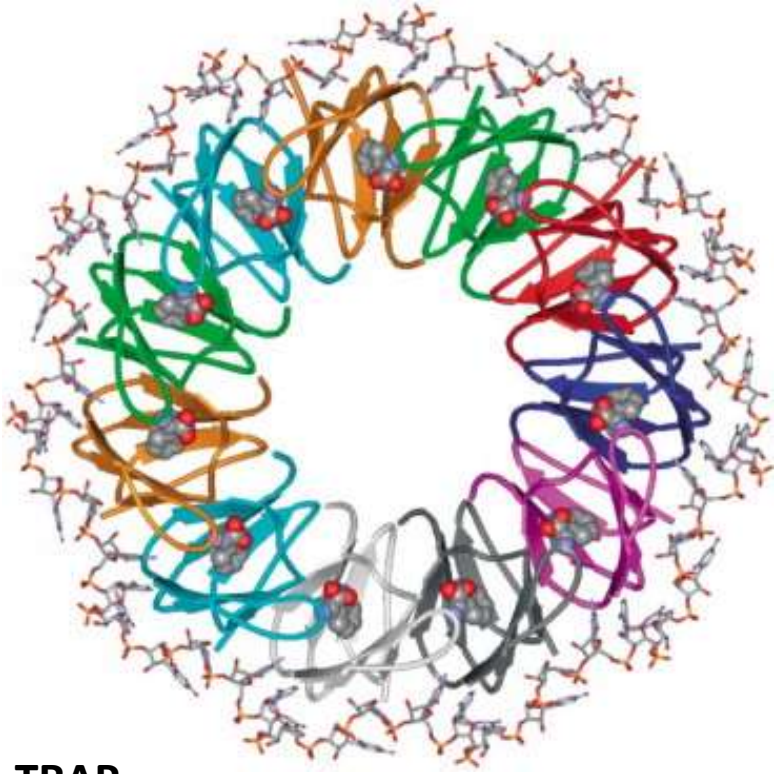
trp OPERON



TRAP

Amal george
MSc Biochemistry

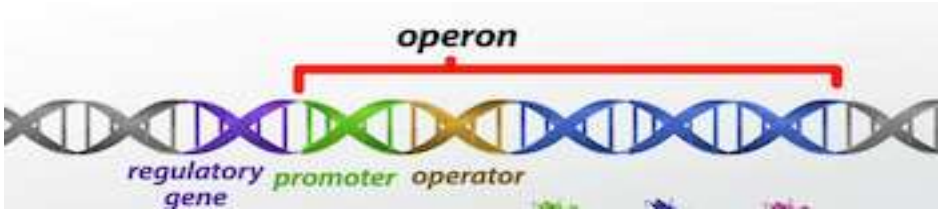
OPERON

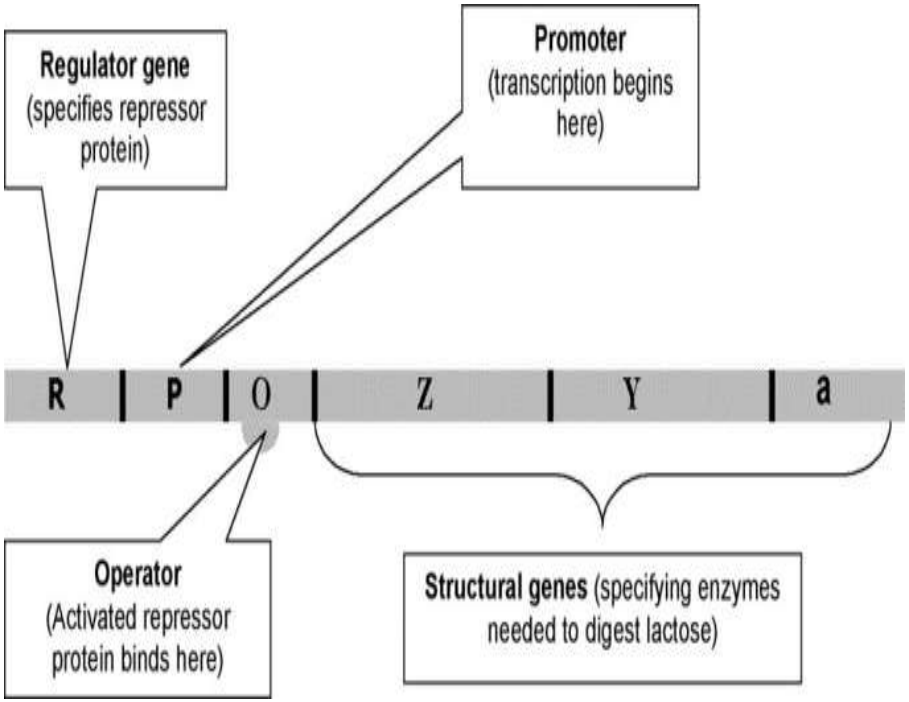
In genetics, an **operon** is a functioning unit of genomic DNA containing a cluster of genes under the control of a single promoter

Promoter sequences - DNA **sequences** that define where transcription of a gene by RNA polymerase begins

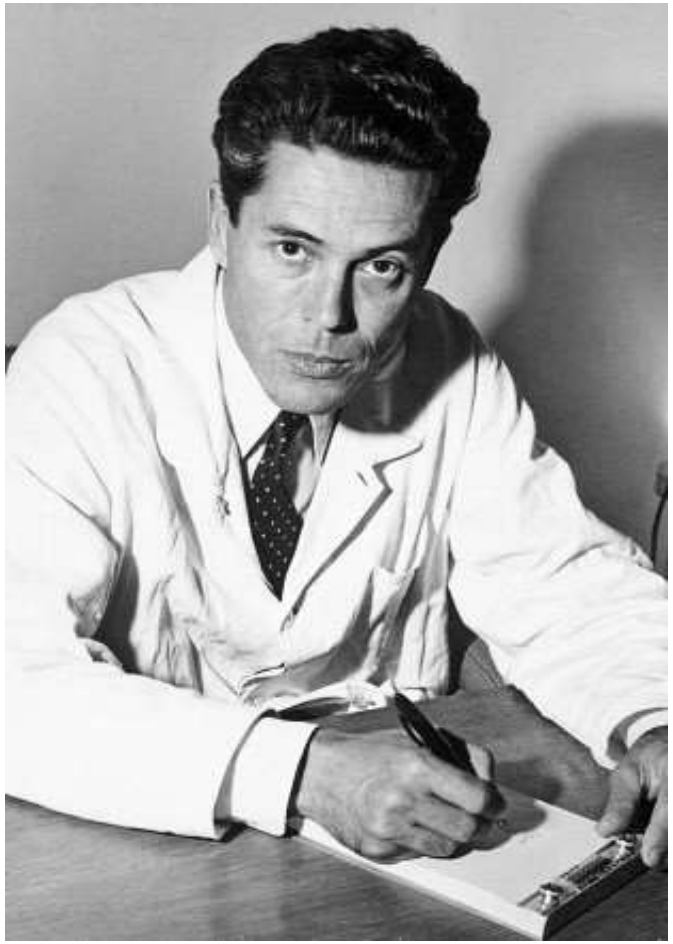
Operator - a segment of DNA to which a transcription factor binds to regulate gene expression by repressing it

Structural genes - **genes** that codes for any RNA or protein product other than a regulatory factor





HISTORY



Jacques Lucien Monod

Discovered in 1953 by **Jacques Monod** and colleagues

The *trp* operon in ***E. coli*** was the first repressible operon to be discovered

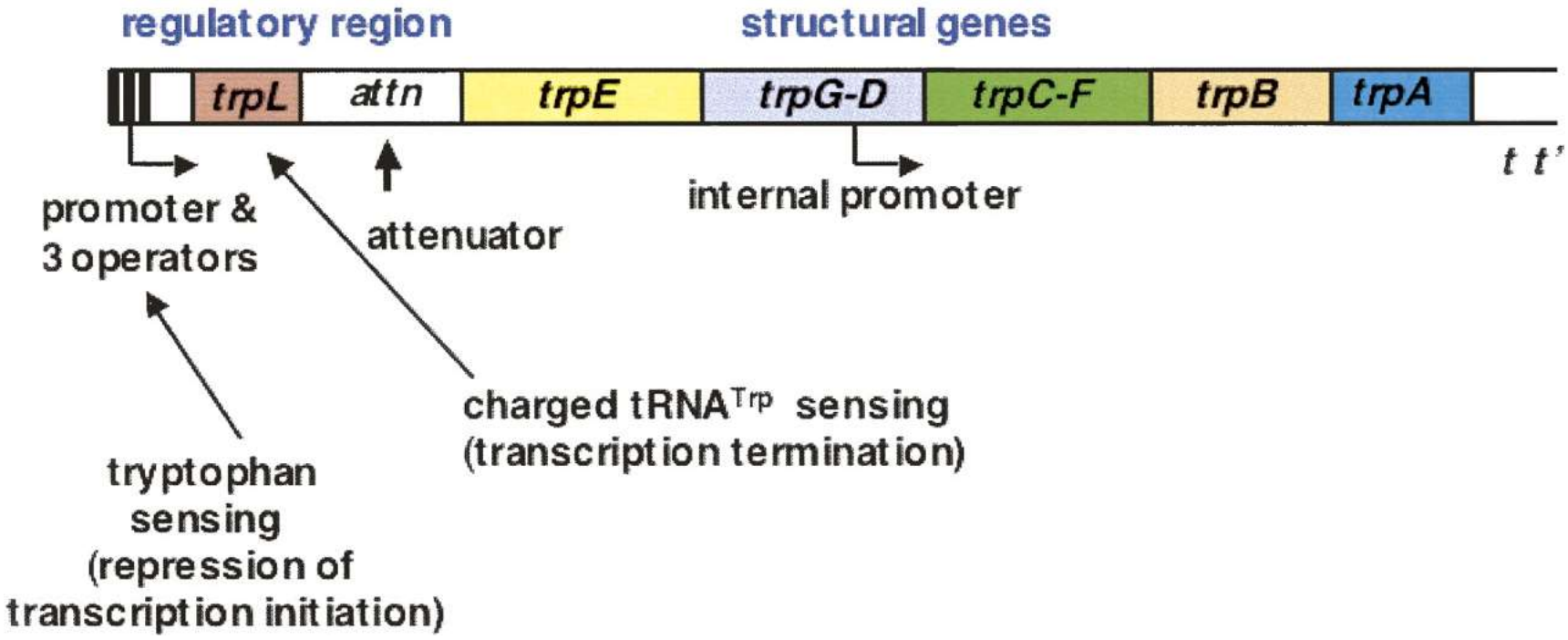
Negative regulatory operon

A totally blind process can by definition lead to anything; it can even lead to vision itself.

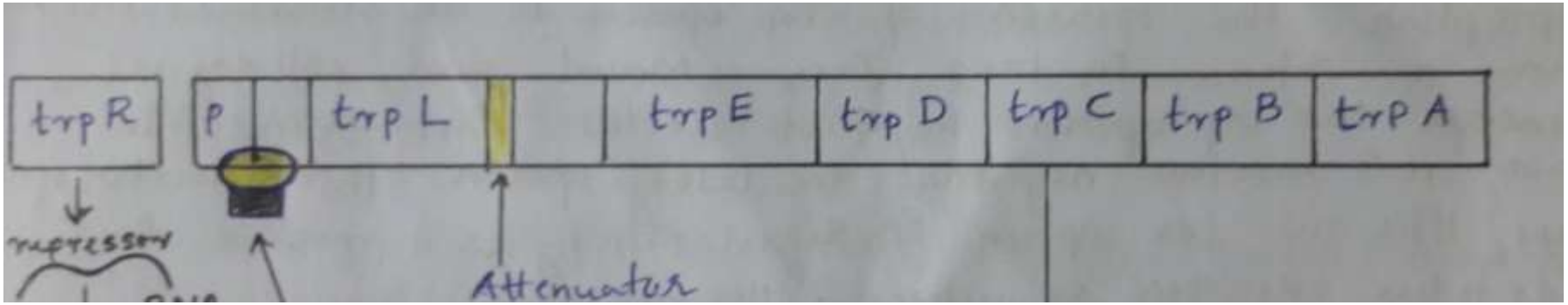
— Jacques Monod —

trp OPERON

- group of genes that transcribed, together&codes for the components for production of **tryptophan**

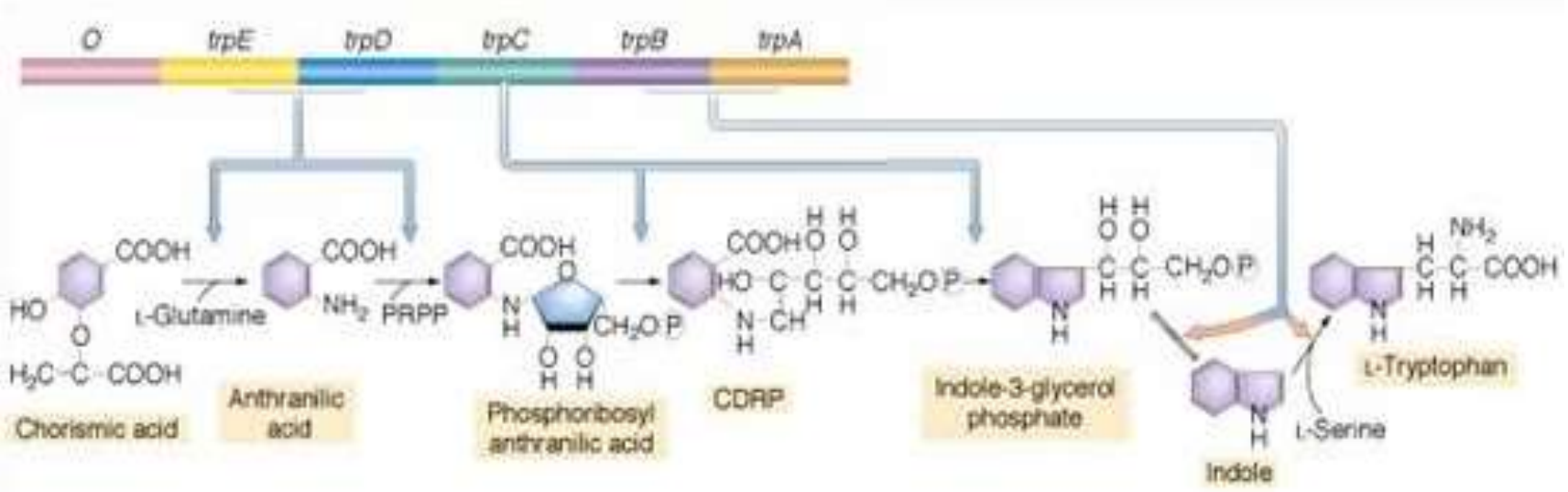


trp OPERON - structure



trp Operon Gene	Gene Function
P/O	**Promoter; operator sequence is found in the promoter**
trp L	**Leader sequence; attenuator (A) sequence is found in the leader**
trp E	**Gene for anthranilate synthetase subunit1**
trp D	**Gene for anthranilate synthetase subunit2**
trp C	**Gene for glycerolphosphate synthetase**
trp B	**Gene for tryptophan synthetase subunit1**
trp A	**Gene for tryptophan synthetase subunit**

1



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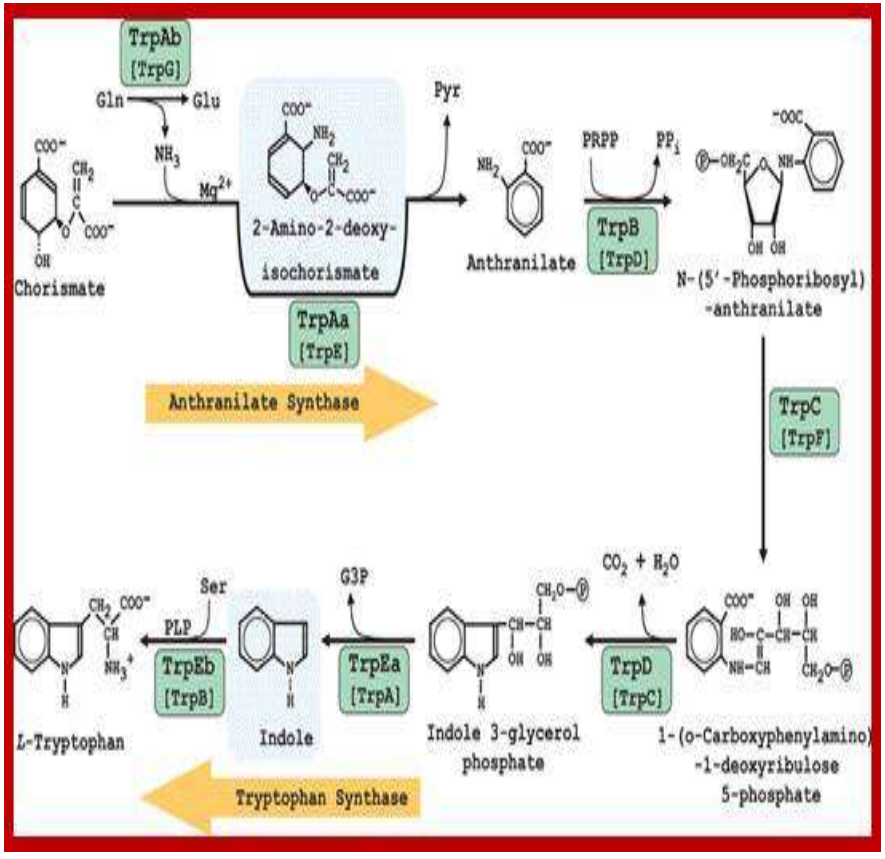


3

Chorismate

↓ anthranilate synthase (*trpE/trpG*)

Anthranilate

↓ anthranilate phosphoribosyl transferase (*trpD*)

N-(5'-phosphoribosyl)-anthranilate

↓ phosphoribosyl-anthranilate isomerase (*trpF*)

1-(o-carboxyphenylamino) -1-deoxyribulose 5-phosphate

↓ indoleglycerol phosphate synthase (*trpC*)

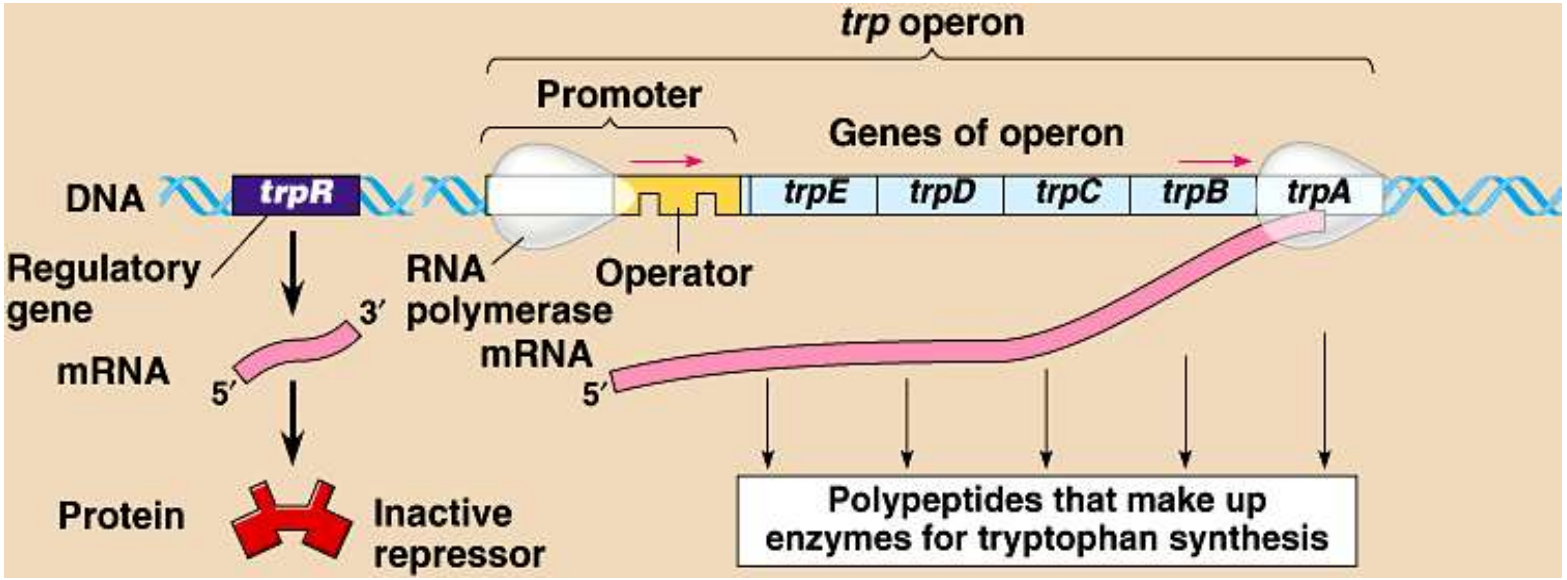
Indole 3-glycerol phosphate

↓ tryptophan synthase (*trpA/trpB*)

L-tryptophan

trp-repressible operon

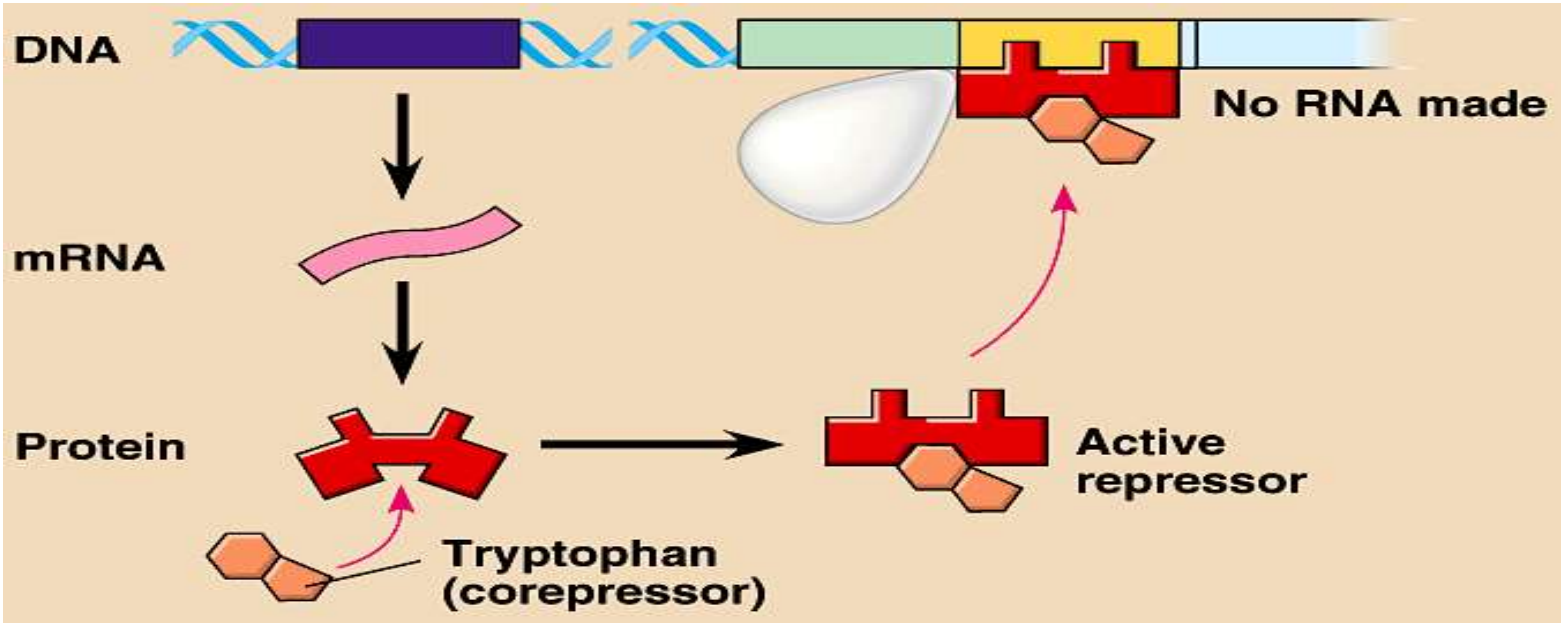
The binding of the effector molecule to the repressor greatly increases the affinity of repressor for the operator and the repressor binds and stops transcription.



A **regulator gene**, **regulator**, or **regulatory gene** is a **gene** **encodes repressor protein**

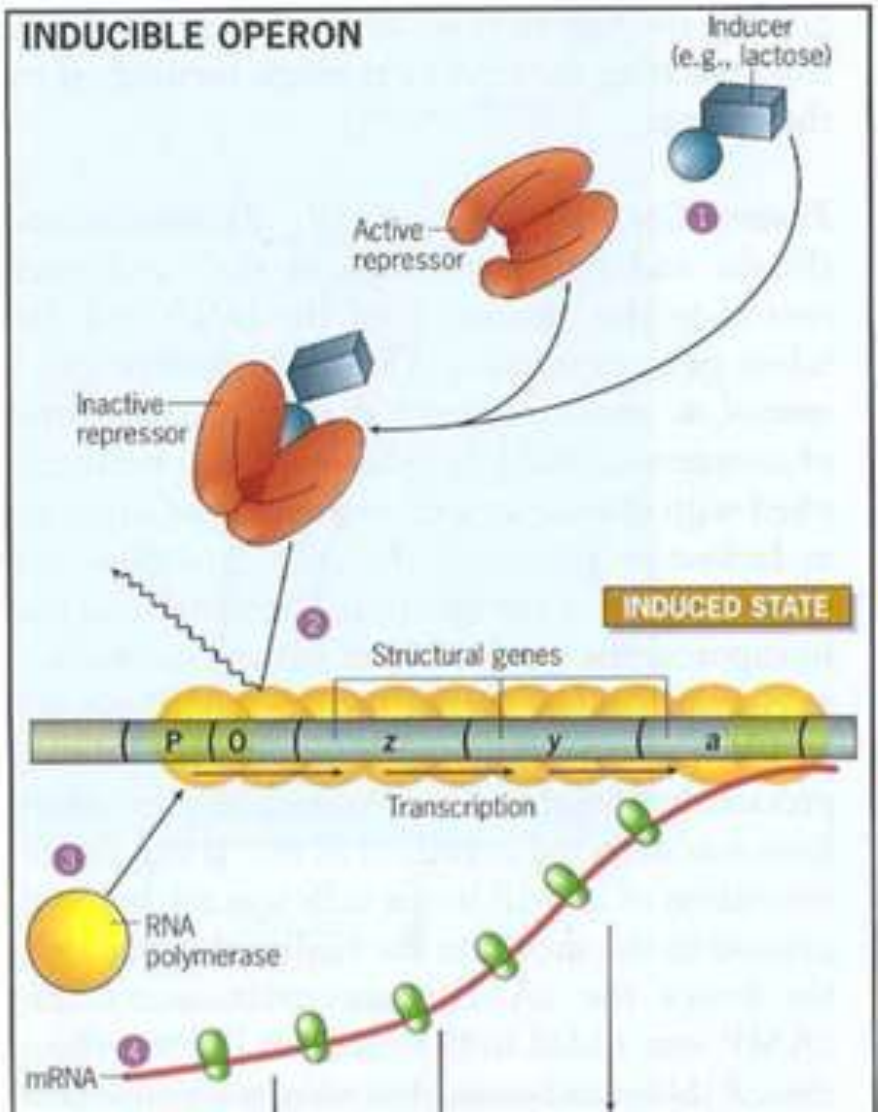
Corepressor

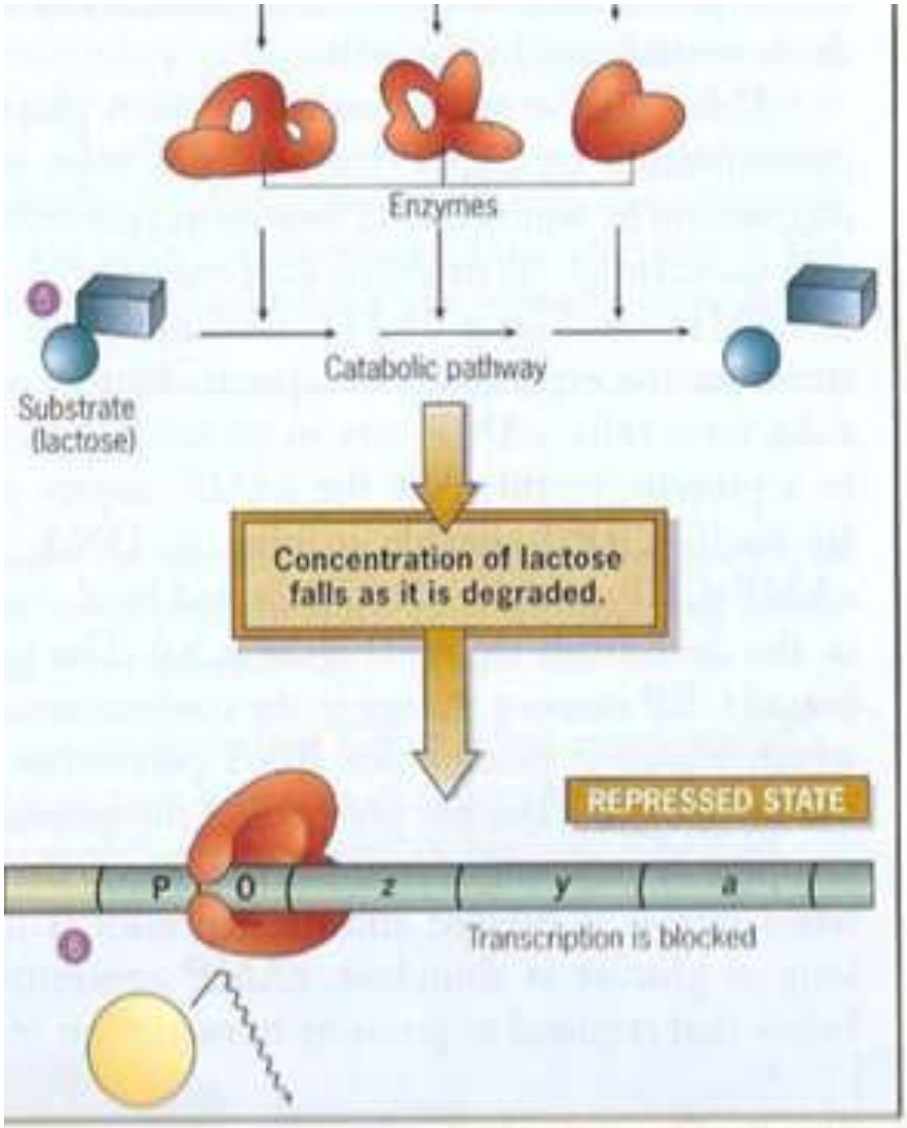
Corepressor is a substance that inhibits the expression of genes



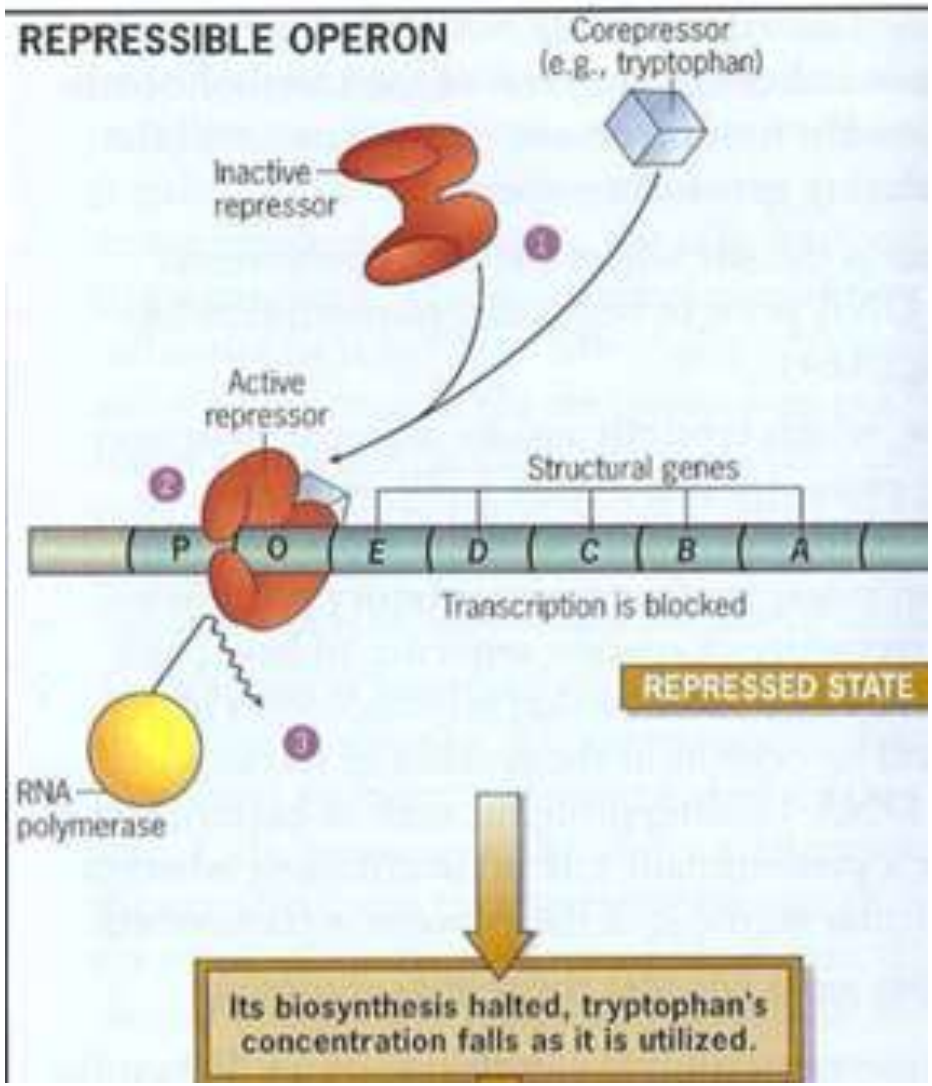
Repressor proteins can be DNA- or RNA-binding: DNA-binding **repressors** - block the binding of RNA polymerase to the promoter

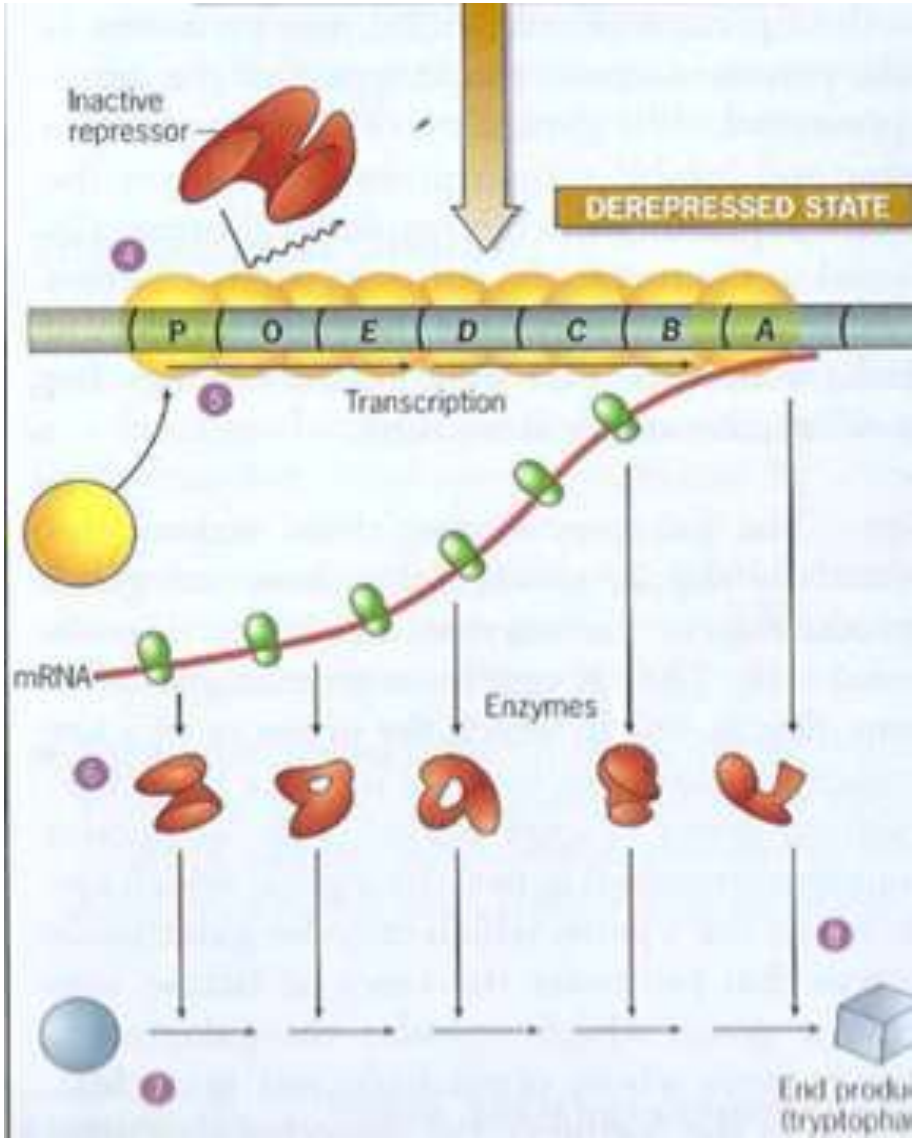
Inducible operon(lac)





repressible operon(trp)

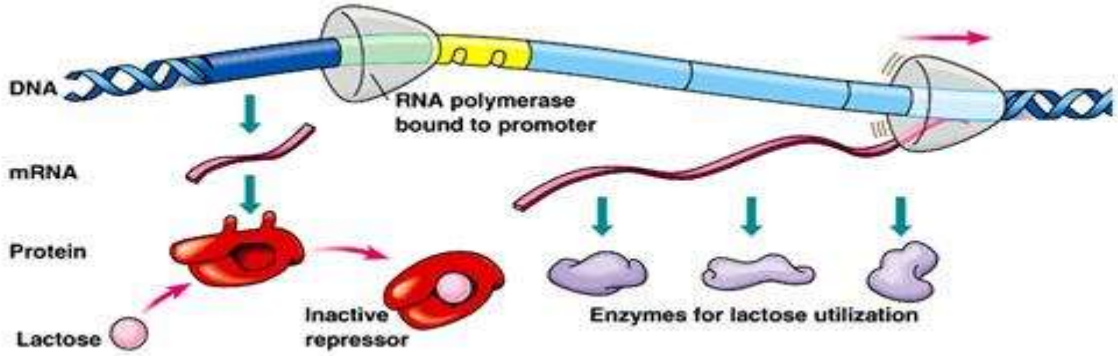




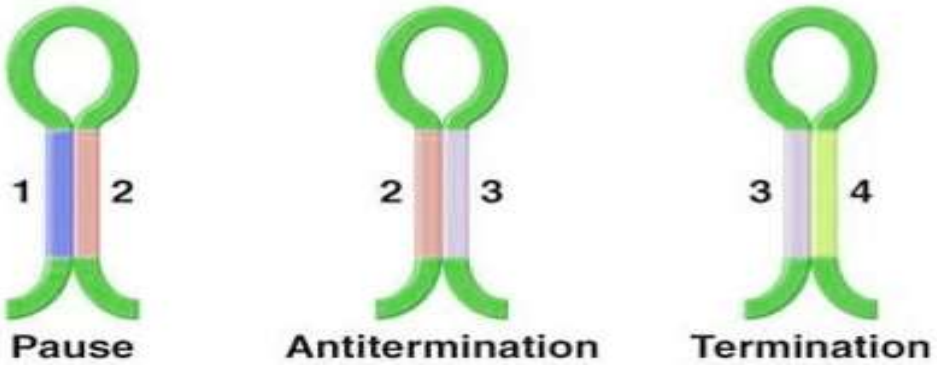
Regulation – trp operon

The **trp operon** is controlled by both

**** repressor protein binding to the operator region***

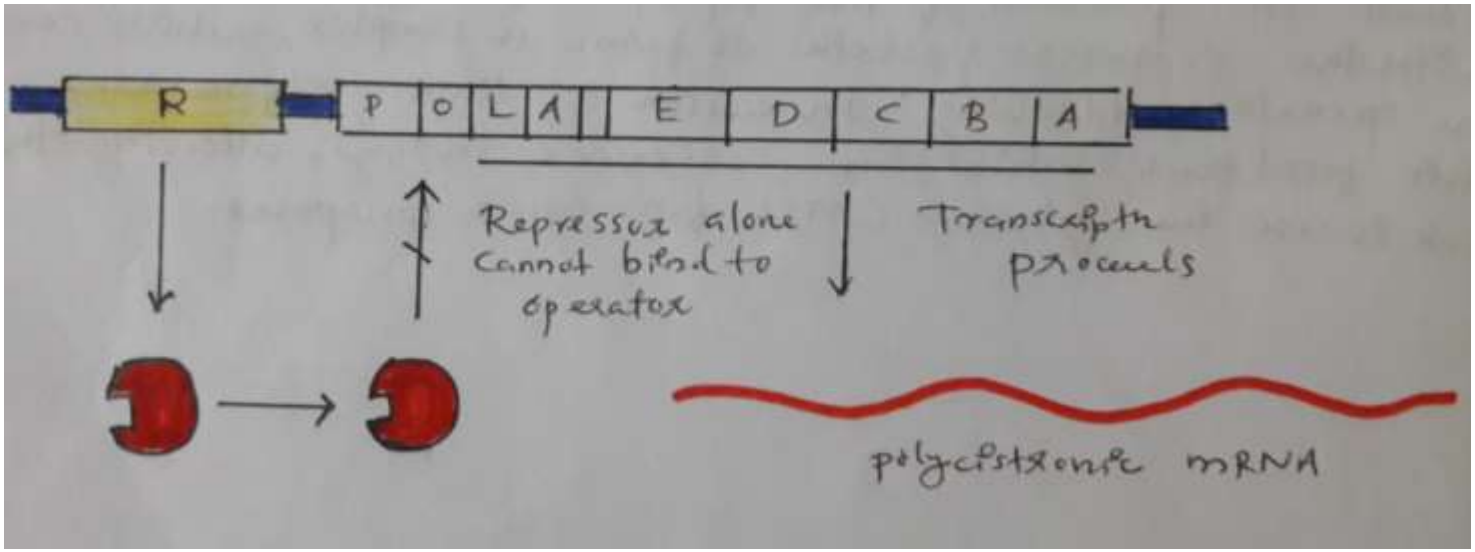


****translation-induced transcriptional attenuation***



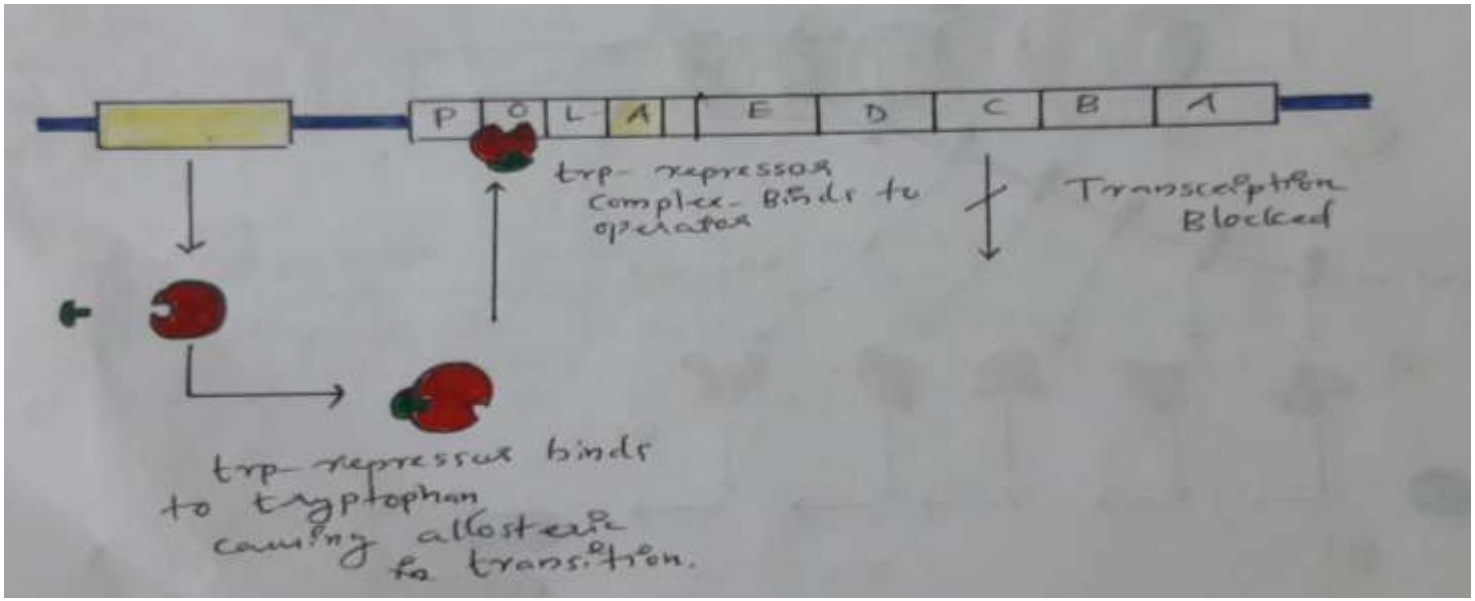
Repression

1



tryptophan* is absent in the *environment

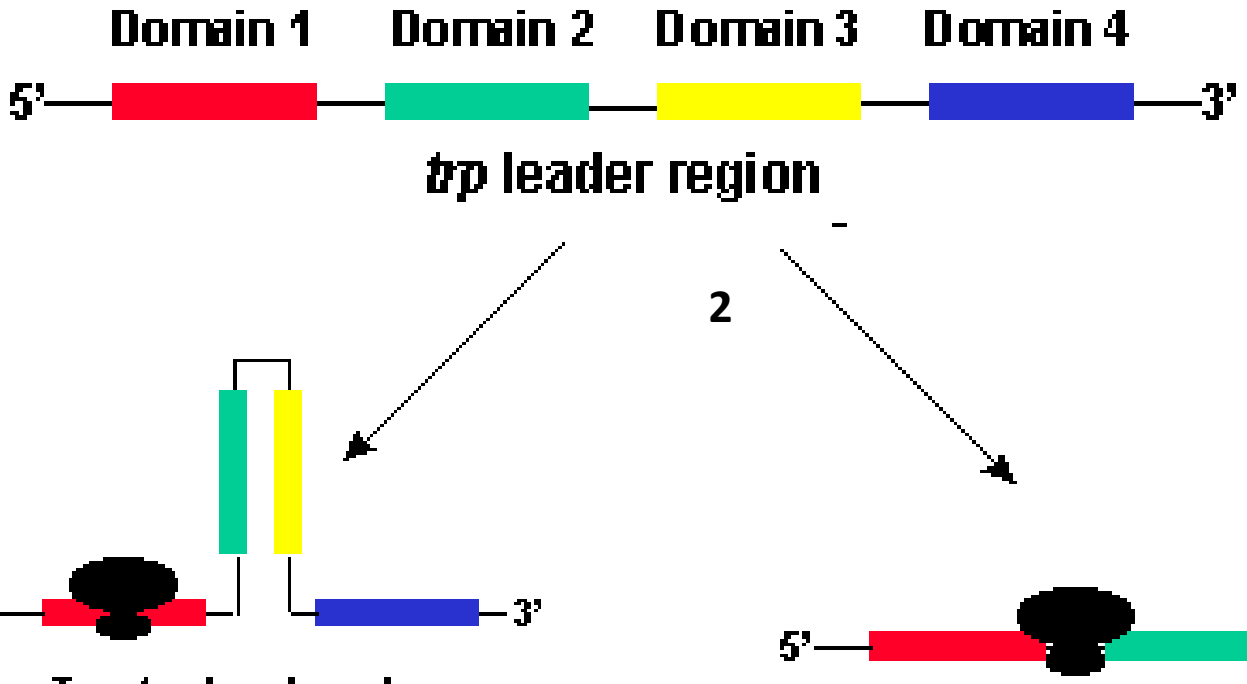
2



tryptophan* is present in the *environment

Attenuation

Transcriptional attenuation is a regulatory mechanism that causes premature termination of **transcription** under certain conditions



Low Tryptophan Levels

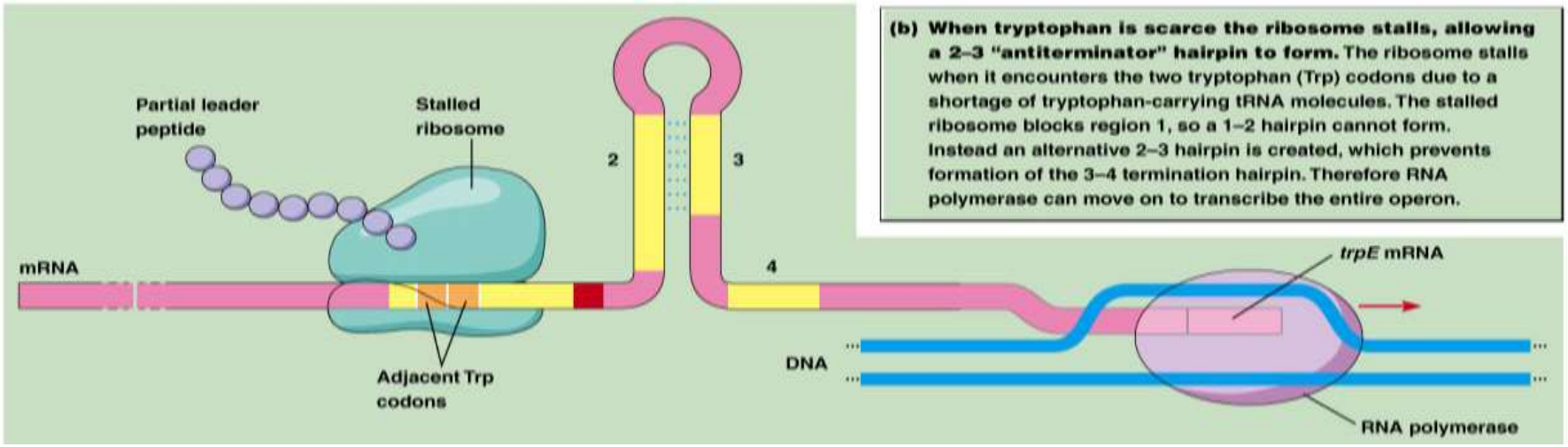
- Slow translation of Domain 1 peptide
- Domain 2-3 pairing occurs
- Normal full gene transcription

High Tryptophan Levels

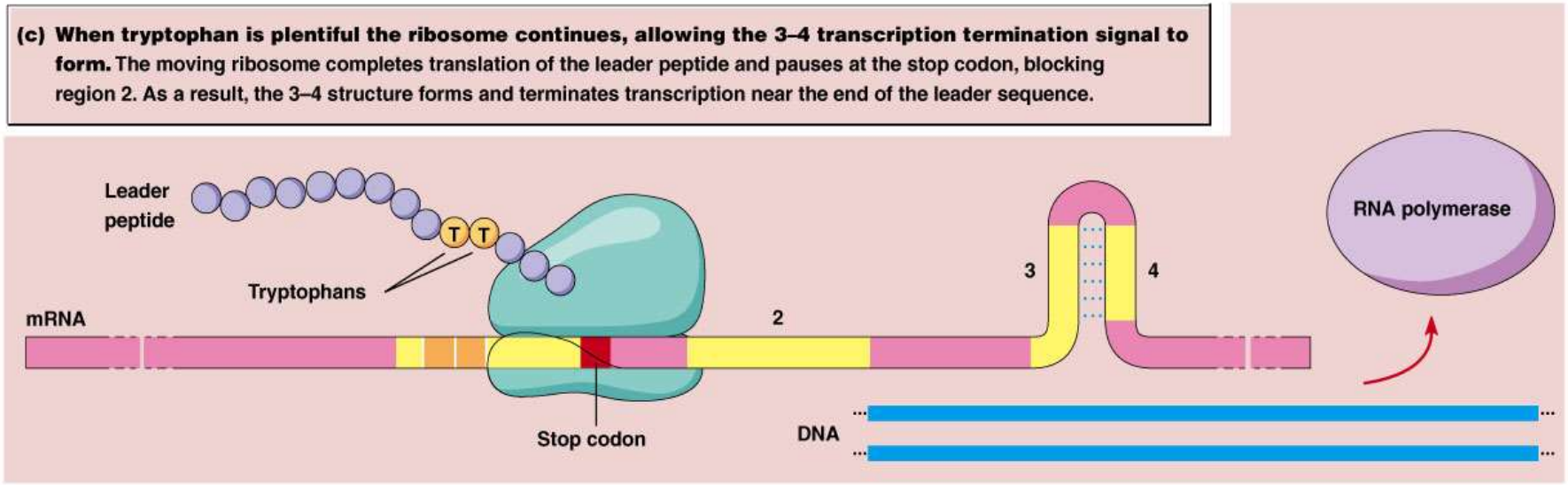
- Fast translation of domain 1 peptide
- Domain 2 blocked by ribosome
- Domain 3-4 pairing occurs
- Attentuation of transcription occurs
- Only 10% of normal mRNAs made

Attenuation loops

anti-termination hairpin

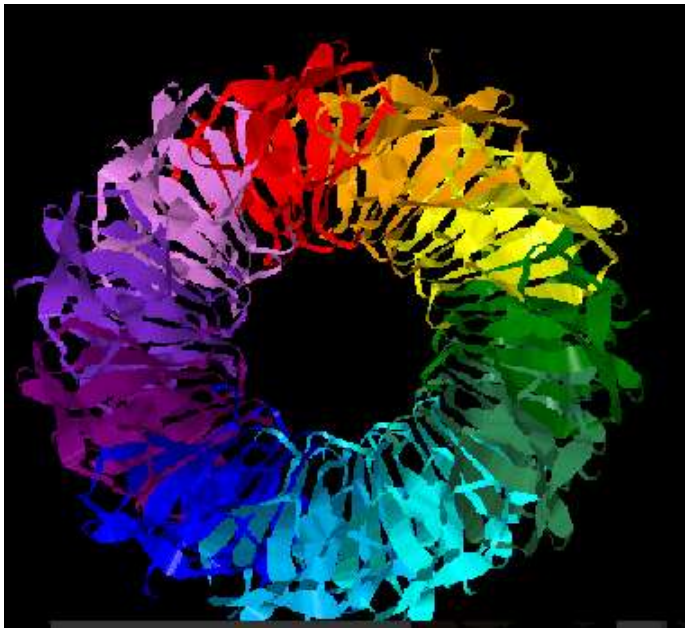


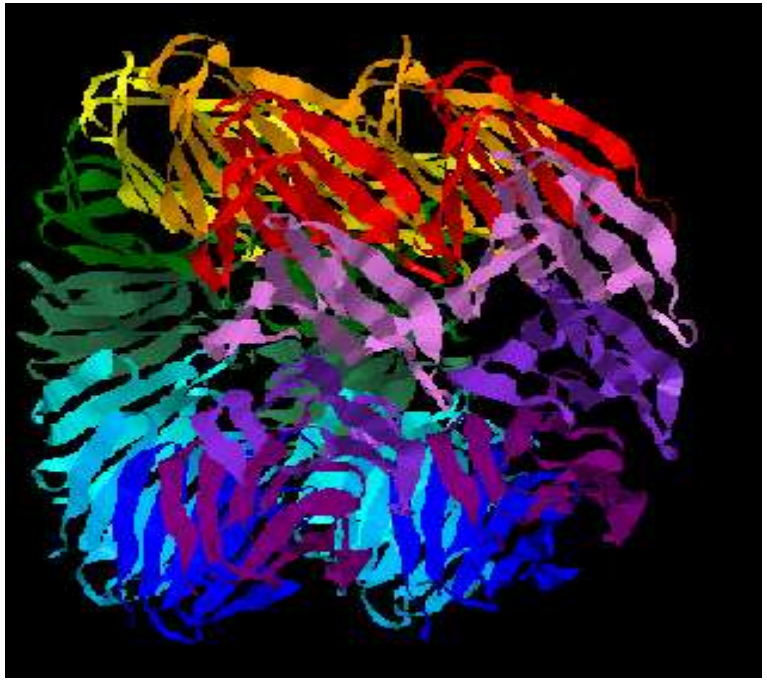
termination hairpin

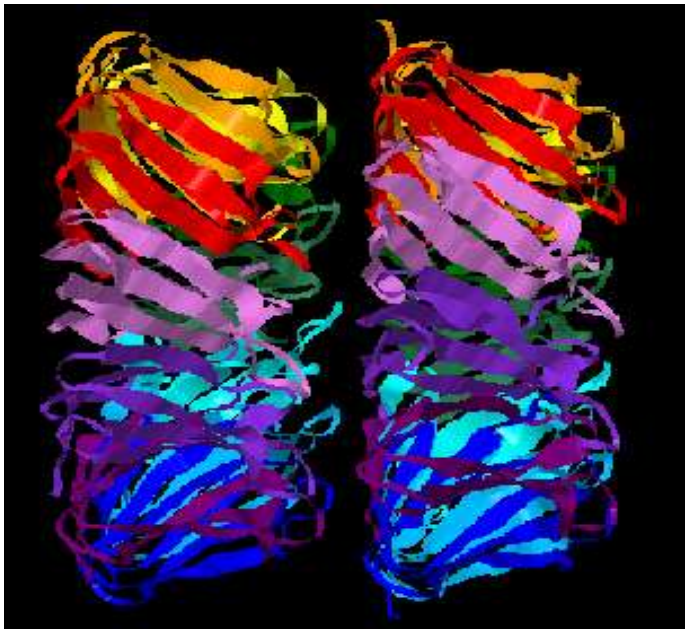


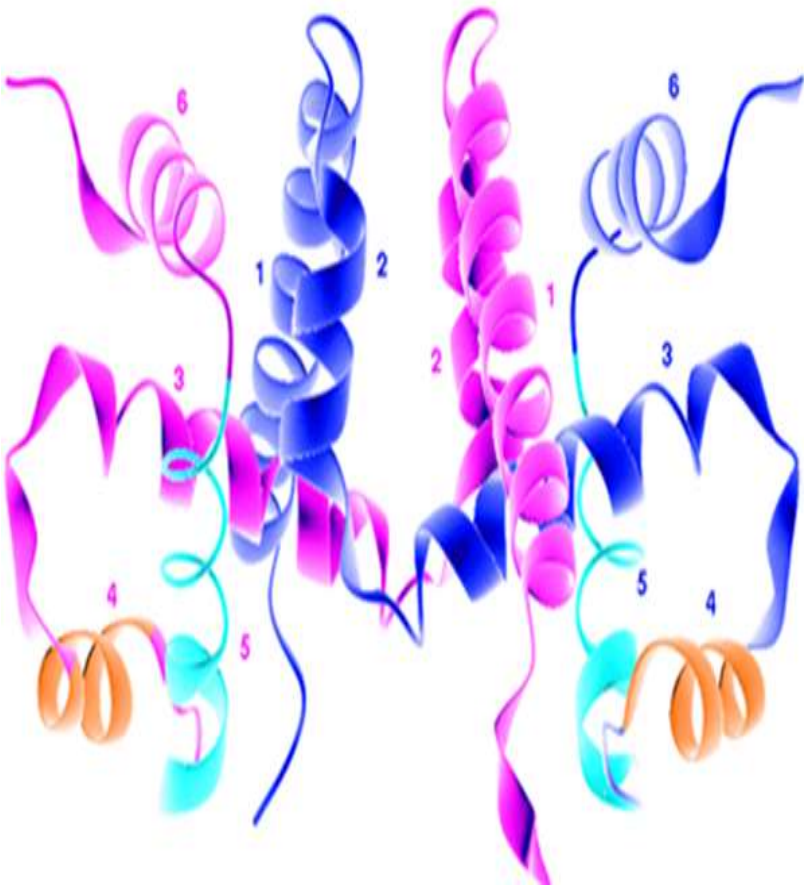
TRAP

tryptophan mediates transcription and translation of the genes responsible for its biosynthesis. Tryptophan accomplishes this through interactions with a regulatory protein known as tryptophan-activated RNA binding attenuation protein (TRAP).

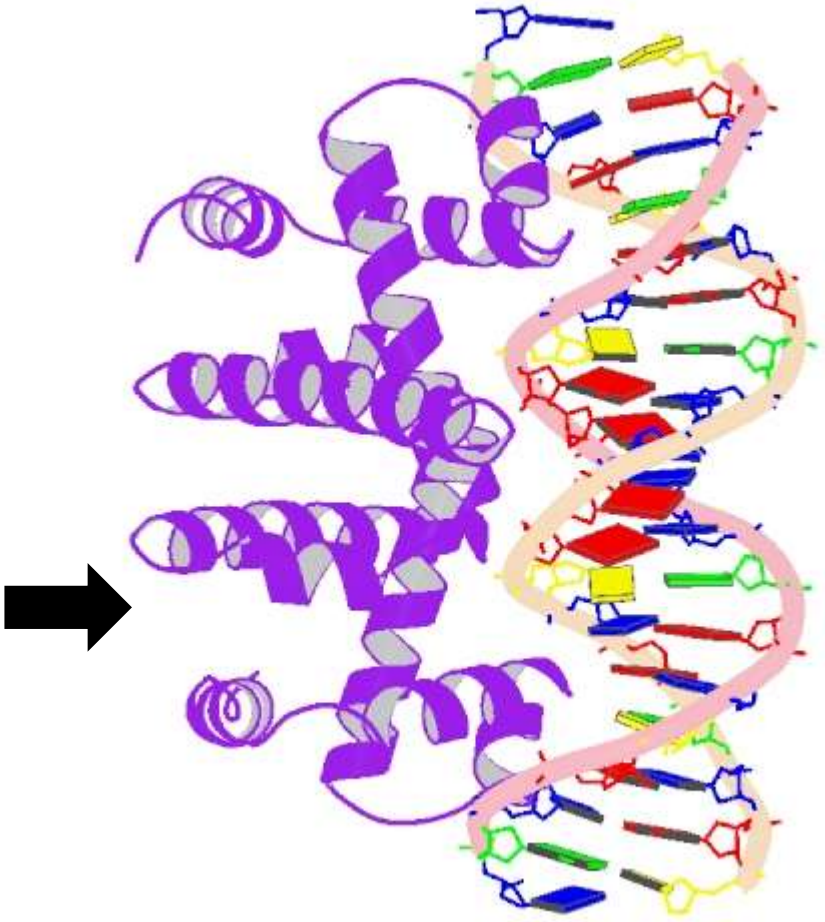








Trp-repressor dimer



Trp -repressor binding to operator DNA

Thank you.