**Worksheet – Control Mechanism (lac & trp operons)** Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ # \_\_\_\_ Blk \_\_\_\_\_

1. Complete the comparison of the *lac* Operon and *trp* Operons as a means of gene regulation.

|  |  |  |
| --- | --- | --- |
|  | *lac* operon | *trp* operon |
| Regulates production of: |  |  |
| Number of genes and how they are controlled |  |  |
| What binds to the operator & when does this occur |  |  |
| High levels of what substance affects the operon how? |  |  |

2. Why have genes under regulation?

3. What is the function of the promoter?

4. What is the function of the operator?

5. What happens if lactose levels are low? Put the following list in order (1-5).

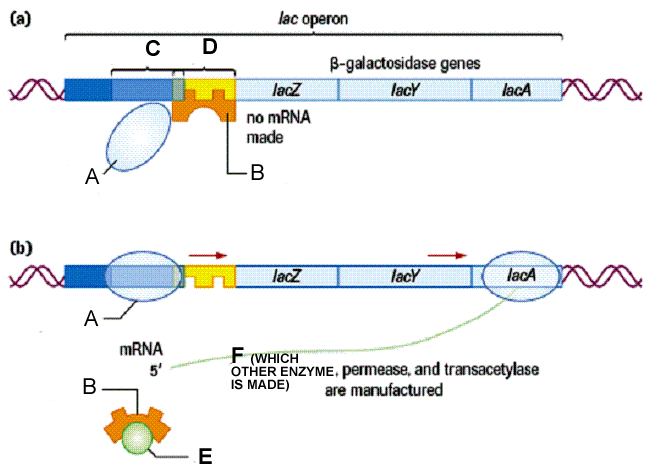
|  |  |
| --- | --- |
|  | RNA polymerase is blocked from transcribing the genes for the lactose metabolizing enzymes |
|  | When RNA polymerase binds to the promoter, it cannot get past the LacI repressor protein |
|  | The enzymes (B-galactosidae, B-galacosidae permease, and transacetylase) are not required by the cell due to low levels of lactose |
|  | Lactose does not bind to the repressor protein, LacI |
|  | LacI, a repressor protein, is bound to the operator, which follows the promoter |

6. What happens if tryptophan levels are high? Put the following list in order (1-4).

|  |  |
| --- | --- |
|  | The trp repressor-tryptophan complex can now bind to the operator of the trp operon |
|  | Tryptophan does not need to be produced by the trp operon |
|  | Tryptophan will bind to the repressor protein, changing its conformation |
|  | RNA Polymerase is blocked from transcribing the genes needed to synthesize tryptophan |

7. What happens if lactose is present and glucose is scarce? Put the following list in order (1-7). Start with the repressor part first.

|  |  |
| --- | --- |
|  | The three enzymes involved in the metabolism of lactose are transcribed and expressed |
|  | cAMP binds to CAP regulatory protein, causing it to bind to the promoter of the lac operon |
|  | The enzymes needed for lactose metabolism must be transcribed when lactose is present |
|  | cAMP levels increase because glucose is scarce (ATP is not being produced through cell respiration) |
|  | Lactose binds to the LacI repressor, changing LacI’s shape and making it fall off the operator |
|  | CAP binding causes RNA Polymerase to bind to the promoter (higher affinity) and transcribe the gene at a higher level than before |
|  | Now that LacI has been removed for the operator, RNA polymerase can proceed with transcription |

8. Label the following diagram.

OMIT: Create a Playdoh model of the lac operon on a manila folder (so you can transport it). Be able to explain how it works when you show me your model. Be able to explain the following: positive regulation, negative regulation, repressible operon, inducible operon, operon, operator, repressor protein, promoter, corepressor, inducer