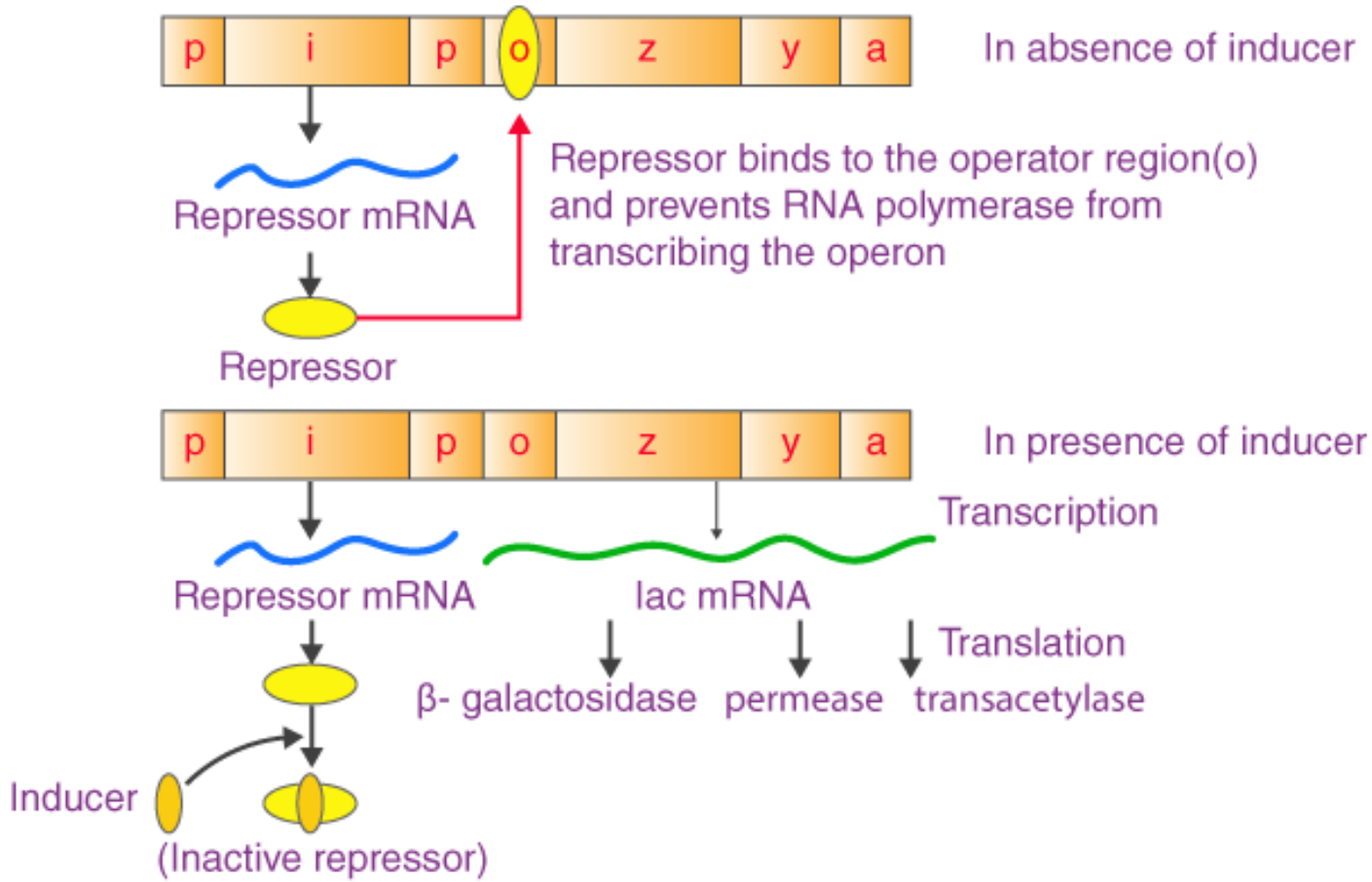
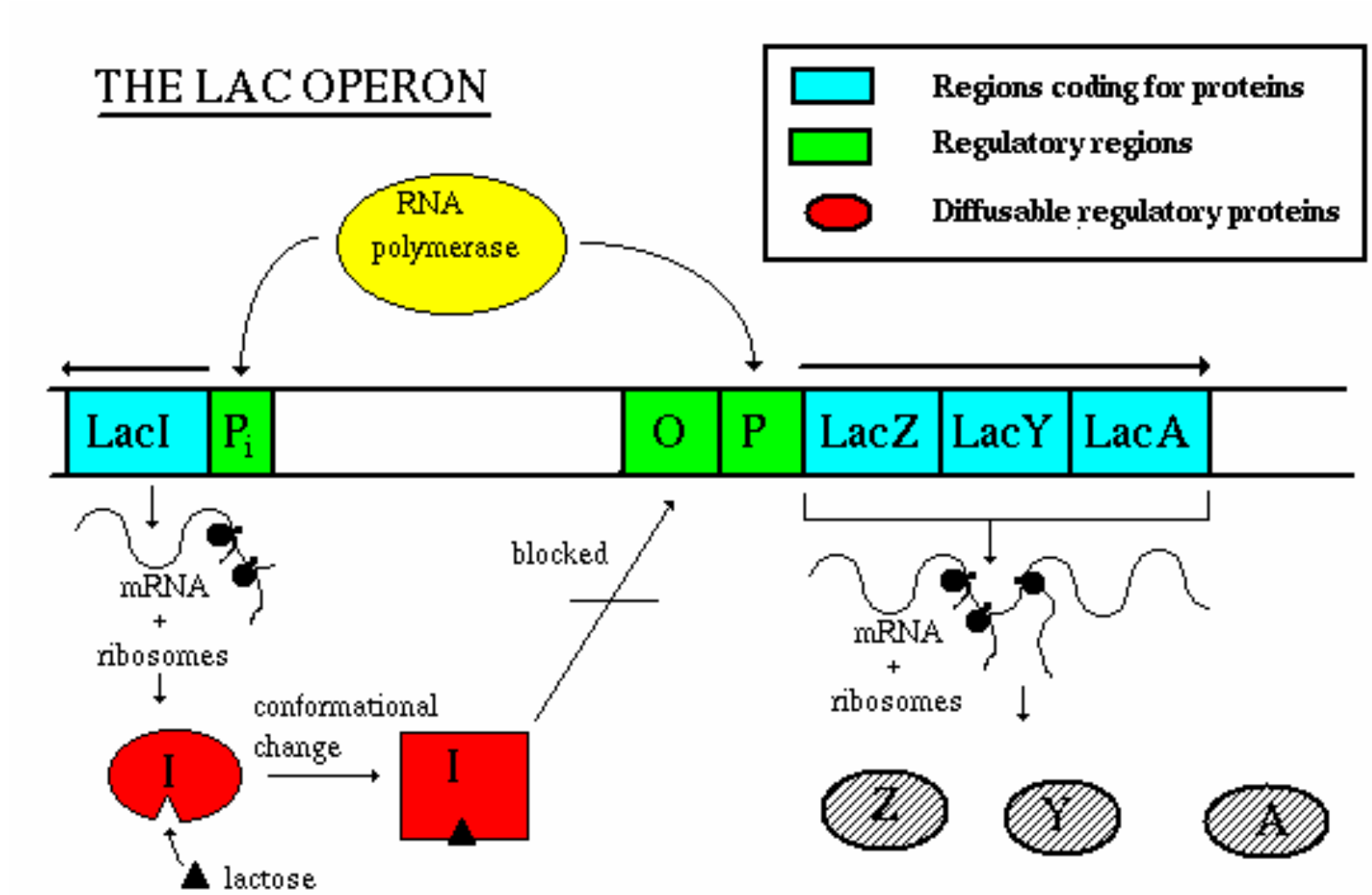
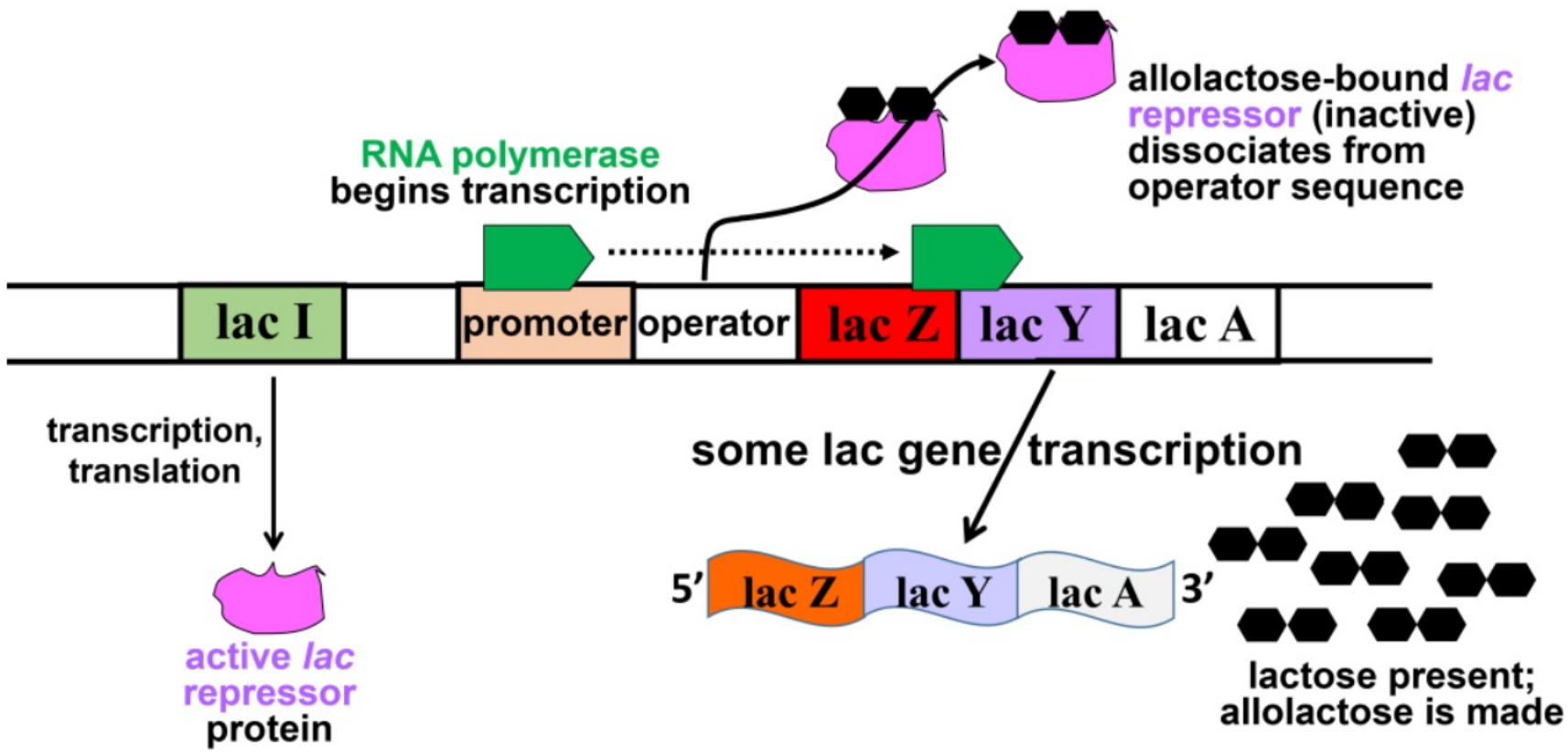
The lac operon

Dr. Kuntala S. Bordoloi
Assistant Professor
Department of Botany
Manga;dai College


p
i
p
o
z
y
a
In absence of inducer
Repressor mRNA
Repressor binds to the operator region(o)
and prevents RNA polymerase from
transcribing the operon
Repressor
p
i
p
o
z
y
a
In presence of inducer
Transcription
Repressor mRNA
lac mRNA
Translation
β- galactosidase
permease
transacetylase
Inducer
(Inactive repressor)

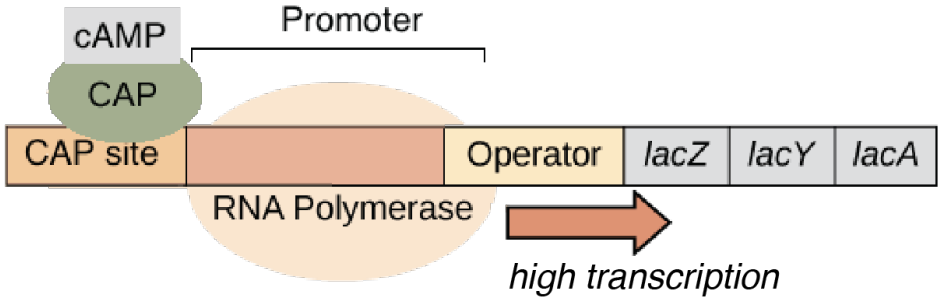

THE LAC OPERON
Regions coding for proteins
Regulatory regions
Diffusable regulatory proteins
RNA polymerase
LacI
Pi
O
P
LacZ
LacY
LacA
mRNA
+
ribosomes
blocked
conformational change
I
I
lactose
mRNA
+
ribosomes
Z
Y
A

lac Operon Derepressed, Some Transcription



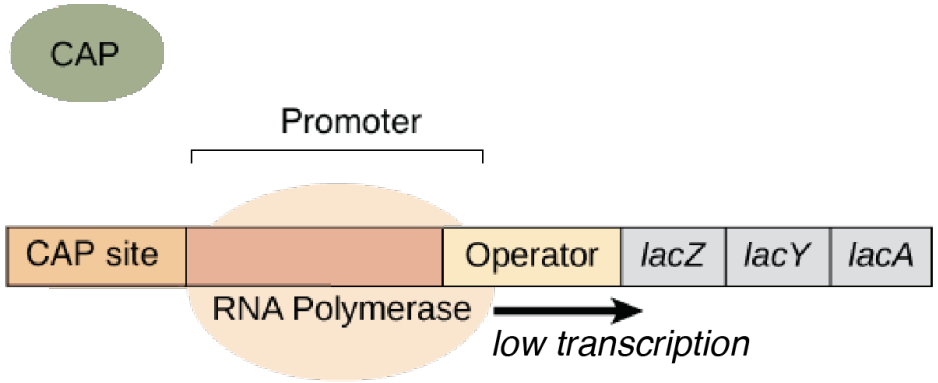
Low glucose:

When glucose levels are low, cAMP is produced. The cAMP attaches to CAP, allowing it to bind DNA. CAP helps RNA polymerase bind to the promoter, resulting in high levels of transcription.

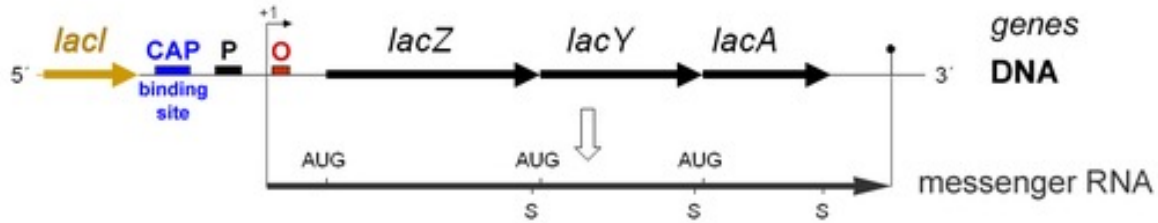


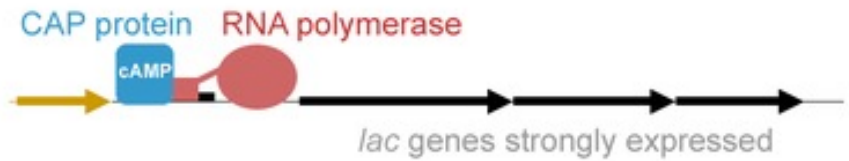
High glucose:

When glucose levels are high, no cAMP is made. CAP cannot bind DNA without cAMP, so transcription occurs only at a low level.



The *lac* Operon and its Control Elements





lac genes strongly expressed

Low glucose
Lactose available

lac genes **not** expressed

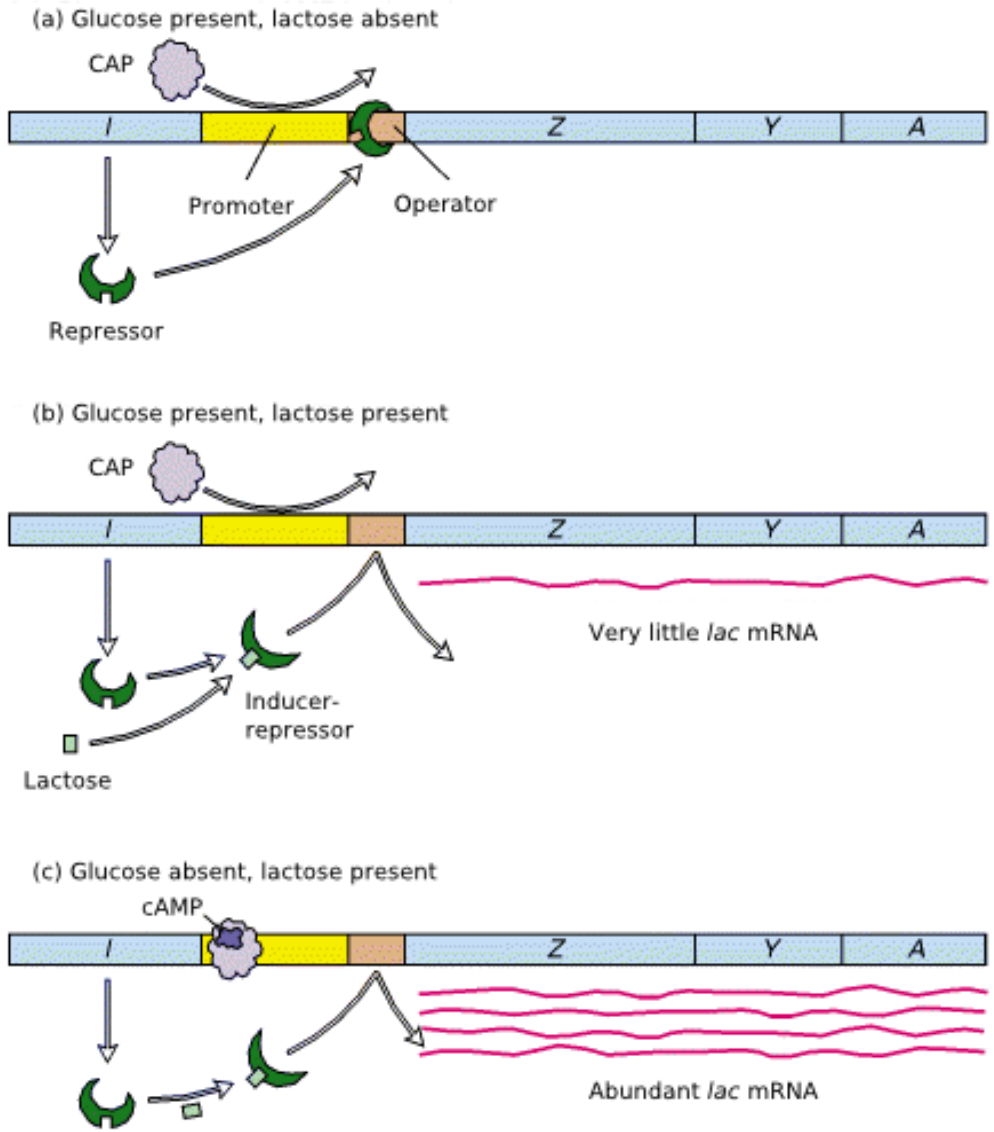
High glucose
Lactose unavailable

lac genes **not** expressed

Low glucose
Lactose unavailable

very low (basal) level of gene expression

High glucose
Lactose available


(a) Glucose present, lactose absent
CAP
I
Z
Y
A
Promoter
Operator
Repressor
(b) Glucose present, lactose present
CAP
I
Z
Y
A
Very little lac mRNA
Inducer-
repressor
Lactose
(c) Glucose absent, lactose present
cAMP
I
Z
Y
A
Abundant lac mRNA