REGULATION OF GENE EXPRESSION IN PROKARYOTES

SUBMITTED BY-

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REGULATION OF GENE EXPRESSION IN PROKARYOTE

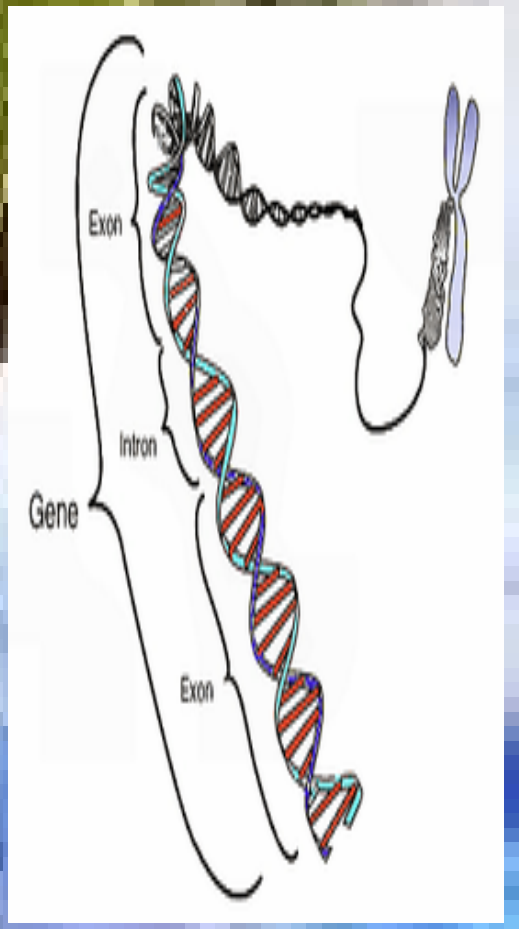
SYNOPSIS

- INTRODUCTION
- INDUCER
- REPRESSER
- CO-REPRESSER
- REGULATION OF GENE EXPRESSION IN PROKARYOTE
  - LAC OPERONE (INDUCIBLE SYSTEM)
  - TRYPTOPHANE OPERON (REPRESSIBLE SYSTEM)
- SUMMRAY
- CONCLUSION
- REFERECES

REGULATION OF GENE EXPRESSION IN PROKARYOTE

INTRODUCTION

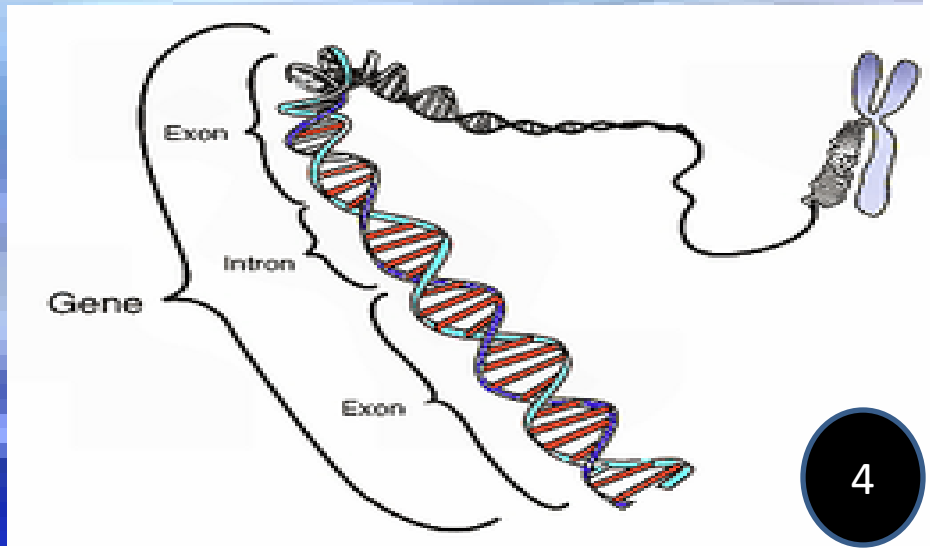
- It takes a lot of energy to make RNA and protein.
- Therefore some genes active all the time because their products are in constant demand.
- Others are turned off most of the time and are only switched on when their products are needed.



REGULATION OF GENE EXPRESSION IN PROKARYOTE

HISTORY

- The first system of gene regulation that was understood was the lac operon in E. coli, worked out by Francois Jacob and Jacques Monod in 1962.



REGULATION OF GENE EXPRESSION IN PROKARYOTE

Induction ;- Induction happens in operons that produce gene products needed for the utilization of energy.

Repression ;- Repression regulates operons that produce gene products necessary for the synthesis of small biomolecules such as amino acids.

Corepressor ;- The end product who addition will cheek or stop the synthesis of biosynthetic enzyme is known as corepressor

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OPERON in gene regulation of prokaryotes

1. LAC OPERON (INDUCIBLE SYSTEM)
2. TRYPTOPHANE OPERON (REPRESSIBLE SYSTEM

1. LAC OPERONE

INDUCIBLE SYSTEM

Such enzyme who synthesis can be induce by adding are substrate are known as inducible system.

Active repressor + Inducer = inactive repressor = inducible system.

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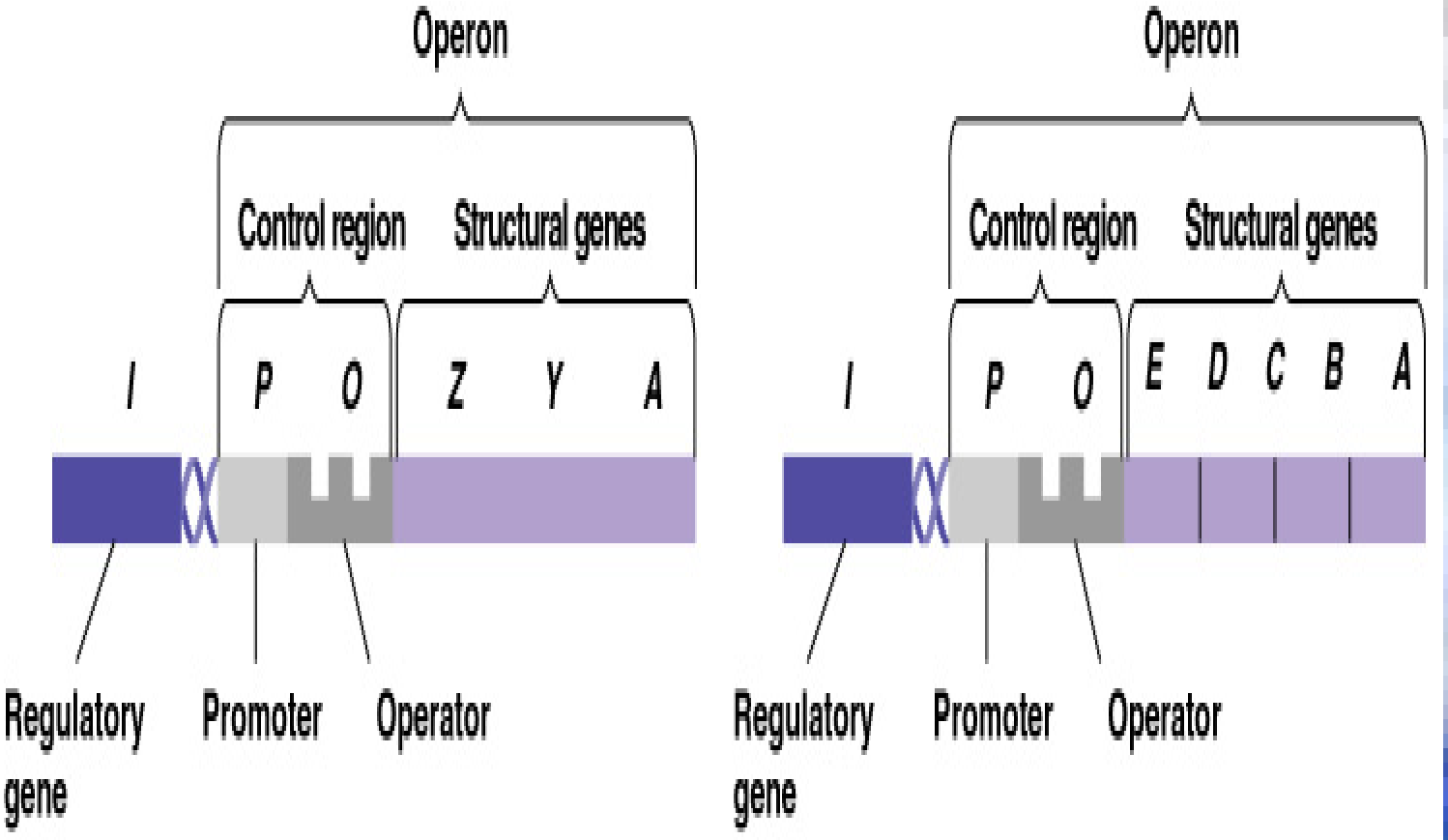
GENERAL ST. OF OPERON



1 **Structure of the operon.** The operon consists of the promoter (*P*), and operator (*O*) sites, and structural genes which code for the protein. The operon is regulated by the product of the regulatory gene (*I*).

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LAC OPERON MODLE

Structure of the operon - The operon consist of the promoter (p), operator (o) site, & structural gene which code for the protein the operon is regulated by the product of the regulatory gene (i).

Structure of lac operon ;-

1. Structural gene.
2. Operator gene.
3. Promoter gene.
4. Regulatory gene.

1. The *lac* operon three structural genes:
   Lac Z
   Lac y
   Lac a

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LAC OPERON

- The ***z*** gene codes for β- galactosidase , responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose.
- The ***y*** gene codes for permease, which increases permeability of the cell to galactosides.
- The ***a*** gene encodes a transacetylase.
- In addition to the structural genes the lac operon also has regulatory genes:

2. Operator gene :-

- Binding site of repressor
- Repressor proteins encoded by repressor genes, are synthesized to regulate gene expression.

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LAC OPERON

- They bind to the operator site to block transcription by RNA polymerase.

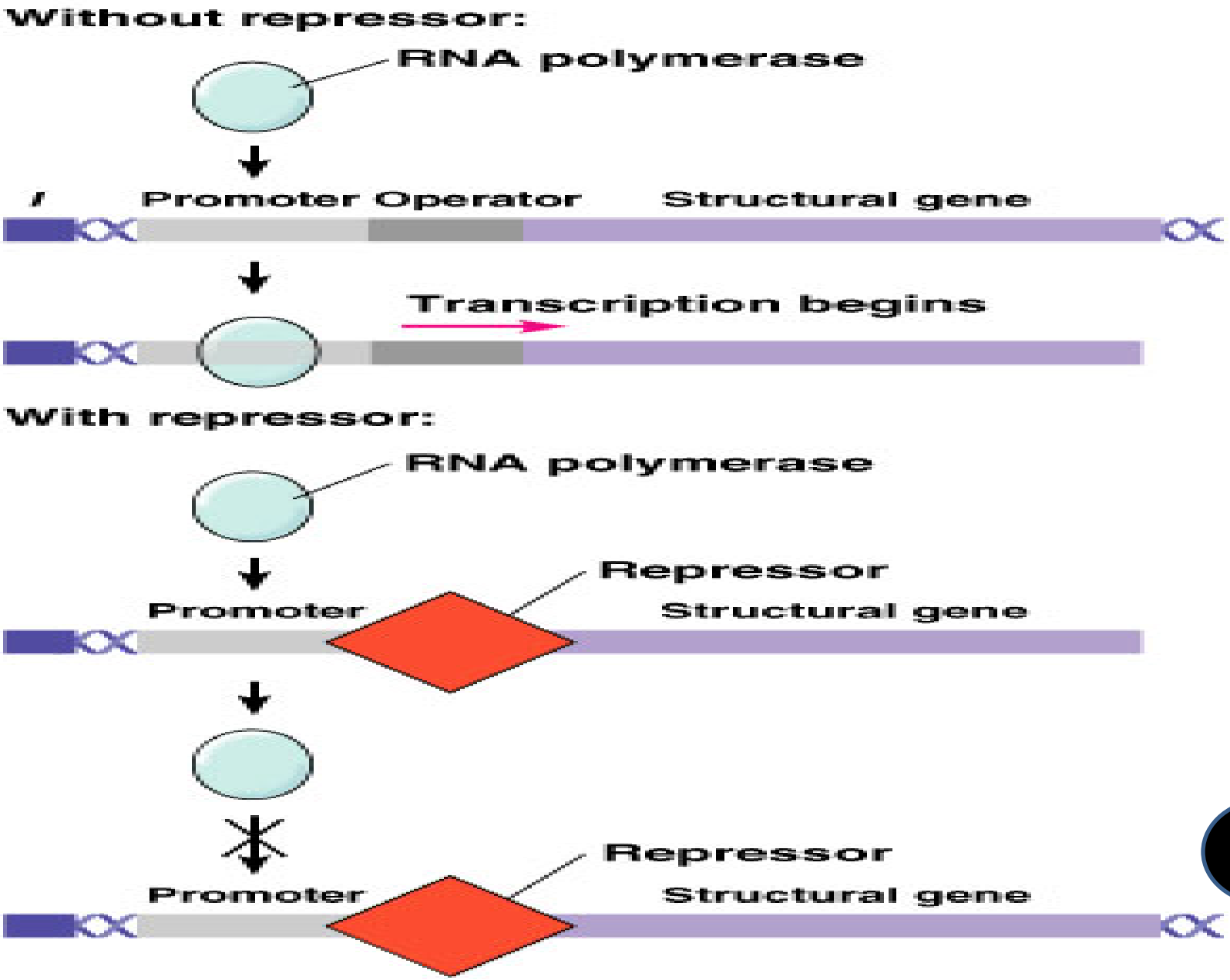
Promoter Gene –

- The promoter sequences are recognized by RNA polymerase.
- When RNA polymerase binds to the promoter, transcription occurs

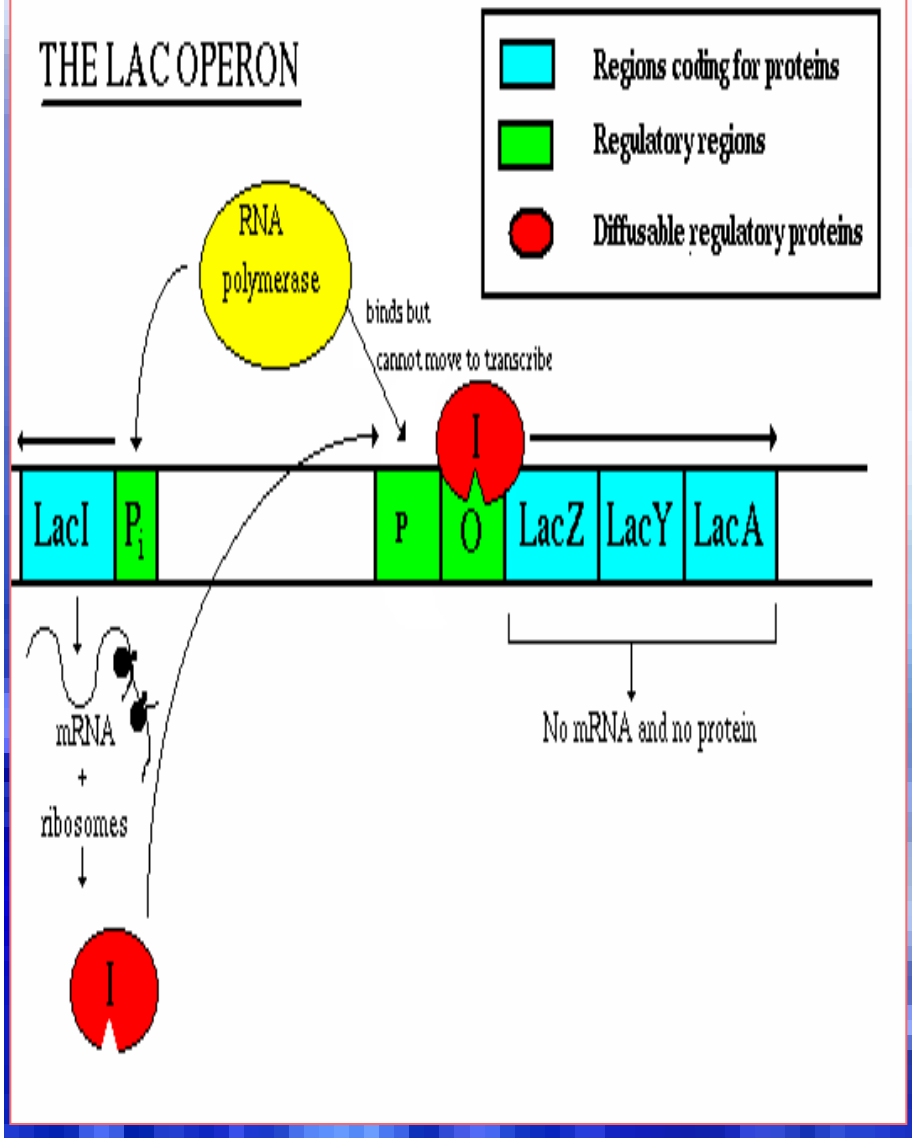
Regulator gene -

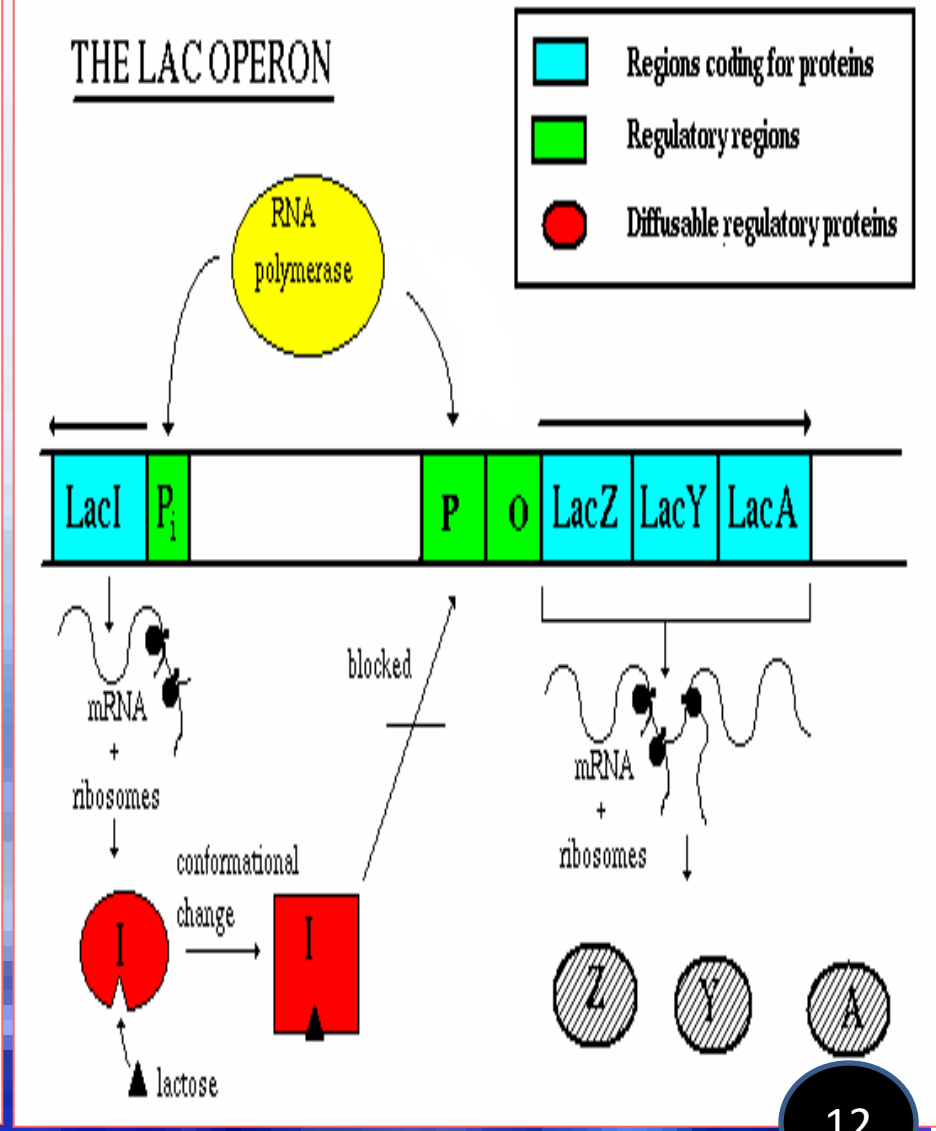
- Repressor is synthesized to the activity of lac I gene these lac I gene known as regulator gene.
- The repressor than attach to the operator gene and the synthesis of mRNA is controlled by promoter gene its left side.

The activity of an Operon in the presence or the absence of repressor



Lac OPERON an inducible Operon





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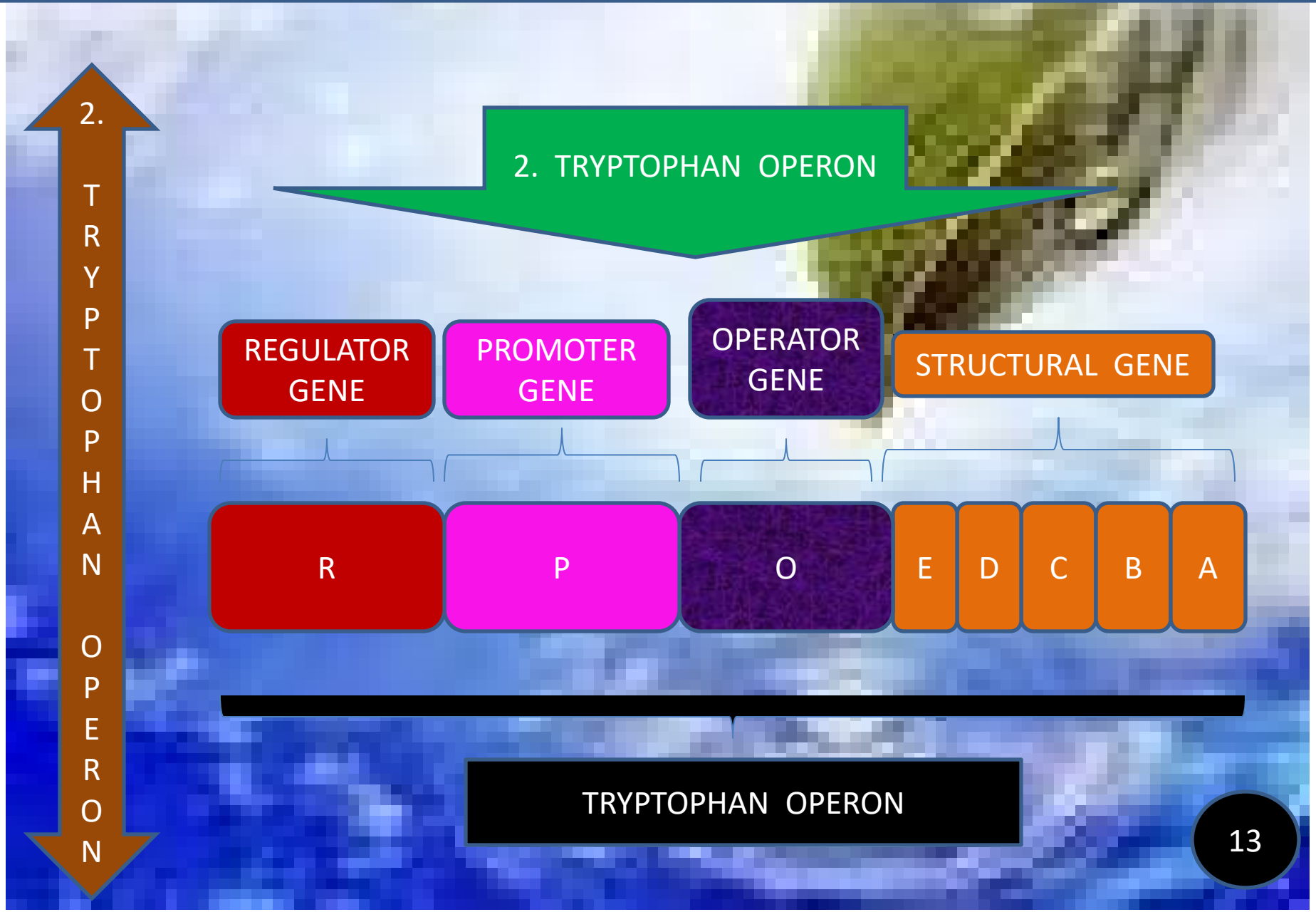
2. TRYPTOPHAN OPERON



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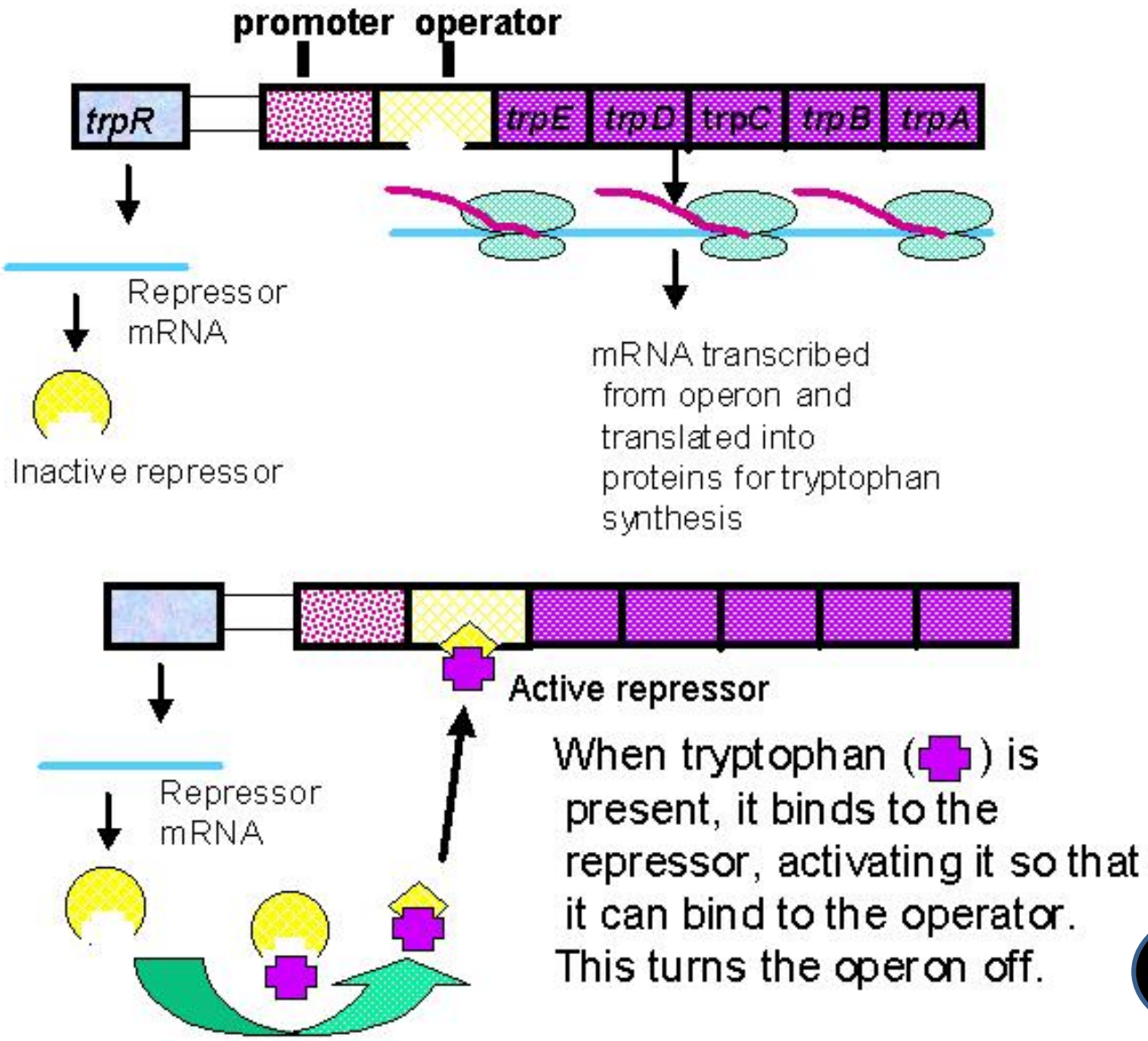
2. TRYPTOPHAN OPERON



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2. TRYPTOPHAN OPERON (REPRESIBLE SYSTEM)

- The *trp* operon encodes the genes for the synthesis of tryptophan.
- As with all operons, the *trp* operon consists of the promoter, operator and the structural genes.
- It is also subject to negative control by a repressor
- In this system, unlike the *lac* operon, the gene for the repressor is not adjacent to the promoter, but rather is located in another part of the *E. coli* genome.
- Another difference is that the operator resides entirely within the promoter
- Unlike an inducible system, the repressible operon is usually turned on.

REGULATION OF GENE EXPRESSION IN PROKARYOTE

TRYTOPHAN OPERON

Structure of the trp operon

- The operon consists of:

1. STRUCTURAL GENE
2. OPERATOR GENE
3. PROMOTER GENE
4. REGULATOR GENE

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TRYPTOPHAN OPERON

TRYPTOPHAN OPERON (REPRESIBLE SYSTEM) -

Inactive repressor + co- repressor → Active repressor (than process in)

1. STRUCTURAL GENE -

There are five types of structural gene.

a) trp E
b) trp D
c) trp C
d) trp B
e) trp A

REGULATION OF GENE EXPRESSION IN PROKARYOTE

2. TRYPTOPHAN OPERON

2. OPERATOR GENE -

- Operator gene is 2nd site of tryptophan operon.
- Operator gene is denoted by trp ‘ o ‘ .

3. PROMOTER GENE -

- Promoter region denoted by trp ‘ p ‘ .
- This gene are attached in operator region.

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2. TRYPTOPHAN OPERON

4. REGULATER GENE -

- Regulator region trp 'R' (Repressor gene).
- A repressor is coded by trp 'R' gene which is not linked with the operator and thus remains inactive but this repressor become active in the presence of co- repressor that is Tryptophan .

REGULATION OF GENE EXPRESSION IN PROKARYOTE

SUMMARY

- Studied of the inducible enzyme β-galactosidase in E.coli have revealed the mechanisms by which synthesis of induce enzyme is regulated.
- Each operon contain the structural gene usually adjacent to each other for each of the enzyme whose synthesis it controls as well as a regulator gene and an operator.

CONCLUSION

- **A few genes that are controlled collectively by one promoter.**
- **Therefore some genes active all the time because their products are in constant demand.**

REGULATION OF GENE EXPRESSION IN PROKARYOTE

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