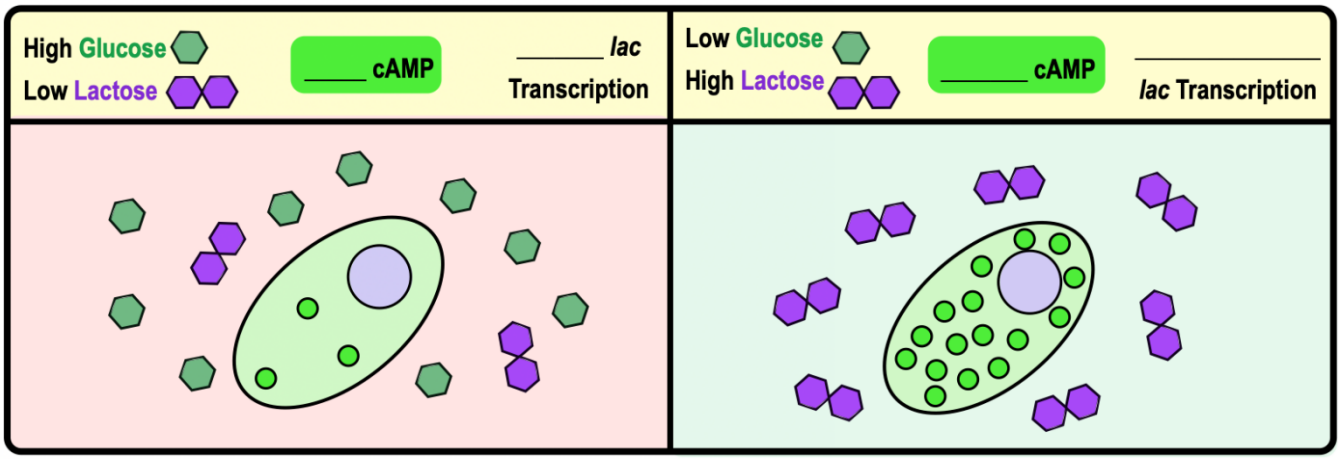
CONCEPT: GLUCOSE'S IMPACT ON LAC OPERON

Glucose Levels, cAMP, & the *lac* Operon

- In most prokaryotes, _____ is the preferred energy source even in the presence of **lactose**.
  - This means that if **glucose** is available, then the lac operon should be turned "_____."
- *Glucose levels* are linked to cellular levels of a molecule called **cyclic AMP** (_____).
  - When **glucose** is *low/absent* & *not* available for metabolism, cellular levels of cAMP _____.
  - *High* cellular *cAMP* levels _____ the *rate* of transcription of the *lac* operon.
  - *cAMP* levels do _____ affect *repressor protein's* activity & only increase transcription when **glucose** is absent.

EXAMPLE: Glucose Levels Control cAMP Levels in the Cell, Which Controls Rate of Lac Operon Transcription.



EXAMPLE: Complete the table below:

Environmental Levels		Cellular Levels			Expressed?
Glucose	Lactose	Glucose	cAMP	Lactose	*lac* Operon
HIGH	HIGH	HIGH	low	_____	_____
HIGH	low	_____	_____	low	_____
low	HIGH	low	_____	_____	_____
low	low	low	_____	low	_____

PRACTICE: How does extracellular glucose inhibit transcription of the lac operon?

a) By strengthening the binding of the repressor to the operator.

b) By weakening the binding of the repressor to the operator.

c) By inhibiting RNA polymerase from opening the strands of DNA to initiate transcription.

d) By reducing the levels of intracellular cAMP.

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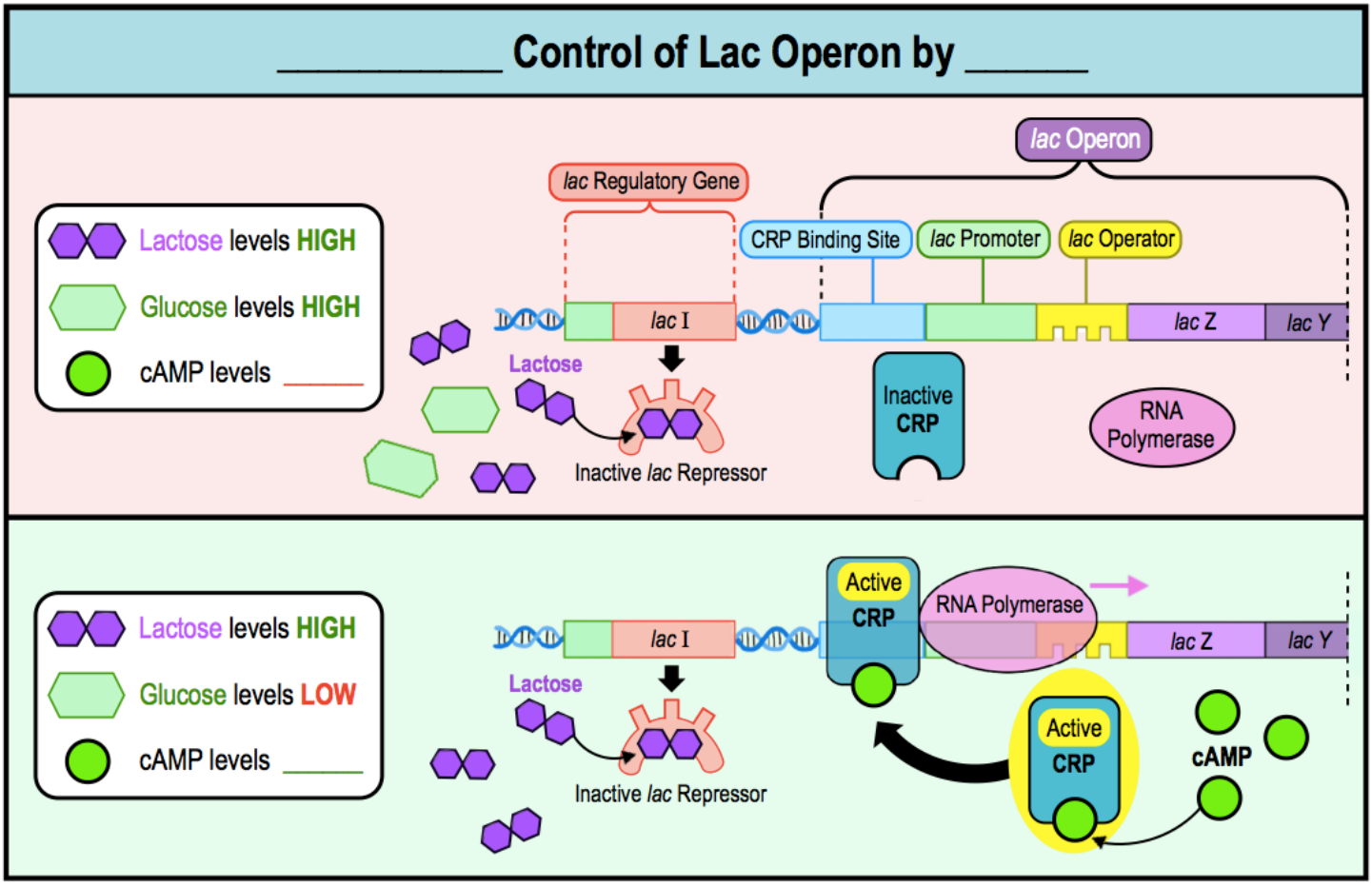
Positive Control by cAMP & CRP

- **C**yclic AMP **R**eceptor **P**rotein (_____) is an _____ *protein* of the *lac* operon when bound to *cAMP.*
- Low Glucose levels =_____ cellular *cAMP* levels which binds to & activates CRP.
  - □ *Active CRP* binds to a region of DNA upstream of the *lac* _____ & recruits *RNA polymerase.*
  - □ _____ Glucose = _____ cAMP = _____ CRP = _____ Rate of Lac Operon Transcription.

EXAMPLE: cAMP & CRP Positively Control Expression of *lac* operon.



PRACTICE: When glucose is present:

a) cAMP is high, CRP binds to the activator binding site, and transcription of the *lac* operon is turned off.

b) cAMP is low, CRP binds to the site activator binding site, and transcription of the *lac* operon is turned on.

c) cAMP is high, CRP does not bind to the activator binding site, and transcription of the *lac* operon is turned on.

d) cAMP is low, CRP does not bind to the activator binding site, and transcription of the *lac* operon is turned off.