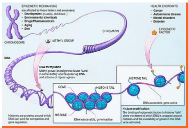
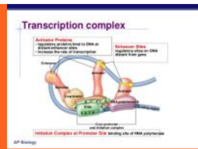
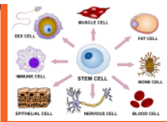
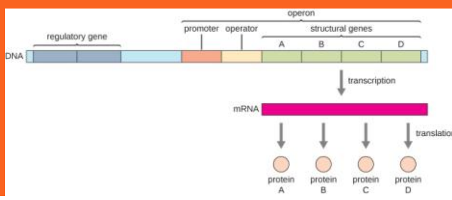




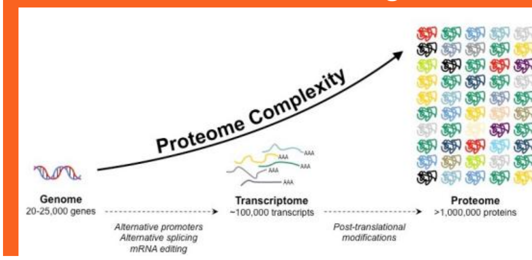


6.5 Regulation of Gene Expression



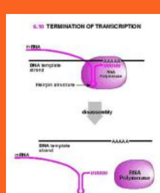
ENDURING UNDERSTANDING

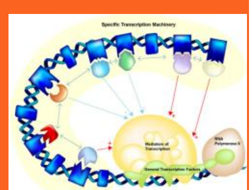
IST-2 Differences in the expression of genes account for some of the phenotypic differences between organisms.



IST-2.A Describe the types of interactions that regulate gene expression

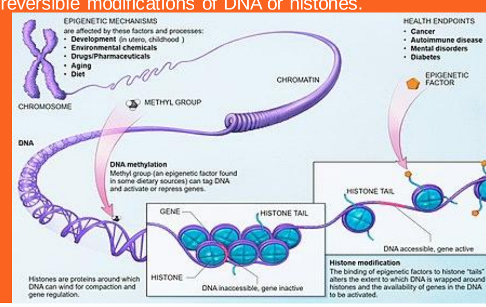
- Regulatory sequences are stretches of DNA that interact with regulatory proteins to control transcription
  - Promoters
  - Terminators
  - Enhancers





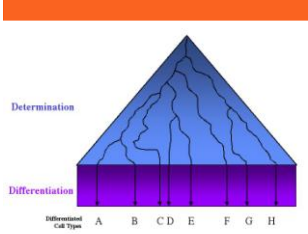
IST-2.A Describe the types of interactions that regulate gene expression

- Epigenetic changes can affect gene expression through reversible modifications of DNA or histones.



IST-2.A Describe the types of interactions that regulate gene expression

- The phenotype of a cell or organism is determined by the combination of genes that are expressed and the levels at which they are expressed



CELL DETERMINATION VERSUS CELL DIFFERENTIATION

CELL DETERMINATION	CELL DIFFERENTIATION
Process by which portions of the genome are selected for expression in different embryonic cells	Process by which a cell becomes specialized in order to perform a specific function
Occurs in totipotent, embryonic stem cells	Follows cell determination
A result of asymmetric segregation of cytoplasmic determinants	A result of differential gene expression
Responsible for assigning the fate of the cells	Responsible for the functional specialization of the cells

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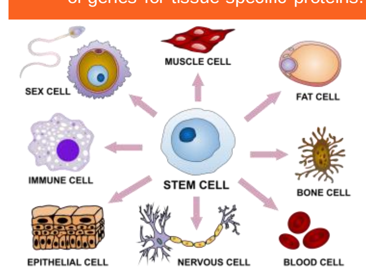
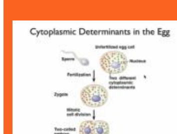
IST-2.A Describe the types of interactions that regulate gene expression

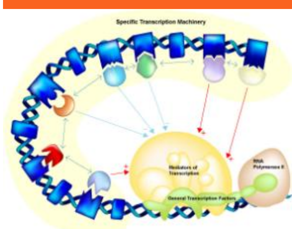
- Observable cell differentiation results from the expression of genes for tissue specific proteins.

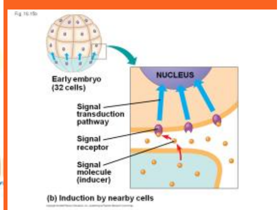




IST-2.A Describe the types of interactions that regulate gene expression

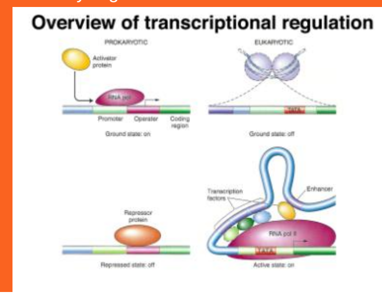
- Induction of transcription factors during development results in sequential gene expression.





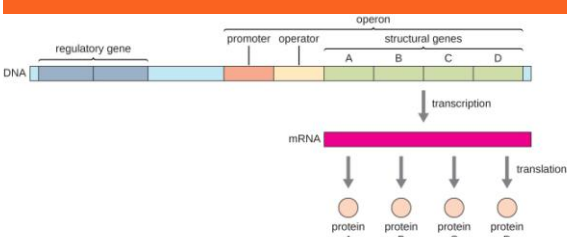
IST-2.B Explain how the location of regulatory sequences relates to their function.

- Both prokaryotes and eukaryotes have groups of genes that are coordinately regulated



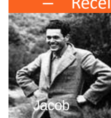
IST-2.B Explain how the location of regulatory sequences relates to their function.

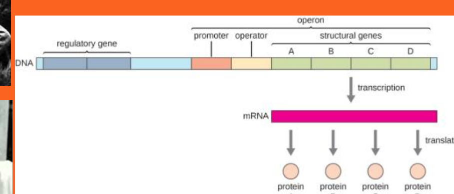
- In prokaryotes, groups of genes called operons are transcribed in a single mRNA molecule.



Operon Model

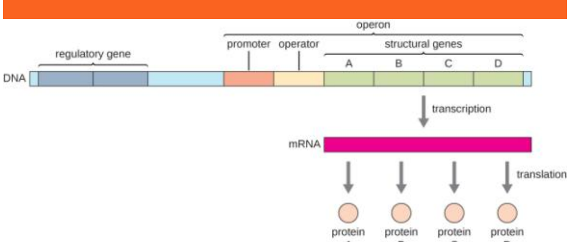
- Francis Jacob and Jacques Monod (1961)
- Model explains regulation of gene expression in prokaryotes
- Received a Nobel prize for this.





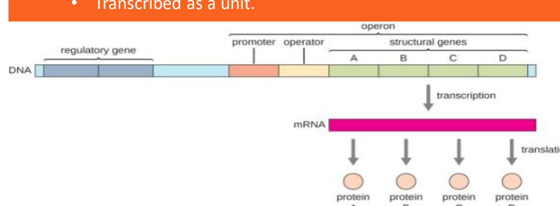
Operon Model

- Genes that function as a single unit
- Regulatory gene codes for a repressor protein molecule.
- Promotor- sequence of DNA where RNA polymerase attaches

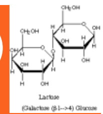


Operon Model

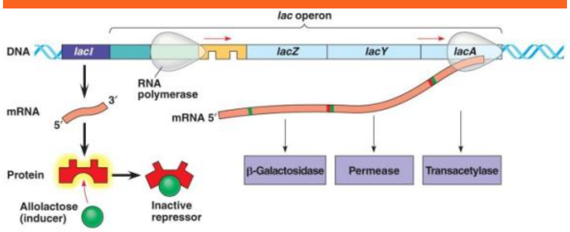
- Operator
  - Sequence of DNA where repressor can bind
  - Prevents RNA polymerase from attaching to the promotor.
- Structural genes
  - Code enzymes of a metabolic pathway
  - Transcribed as a unit.



The lac Operon (inducible)

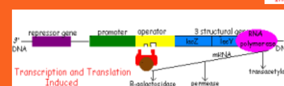


- E. coli produces three enzymes to metabolize lactose.
- The regulatory gene codes for a lac operon repressor protein
- Repressor binds to the operator and prevents transcription of the three genes.



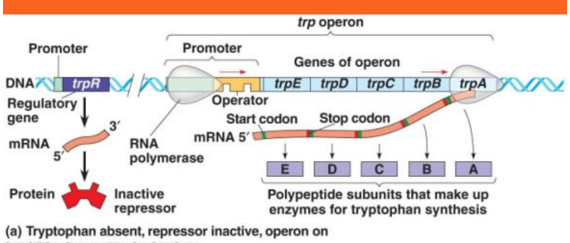
The lac Operon (inducible)

- Lactose binds to the repressor
- Prevents repressor from binding to the operator.
- RNA polymerase is able to bind to promoter
- Induces transcription of the three structural genes.



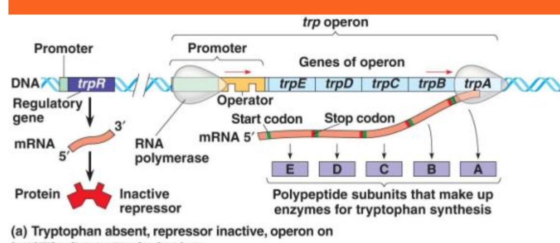
The trp Operon (repressible)

- E. coli produces five enzymes to synthesize the amino acid tryptophan.
- Regulatory gene codes for a repressor that is unable to attach to the operator.
- Operon is able to make tryptophan.



The trp Operon (repressible)

- The repressor has a binding site for tryptophan.
- If tryptophan is present, it binds to the repressor.
- Repressor now binds to the operator stopping tryptophan production.



IST-2.B Explain how the location of regulatory sequences relates to their function.

- In eukaryotes, groups of genes may be influenced by the same transcription factors to coordinately regulate expression.