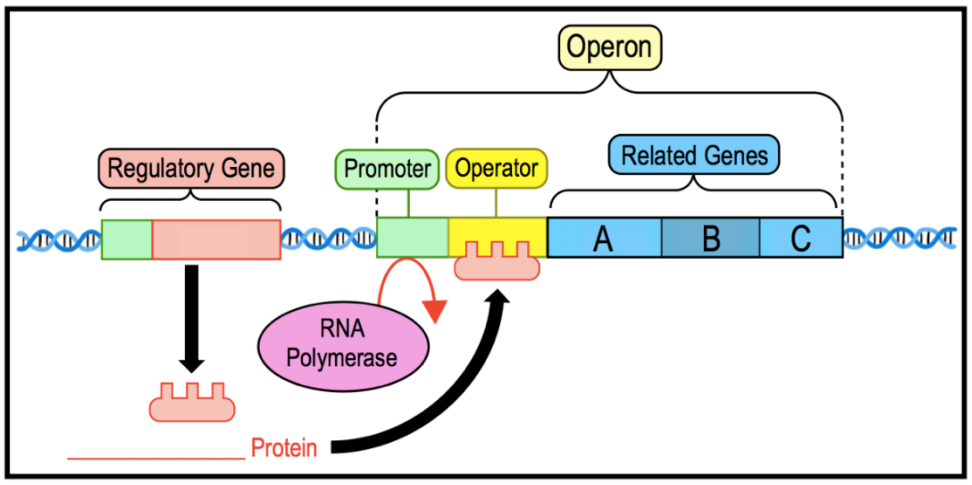
CONCEPT: PROKARYOTIC GENE REGULATION VIA OPERONS

- *Prokaryotes* must survive in environments that constantly _____ in the availability of nutrients.
  - □ Requires them to rapidly change their metabolic pathways by _____ expression of certain genes.
  - □ *Prokaryotes* commonly control expression of genes using _____.

Structure of an Operon

- _____: a set/group of prokaryotic genes of related function controlled by a *single* **promoter**.
- Transcription of the *operon* is regulated by the _____: region of DNA where *regulatory proteins* bind.
  - □ **Regulatory protein**: binds to the *operator* & _____ RNA polymerase binding to the promoter.
  - □ **Repressor**: regulatory protein that _____ RNA polymerase binding (*preventing* transcription).
  - □ **Activator**: regulatory protein that _____ RNA polymerase binding (*stimulating* transcription).

EXAMPLE: Structure of an Operon & Repressor Protein Binding.



PRACTICE: Altering patterns of gene expression in prokaryotes would likely increase a prokaryote's survival by _____.

a) Organizing gene expression, so that genes are expressed in a given order.
b) Allowing each gene to be expressed an equal number of times.
c) Allowing a prokaryote to adjust to changes in environmental conditions.
d) Allowing environmental changes to alter a prokaryote's genome.

PRACTICE: Which of the following is true about operons?

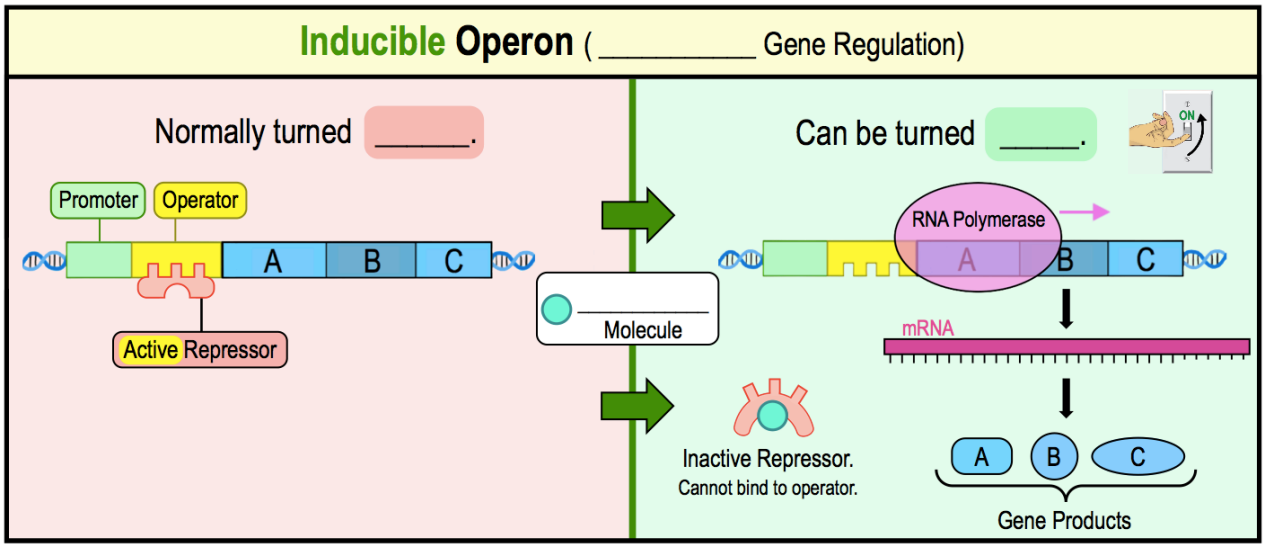
a) They allow the organism the opportunity to simultaneously regulate transcription of multiple genes.
b) They allow the organism the opportunity to regulate transcription of a single gene.
c) They allow many genes to be expressed at the same time, even those unrelated in function.
d) They significantly increase the rate of DNA replication, thereby make transcription more efficient.

CONCEPT: PROKARYOTIC GENE REGULATION VIA OPERONS

Inducible Operons

- _____ **Operon:** normally turned "_____" but can be turned "_____" (*induced*) in presence of **inducer**.
  - □ **Active** *represssor protein* represses transcription but can be inactivated by the _____ *molecule.*
  - □ In other words: the inducer inactivates the repressor protein, so transcription is turned _____.

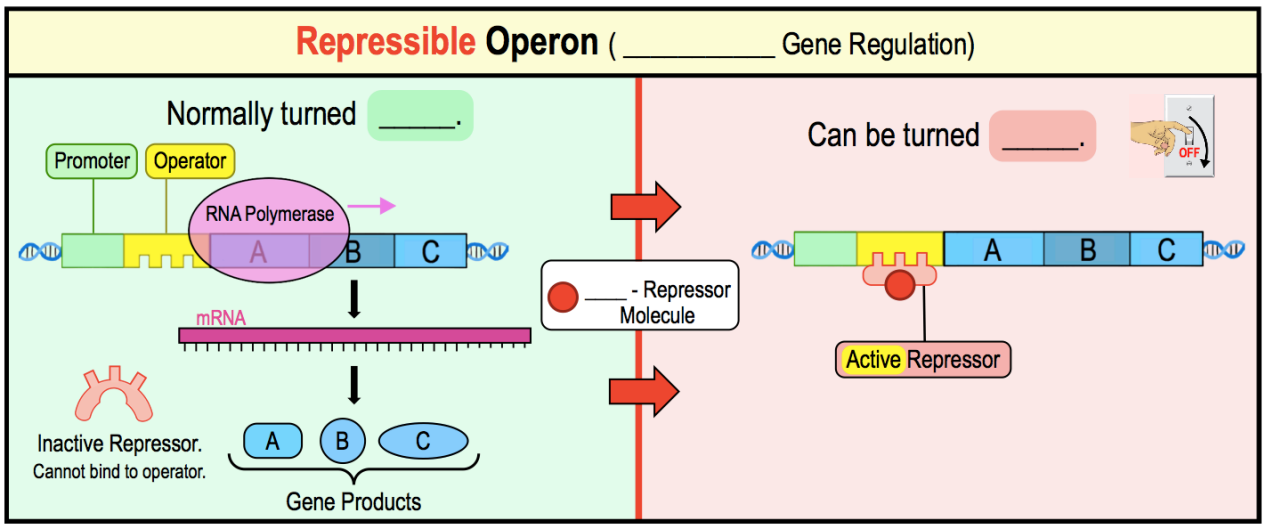
EXAMPLE: An inducible operon is turned on in the presence of an inducer molecule.



Repressible Operons

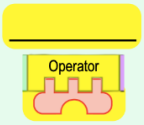
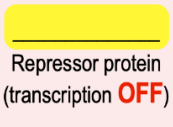
- _____ **Operon:** normally turned "_____" but can be turned "_____" (*repressed*) by **active** *repressor protein*.
  - □ Inactive *Repressor protein* can _____ repress transcription without a co-repressor.
  - □ _____***-repressor:*** small molecule that binds to the repressor forming an **active** *repressor protein*.
  - □ In other words, the *co-repressor* activates the *repressor protein*, so transcription is turned _____.

EXAMPLE: A repressible operon is turned off in the presence of a co-repressor molecule.



CONCEPT: PROKARYOTIC GENE REGULATION VIA OPERONS

Review of Inducible vs. Repressible Operons

Type:	Normally turned:	Can be turned:	Repressor protein normally:	Regulatory molecule:	Effect of regulatory molecule:	Example:
Inducible Operon					Repressor protein (transcription ON) 	*lac* operon
Repressible Operon					 Repressor protein (transcription OFF) 	*trp* operon

PRACTICE: Which of the following molecules is a protein that stops the transcription of a gene?

a) Operon.
b) Inducer.
c) Promoter.
d) Repressor.

PRACTICE: When this is present in the cell, it binds to the repressor and the repressor can no longer bind to the operator:

a) Operon.
b) Inducer.
c) Promoter.
d) Repressor.
e) Corepressor.

PRACTICE: Which of the following statements is FALSE?

a) An inducible operon is turned on by the presence of an inducer molecule.
b) An inactive repressor protein requires binding of a corepressor molecule to become active.
c) A repressible operon is turned on when the repressor protein is not bound to the corepressor molecule.
d) An active repressor protein is inactivated by the binding of an activator molecule.