The Operon: A Group of Genes Whose Expression is Coordinated by an Operator

By François Jacob, David Perrin, Carmen Sanchez and Jacques Monod

"Man at last knows he is alone in the unfeeling immensity of the universe, out of which he has emerged only by chance. His destiny is nowhere spelled out, nor is his duty. The kingdom above or the darkness below; it is for him to choose", Jacques Monad 1971.

Monod's Diauxie Experiments

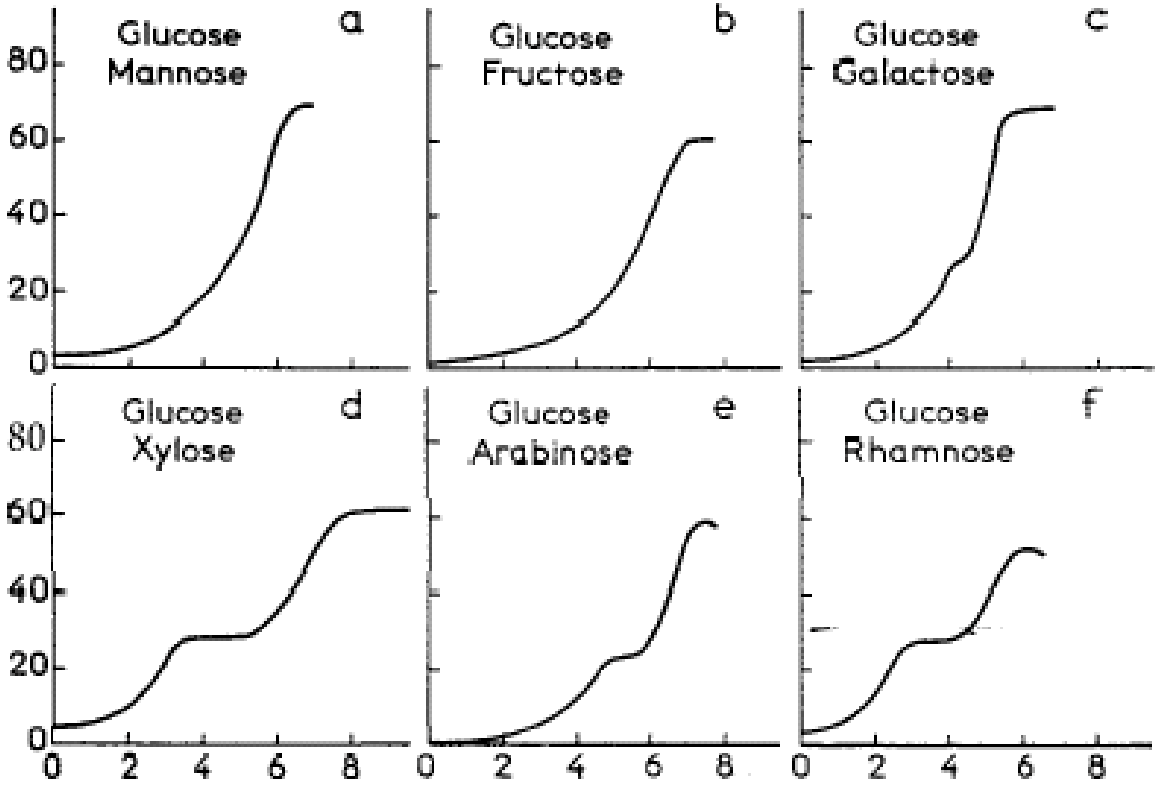
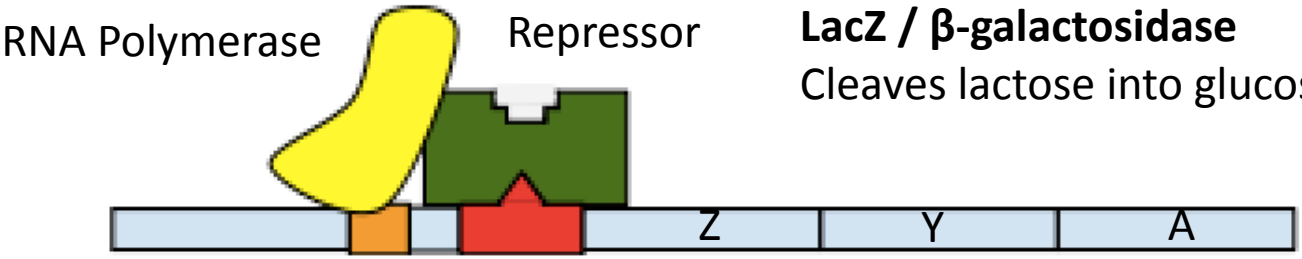
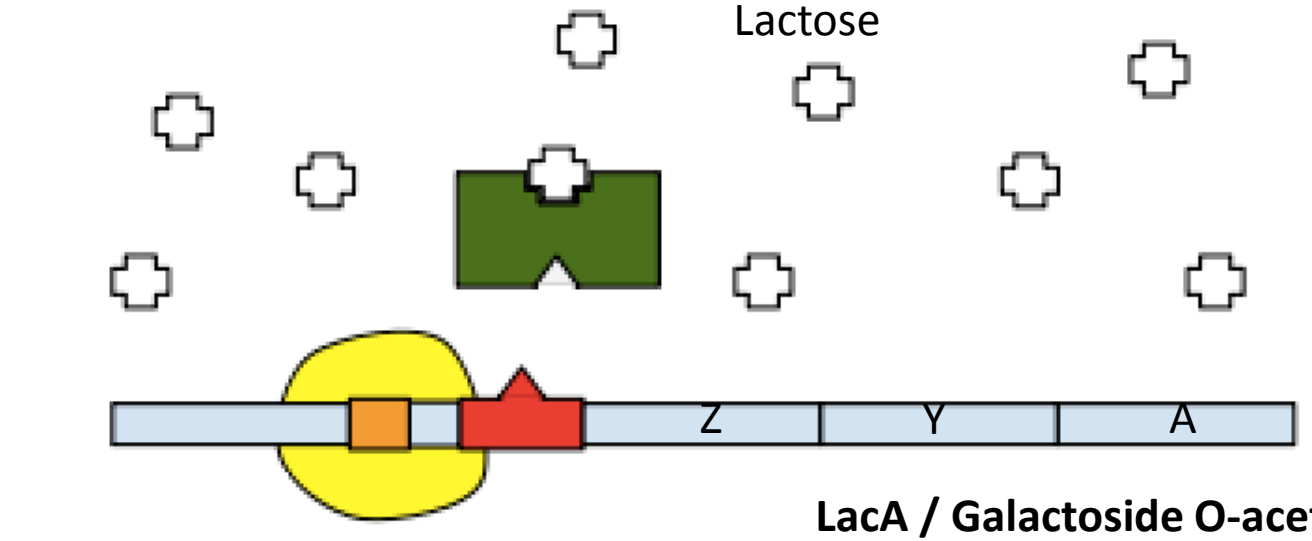


Fig.1. Growth of *Escherichia coli* in the presence of different carbohydrate pairs serving as the only source of carbon in a synthetic medium[30].

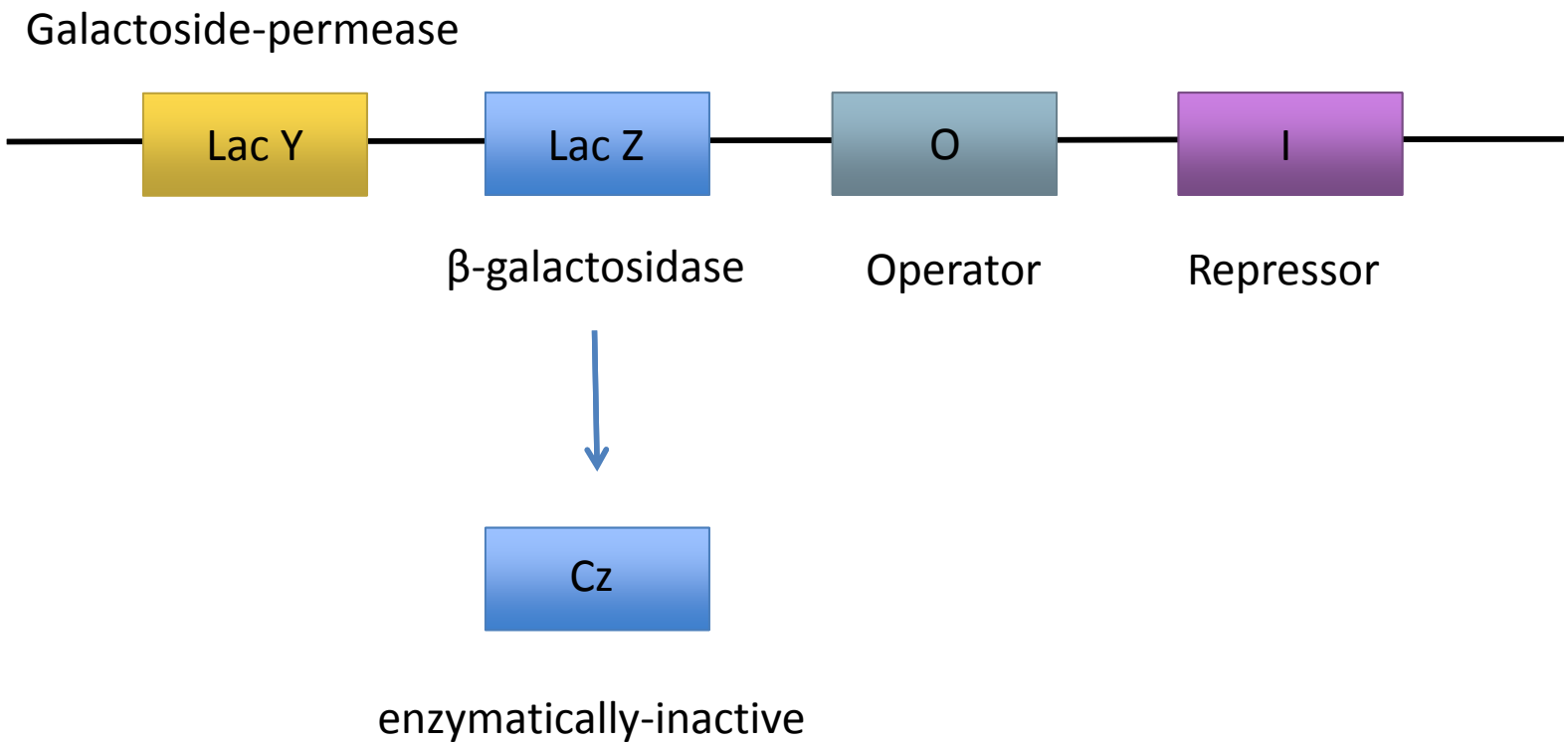


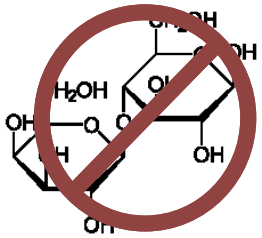
LacZ / β-galactosidase
Cleaves lactose into glucose and galactose

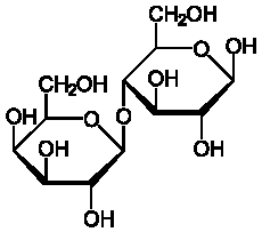
LacY / Lactose permease
Transports β-galactosides into cell



LacA / Galactoside O-acetyltransferase
Puts acetyl group on β-galactosides


Galactoside-permease
Lac Y
Lac Z
O
I
β-galactosidase
Operator
Repressor
Cz
enzymatically-inactive

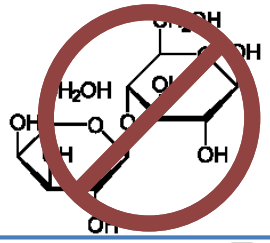


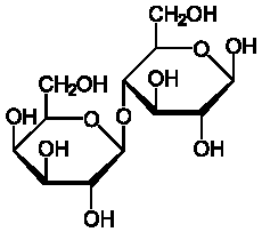


Genotype		Non-induced Bacteria			Induced Bacteria		
Chromosome	*F-Lac*	*Galactosidase*	*Protein Cz*	*Permease*	*Galactosidase*	*Protein Cz*	*Permease*
$i^+o^+z^+y^+$		<1	—	nd	100	—	100
		Lac Z	Broken Z	Lac Y	Lac Z	Broken Z	Lac Y

Units described as “percentage of amount found in induced bacteria”

i = repressor
o = operator





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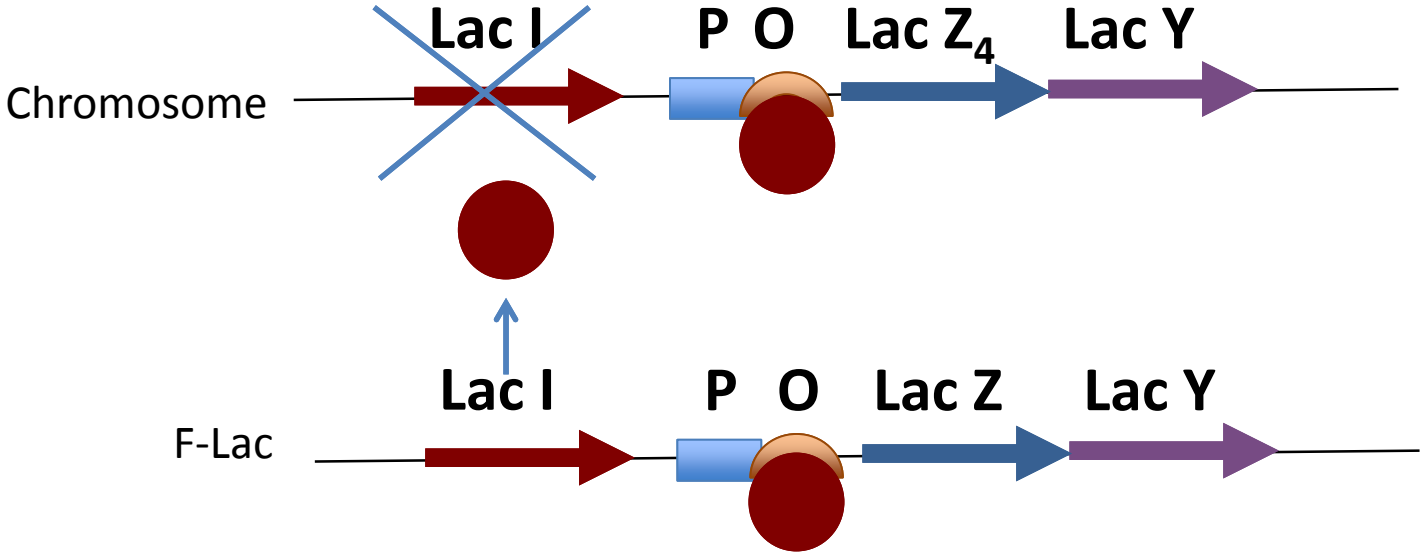
$i^+o^+z^+y^+$		<1	—	nd	100	—	100
$i^-_3o^+z^-_4y^+/Fi^+o^+z^+y^+$		<1	nd	nd	320	100	100
		Lac Z	Z_4/Z_1	Lac Y	Lac Z	Z_4/Z_1	Lac Y



Excess of Z "seems to indicate presence of several F-Lac per chromosome"

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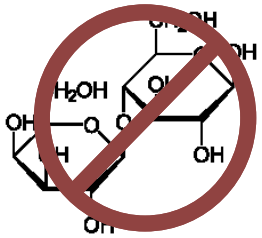

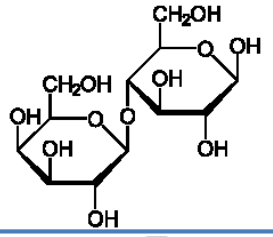

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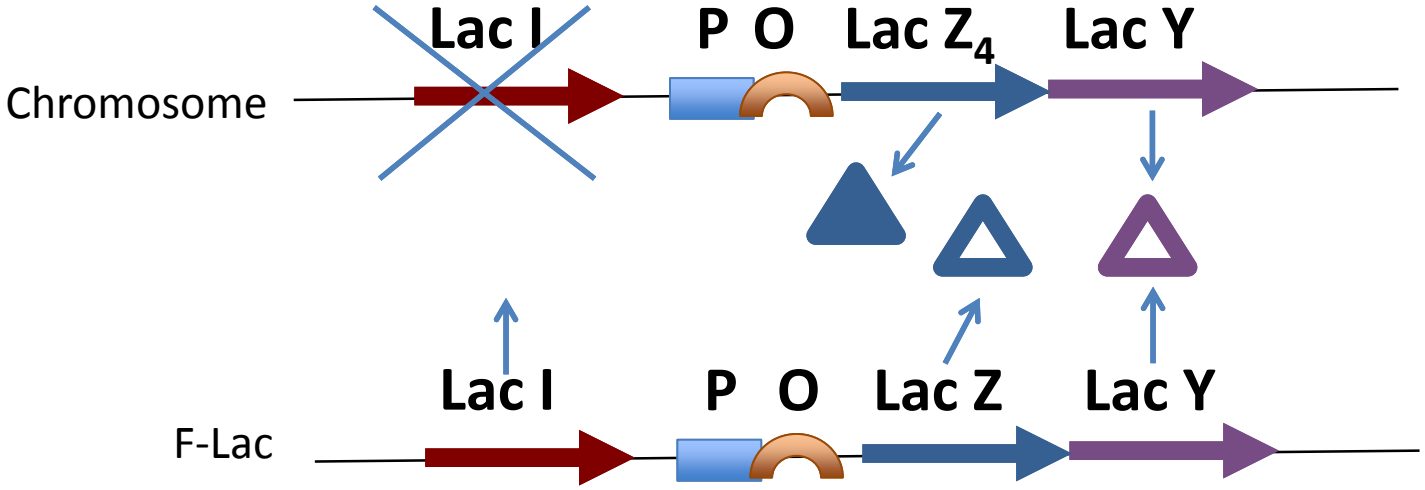

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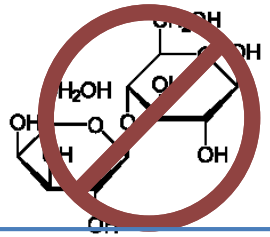

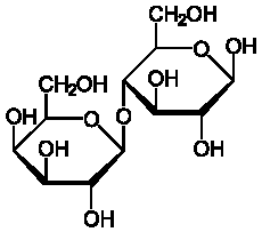

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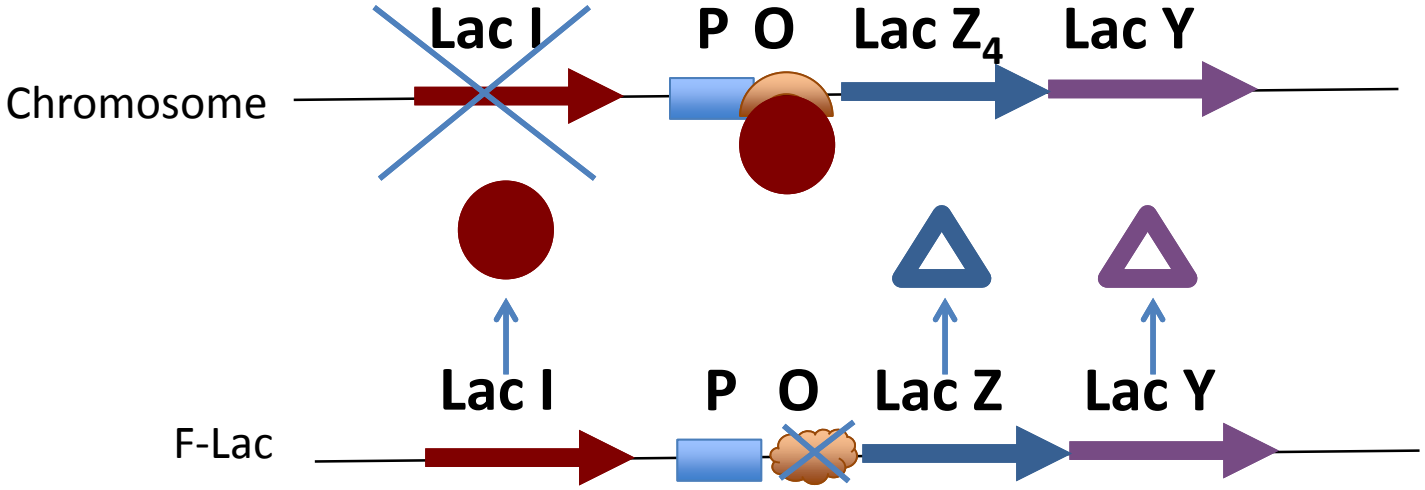

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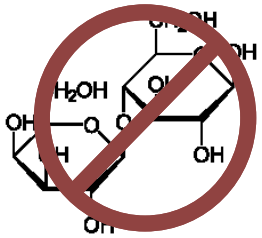

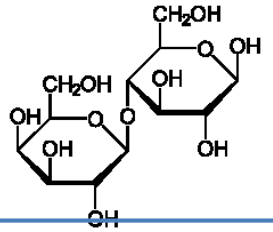

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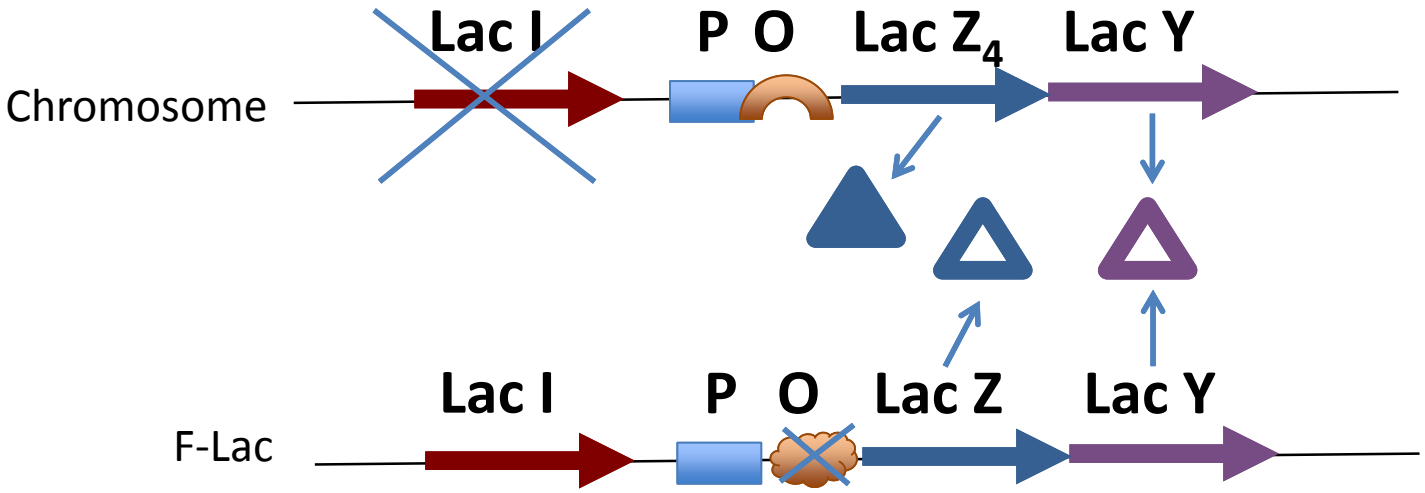

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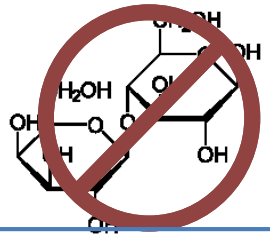

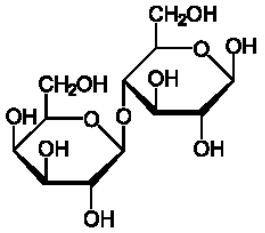

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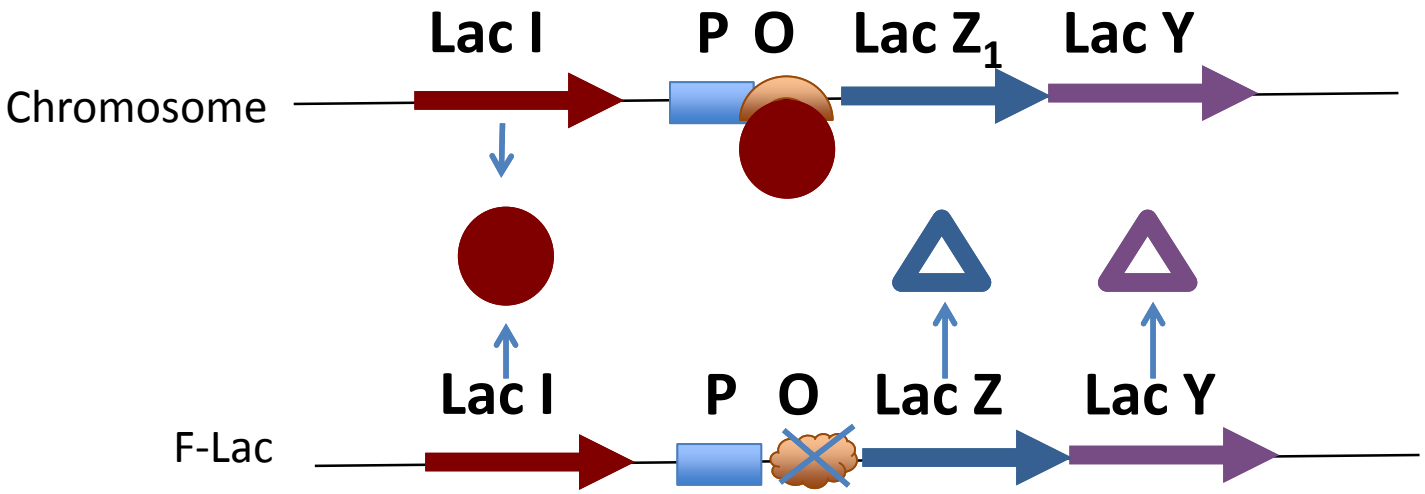
		Lac Z	Z_4/Z_1	Lac Y	Lac Z	Z_4/Z_1	Lac Y



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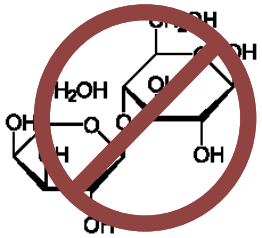

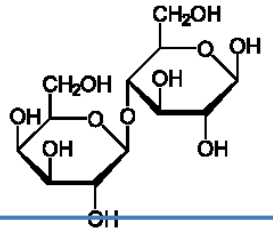

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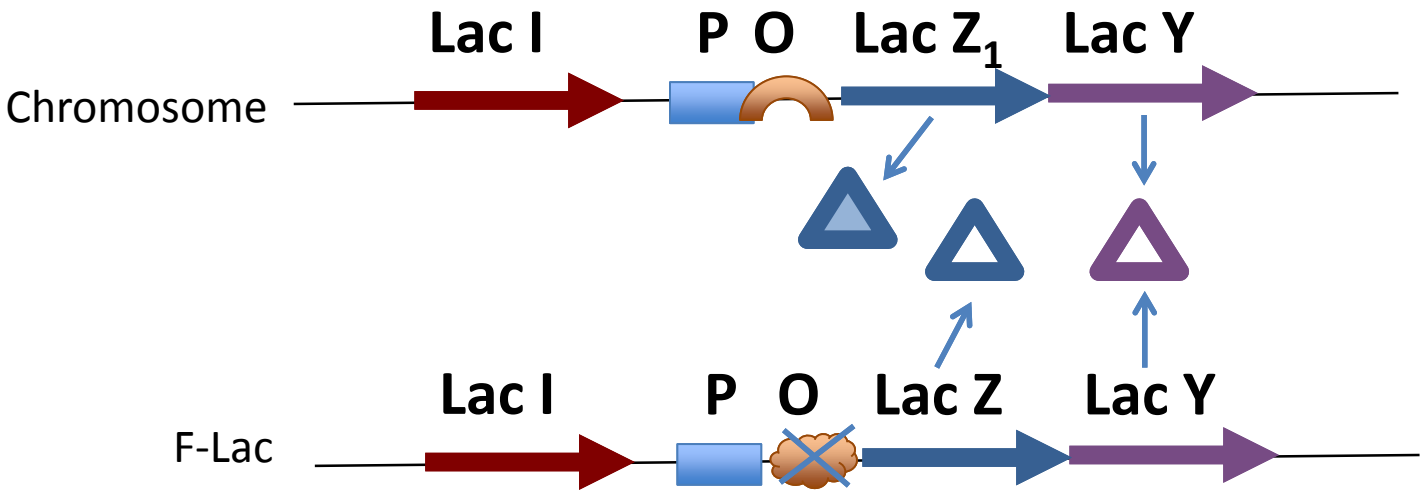

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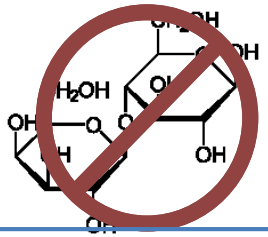

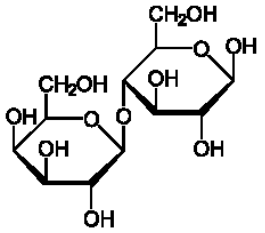

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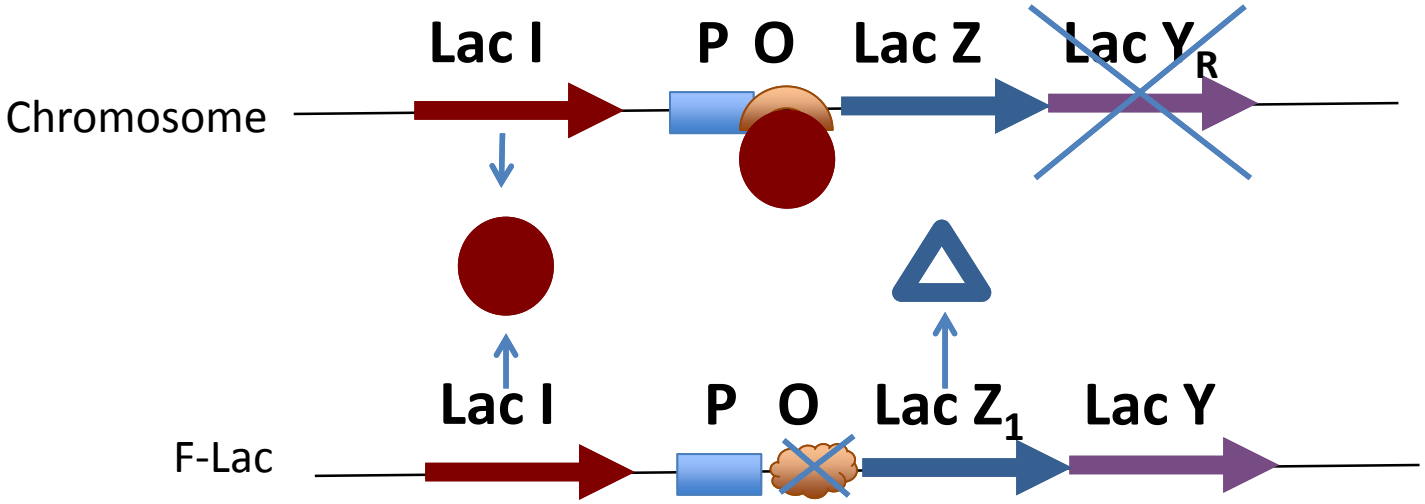
$i^-_3o^+z^-_4y^+/Fi^+o^+z^+y^+$		<1	nd	nd	320	100	100
$i^-_3o^+z^-_4y^+/Fi^+o^cz^+y^+$		36	nd	33	270	100	100
$i^+o^+z^-_1y^+/Fi^+o^cz^+y^+$		110	nd	50	330	100	100
$i^+o^+z^+y^-_R/Fi^+o^cz^-_1y^+$		<1	30	—	100	400	—
		Lac Z	Z_4/Z_1	Lac Y	Lac Z	Z_4/Z_1	Lac Y



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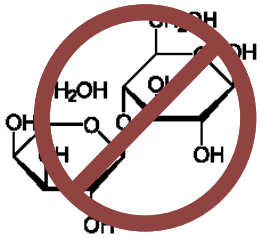

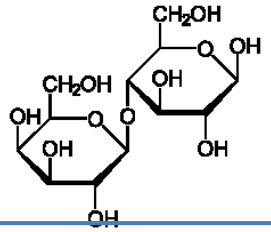

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$i^-_3o^+z^-_4y^+/Fi^+o^+z^+y^+$		<1	nd	nd	320	100	100
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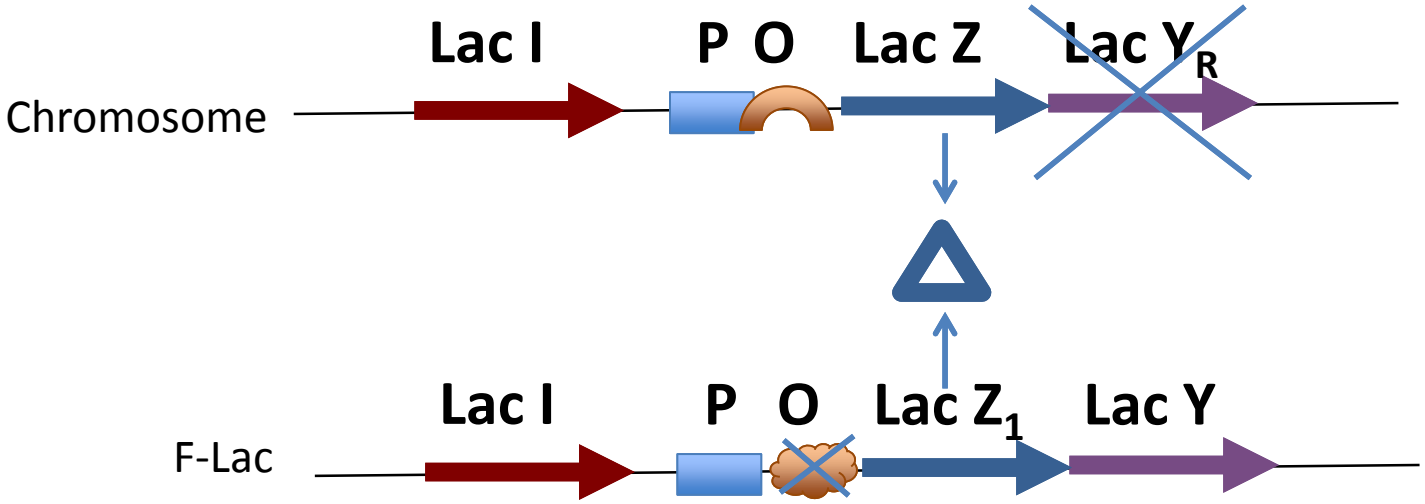
$i^+o^+z^-_1y^+/Fi^+o^cz^+y^+$		110	nd	50	330	100	100
$i^+o^+z^+y^-_R/Fi^+o^cz^-_1y^+$		<1	30	—	100	400	—
		Lac Z	Z_4/Z_1	Lac Y	Lac Z	Z_4/Z_1	Lac Y



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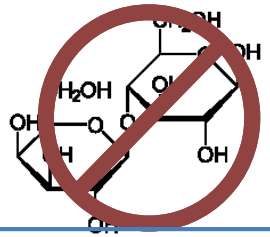

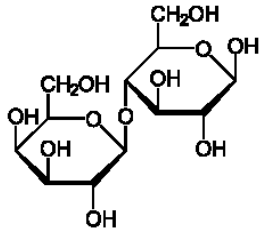

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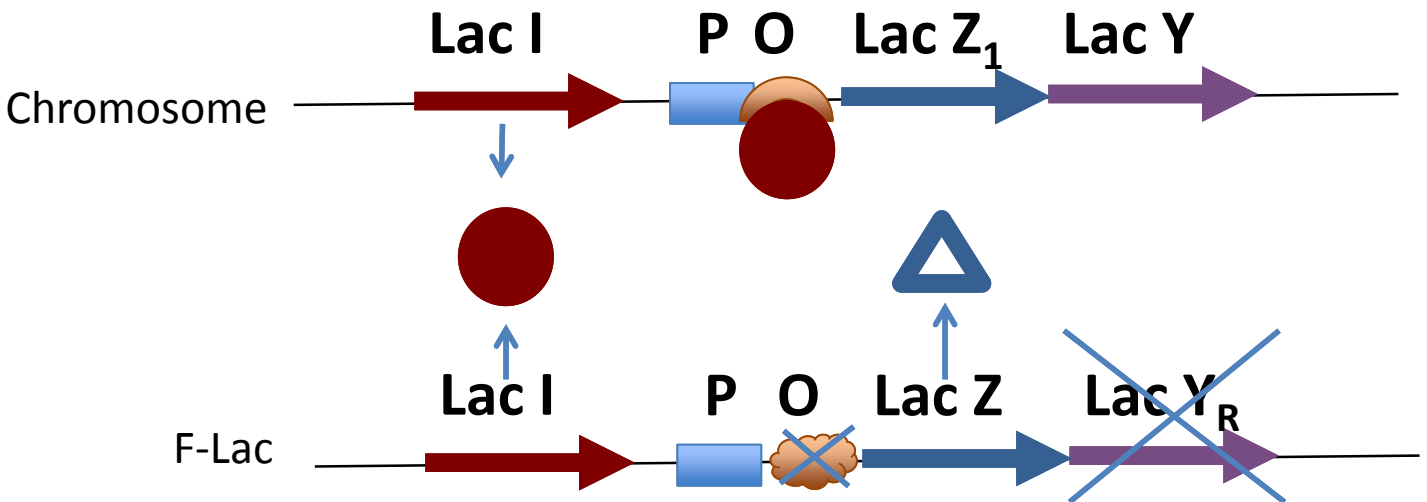
$i^+o^+z^+y^-_R/Fi^+o^cz^-_1y^+$		<1	30	—	100	400	—
$i^+o^+z^-_1y^+/Fi^+o^cz^+y^-_R$		60	—	nd	300	—	100
		Lac Z	Z_4/Z_1	Lac Y	Lac Z	Z_4/Z_1	Lac Y



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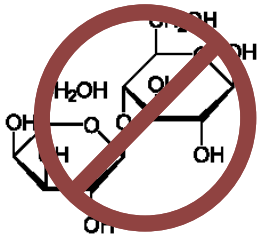

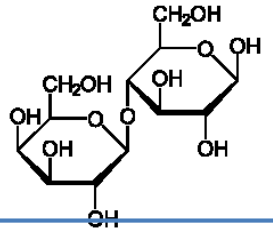

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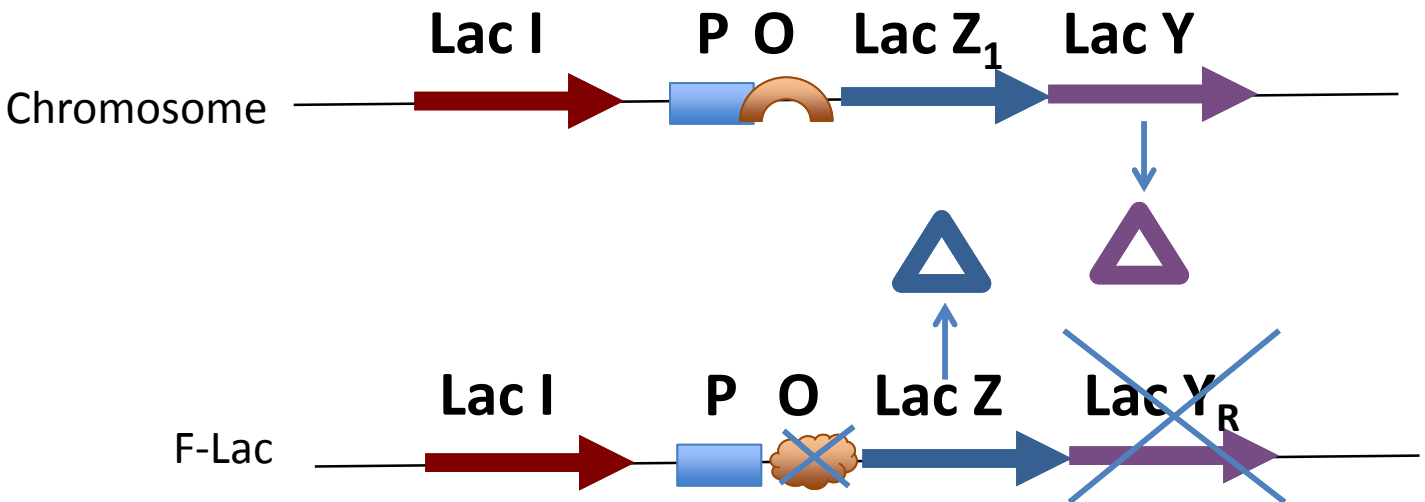

IPTG protein expression