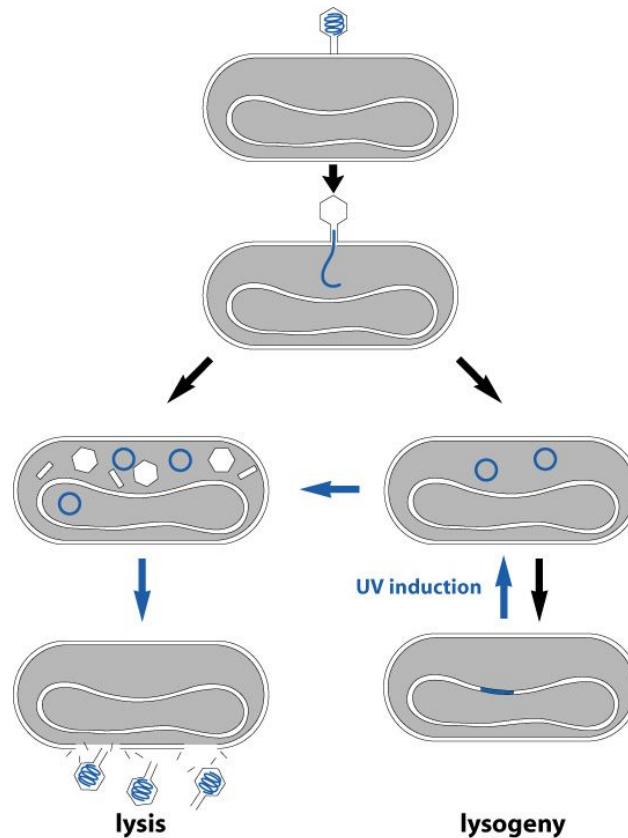
А. Зеленая точка в центре — немутированый белок, точки на окружностях — мутантные варианты Цвет отражает фенотип (индивидуальные свойства) мутанта: Стрелки отражают возможные маршруты движения по ландшафту приспособленности.

В. Визуализация всех полученных в работе данных на одной картинке. Последовательность зеленого флуоресцентного белка изображена в виде окружности: каждый маленький сектор обозначает одну аминокислотную позицию. Чем дальше круг находится от центра, тем больше мутаций содержит белок. Доля зеленого в каждом секторе отражает долю функциональных мутантов.

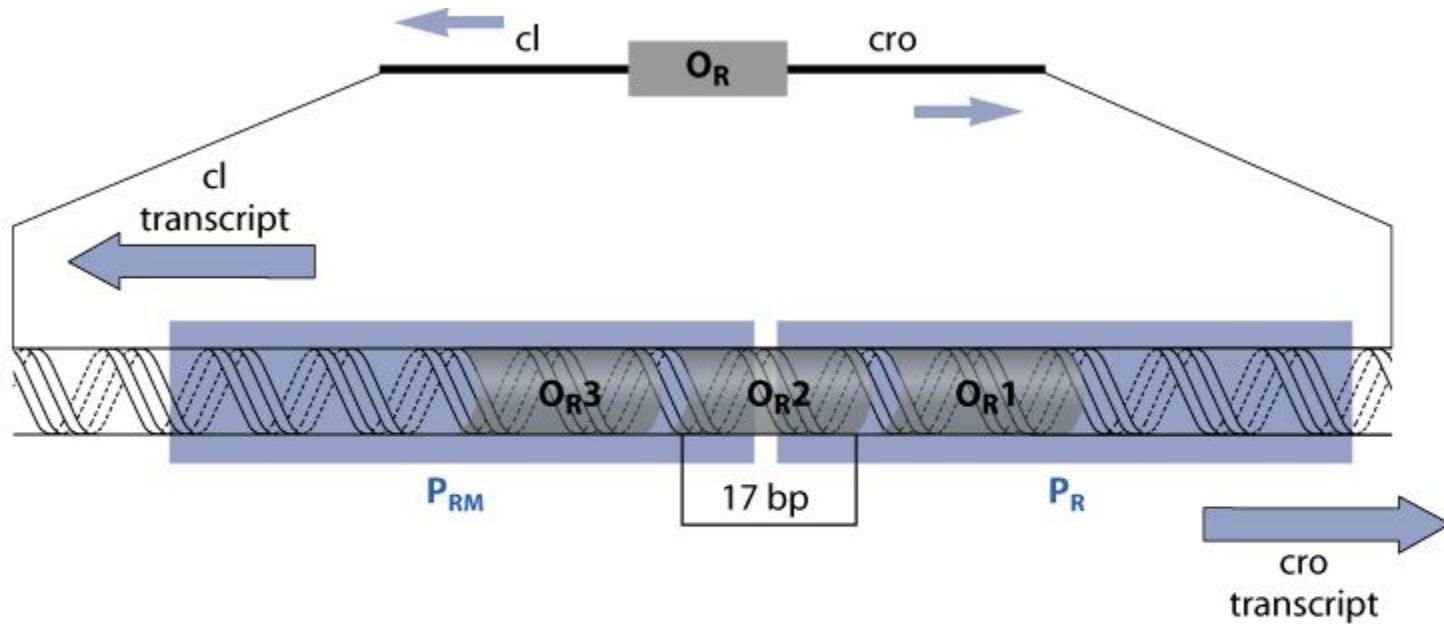
Sarkisyan, Bolotin, Meer, et al., Nature, (2016)

[Биомолекула](#)

Growth of phage λ



A short segment of the λ DNA molecule



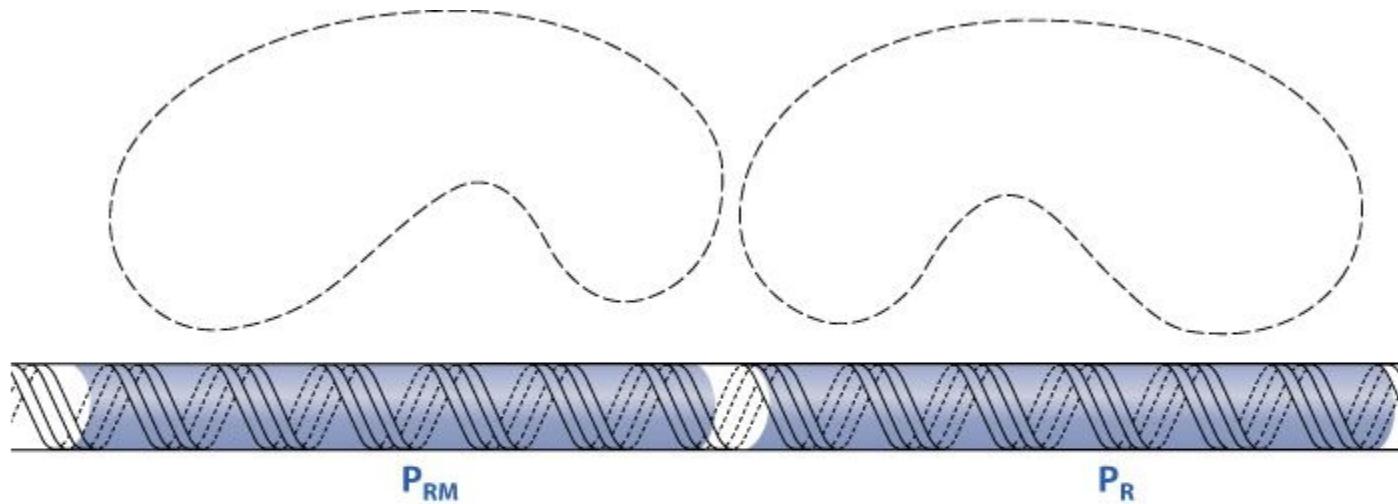
OR, the right operator of λ

OR1, OR2, OR3 - 17 bp, similar, but not identical

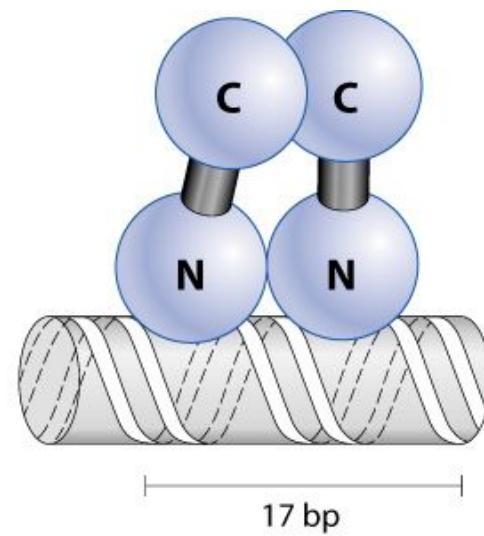
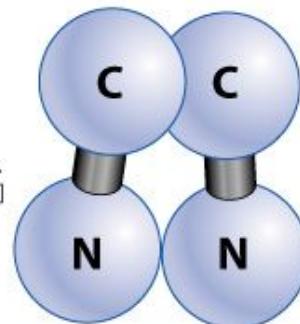
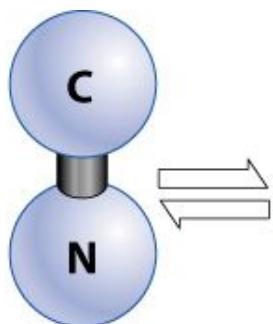
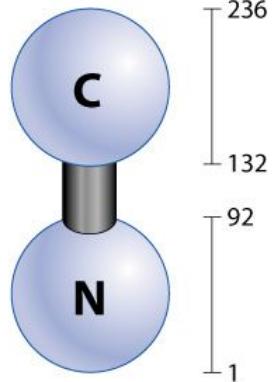
cro stands for control of repressor

PRM stands for promoter promoter of repressor maintenance

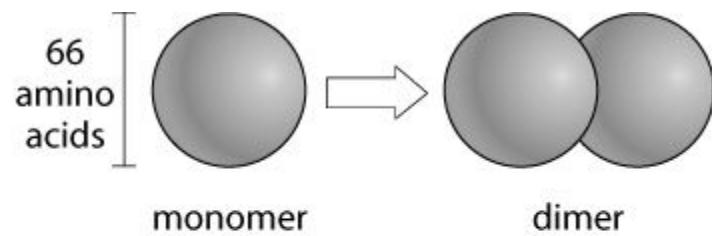
An event that never occurs



The Repressor

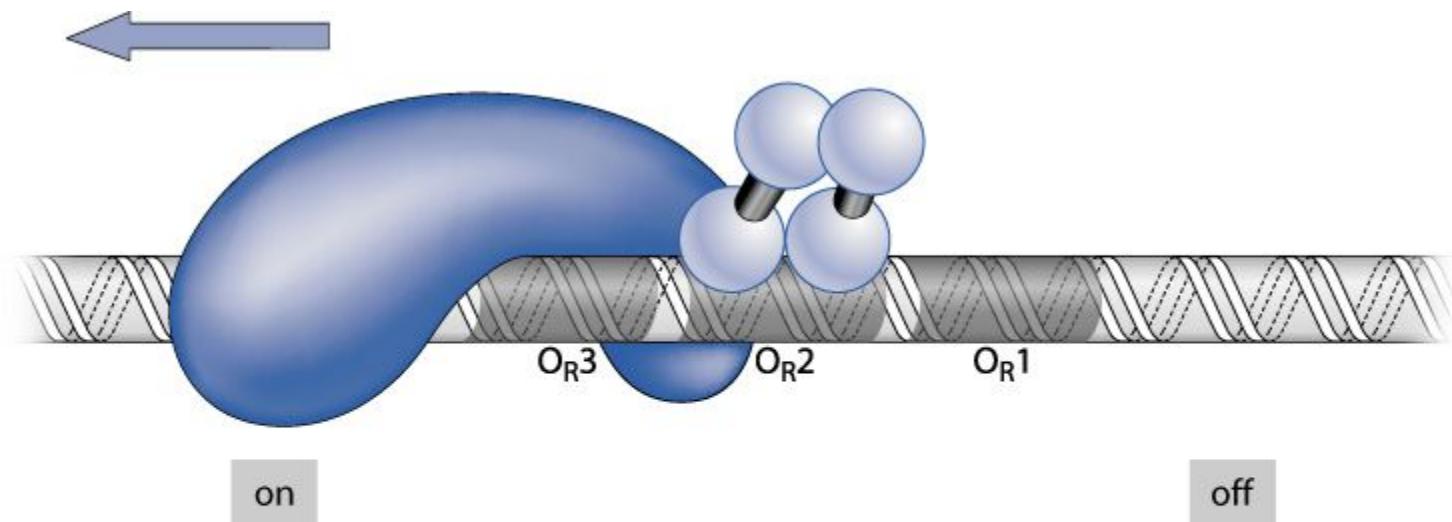


Cro

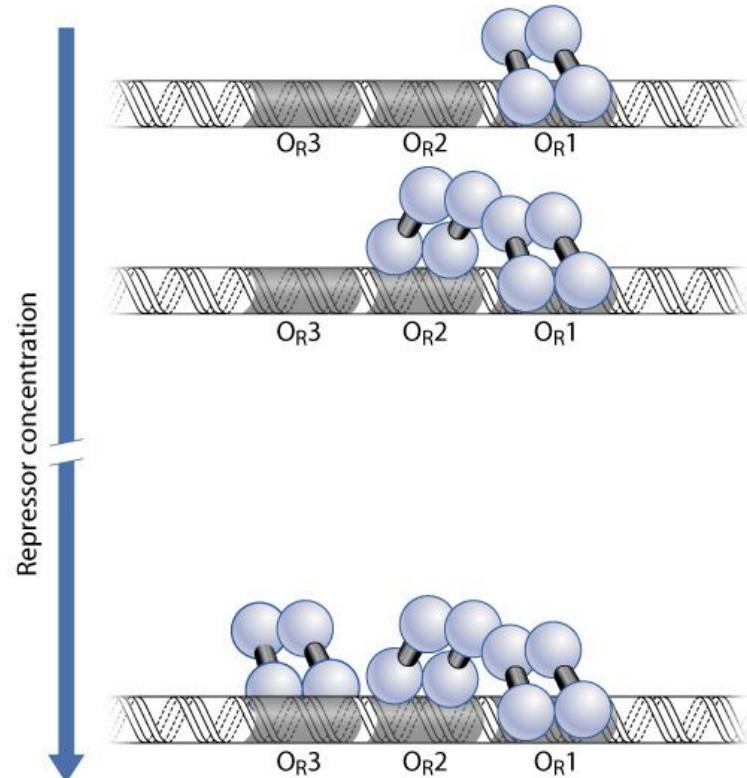
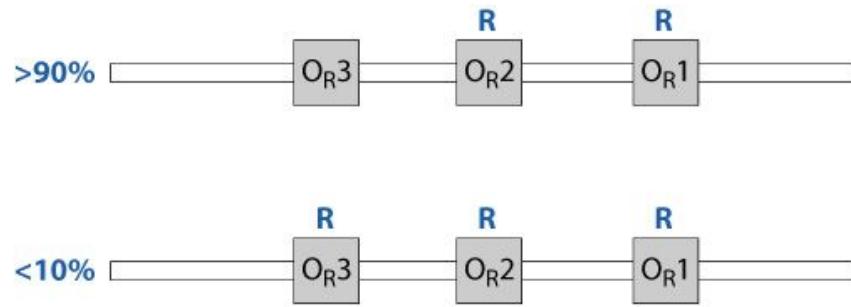


THE ACTION OF REPRESSOR

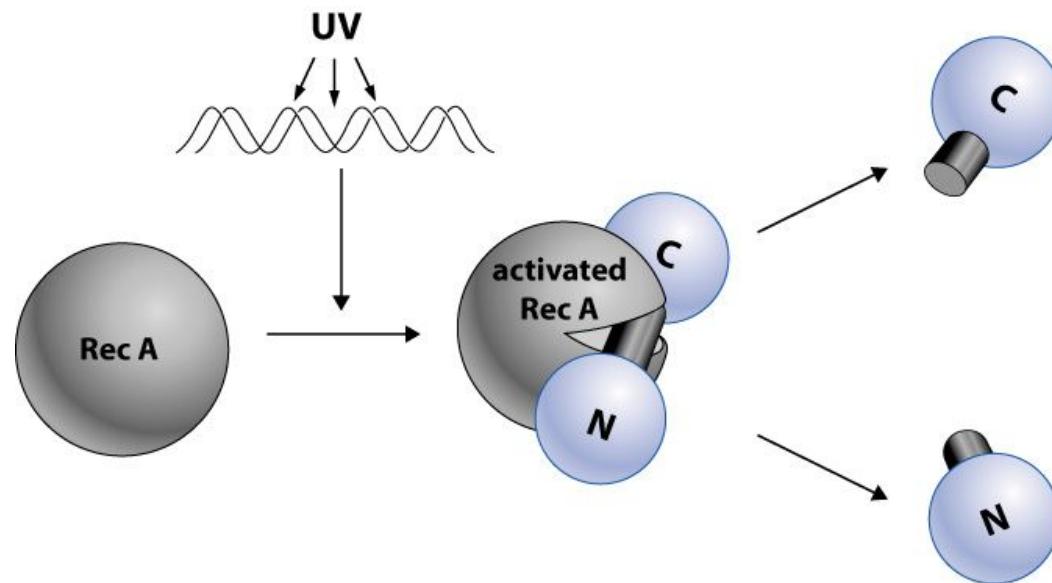
A repressor at OR2 performs the two functions necessary for maintaining the lysogenic state: **it turns off the cro gene** by preventing binding of RNA pol to PR and **it turns on the repressor (=cl) gene**



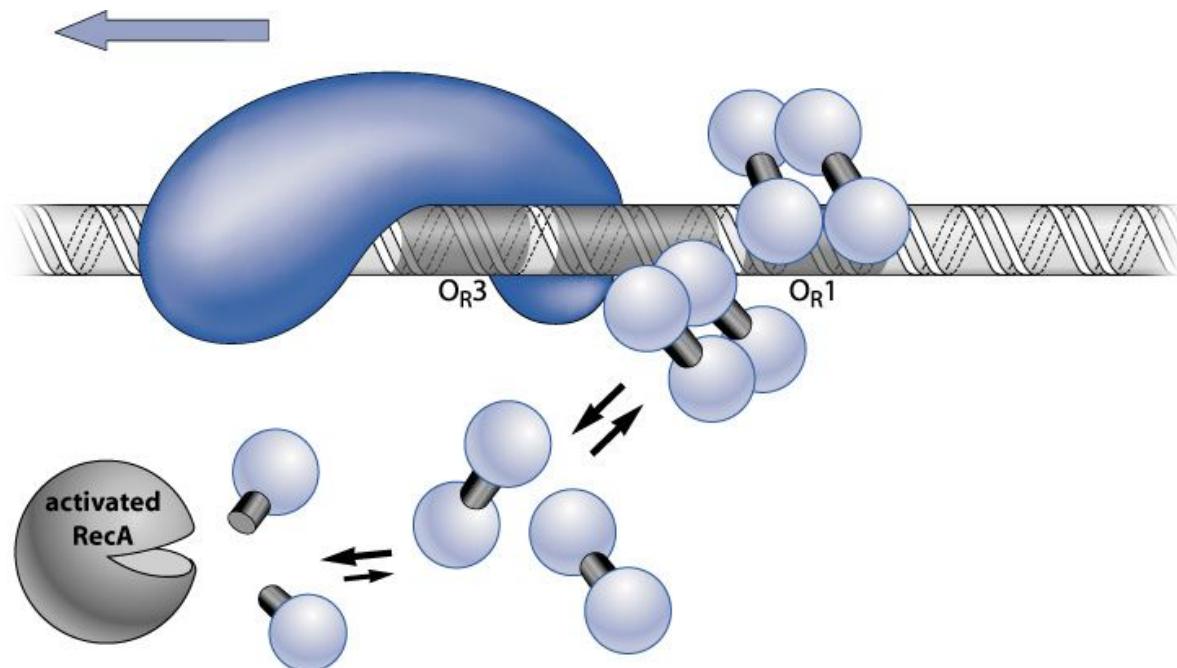
Cooperativity of Repressor Binding



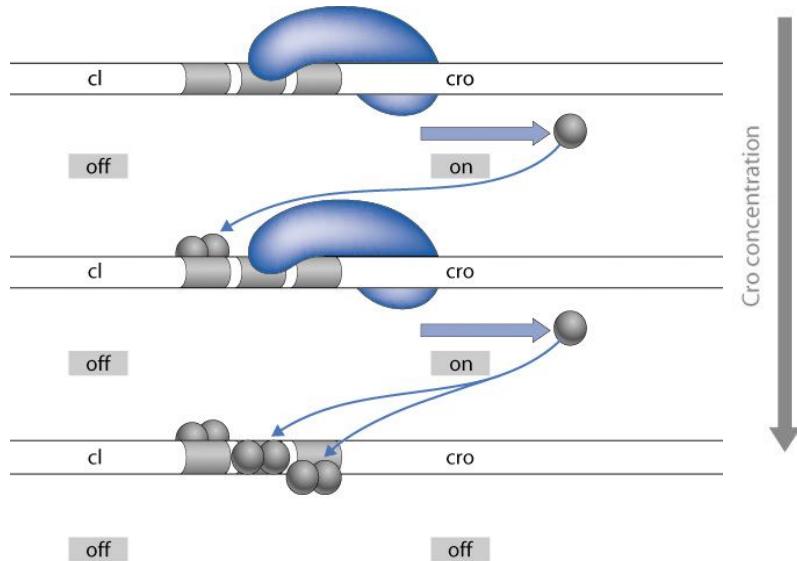
INDUCTION—FLIPPING THE SWITCH



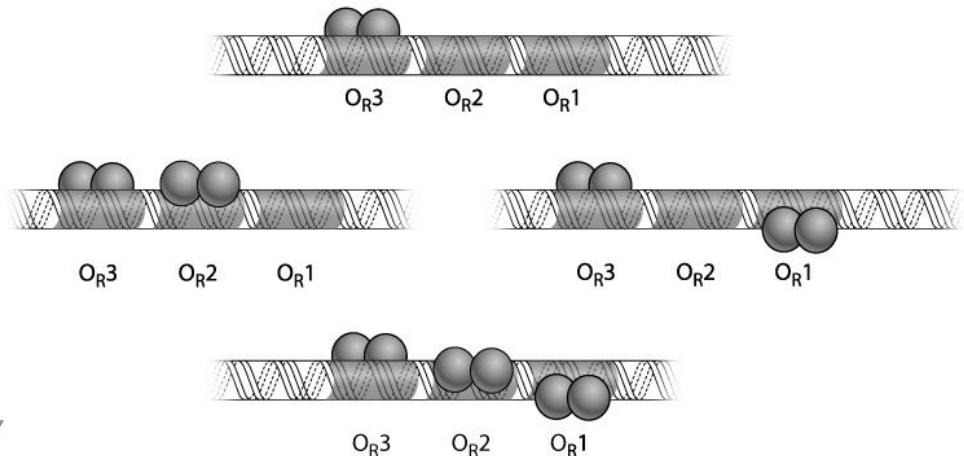
INDUCTION—FLIPPING THE SWITCH



INDUCTION—FLIPPING THE SWITCH



Cro concentration ↓



Source:

Ptashne, Mark. A Genetic Switch, Third Edition, Phage Lambda Revisited. Cold Spring Harbor Laboratory Press. Kindle Edition.