DNA AND RNA

CH 12

12-1 EARLY EXPERIMENTS-TRANSFORMATION

1928

Griffith was trying to figure out what was causing pneumonia

He took heat treated bacteria that could cause the disease and mixed with bacteria that did not cause pneumonia

Neither should cause disease but they did

Concluded the dead disease bacteria transferred some substance to the non-disease causing bacteria that transformed it into a disease causing bacteria

Transformation

12-1 EARLY EXPERIMENTS-TRANSFORMATION

1944

Aver y repeated Griffith's experiment but first treated the heat killed disease causing bacteria with enzymes that broke down all proteins, carbs, lipids and RNA, so only DNA was left

Still caused disease so concluded DNA was the transforming material of the gene

12-1 EARLY EXPERIMENTS-TRANSFORMATION

1952

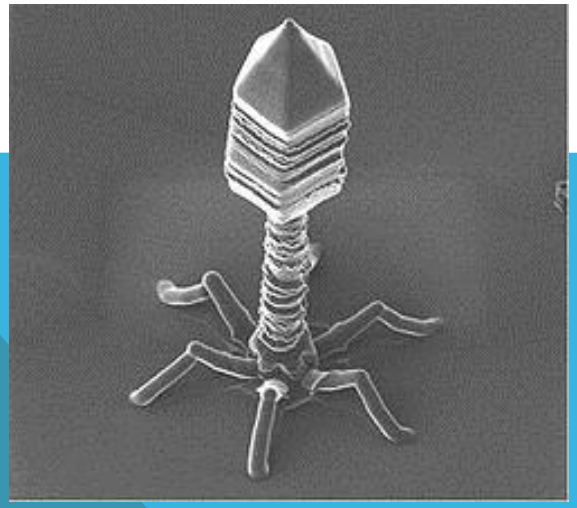
Hershey and Chase

Doubted previous experiments

Used a virus that infects bacteria-bacteriophage-made of DNA and protein

They infected bacteria with phage labelled with ^{35}S(proteins) or ^{32}P(DNA)

After virus injected its genetic material, found it was ^{32}P labelled



12-1 EARLY EXPERIMENTS-DNA STRUCTURE

1950's

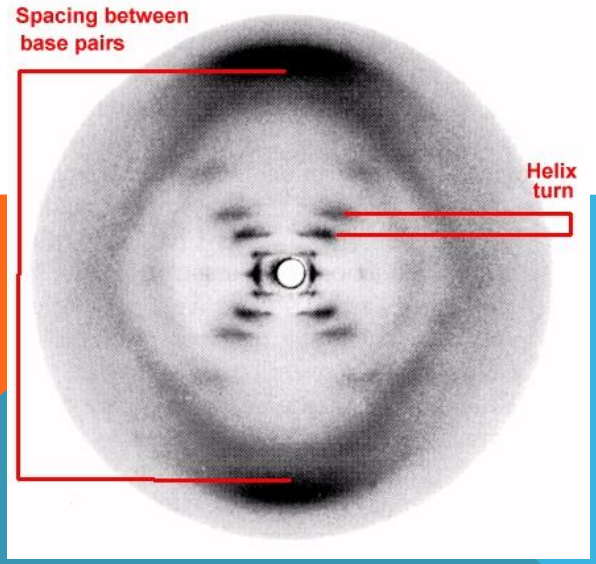
Chargaff noticed that the nucleotides A&T and C&G were always present in the same ratios to each other

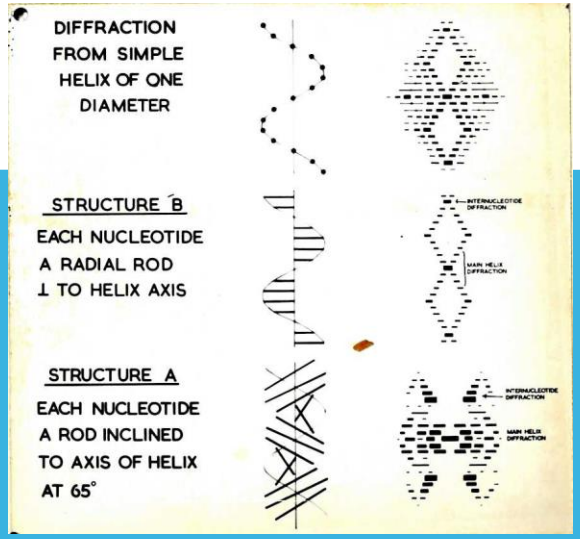
Chargaffs Rules

A=T, C=G

Rosalind Franklin used x-ray diffraction to study DNA

Her data suggested that DNA was helical, a double strand, and bases were near the center of the molecule

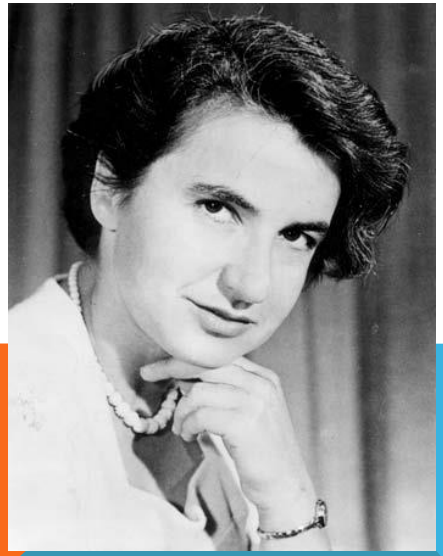




12-1 EARLY EXPERIMENTS-DNA STRUCTURE

At the same time, Watson and Crick were studying the chemical properties of DNA by building 3-D models

After seeing Franklins paper, they “solved” the structure and published “their” results



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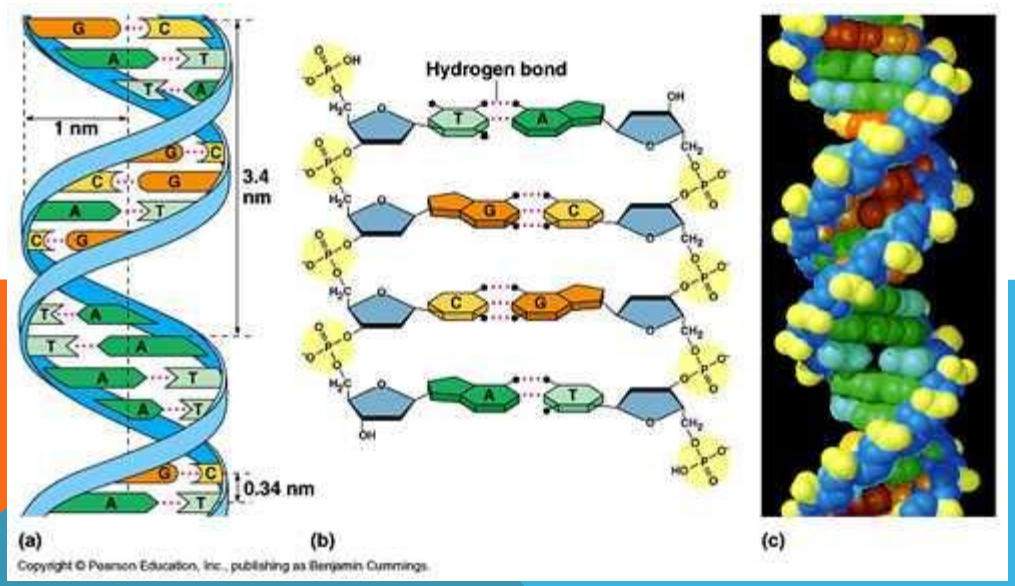


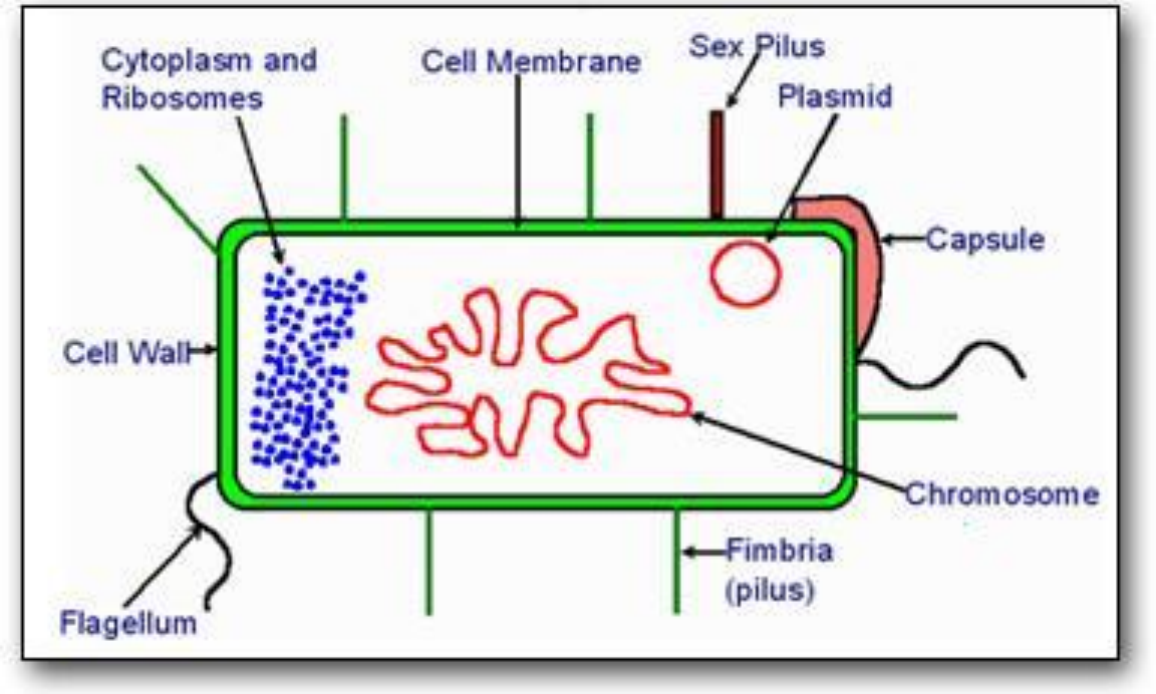
12-2 CHROMOSOMES AND DNA REPLICATION

Bacteria chromosome

4,600,000 base pairs

1.6 mm

Bacteria cell only about 1.6 µm!



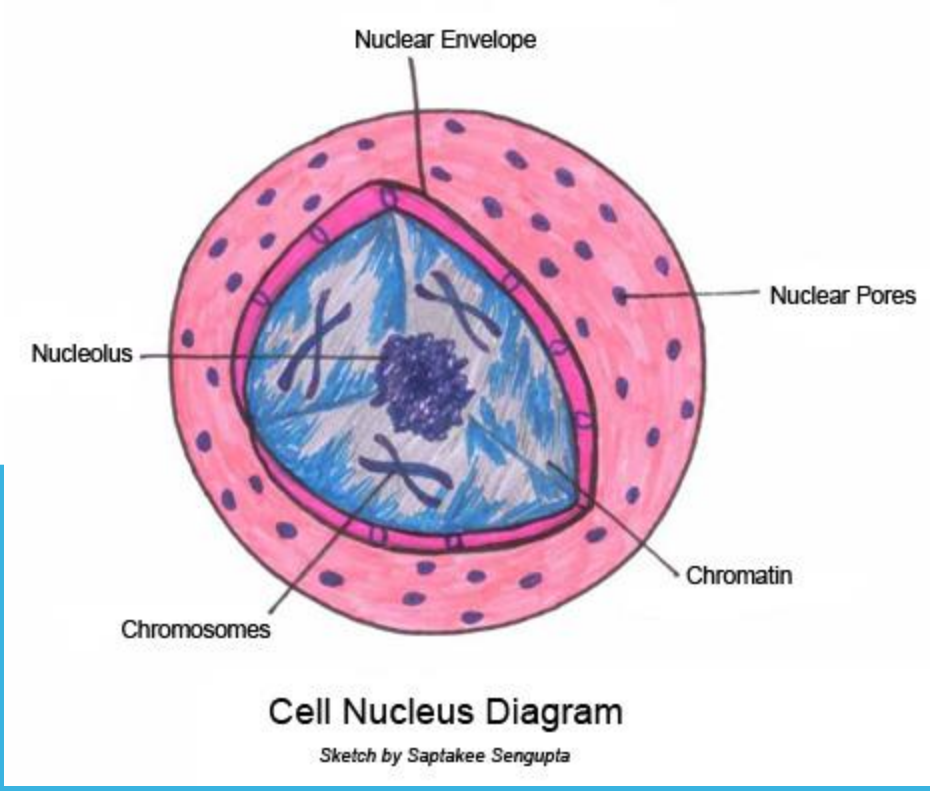
12-2 CHROMOSOMES AND DNA REPLICATION

Eukaryotic DNA

1000x as much as bacteria cell

1 meter in length

Packed around histones into nucleosomes, then into chromatin



12-2 CHROMOSOMES AND DNA REPLICATION

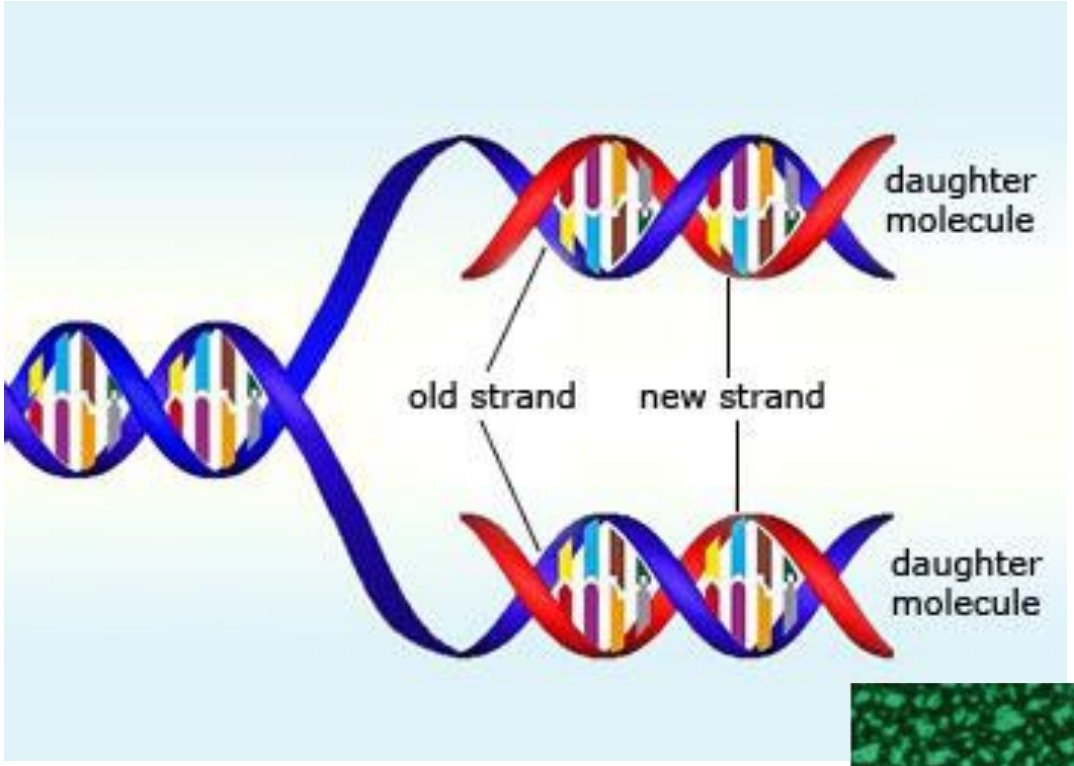
During DNA replication the two strands are separated and each strand is copied

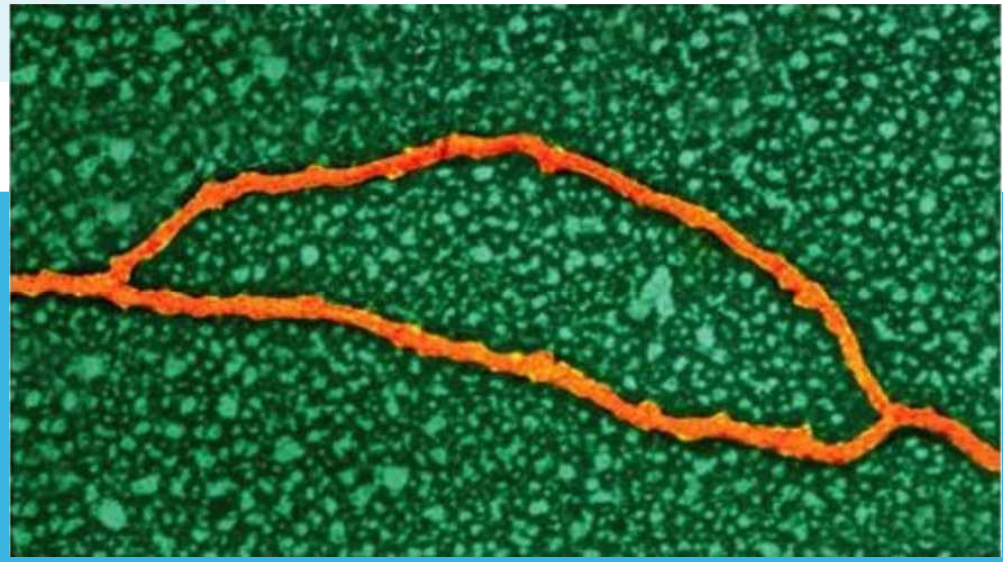
New strands are complementary to old strands

Each new molecule has 1 old strand and 1 new strand- Semiconservative replication

DNA polymerase is the enzyme that replicates DNA

12-2 CHROMOSOMES AND DNA REPLICATION





12-2 CHROMOSOMES AND DNA REPLICATION

https://www.youtube.com/watch?v=27TxKoFU2Nw

12-3 RNA AND PROTEIN SYNTHESIS

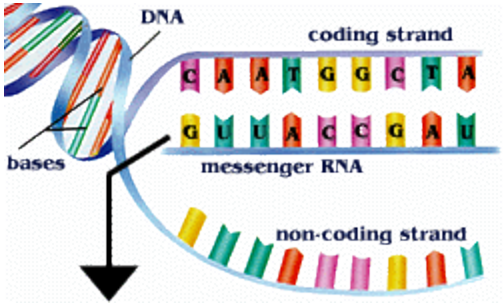
DNA →mRNA →Protein

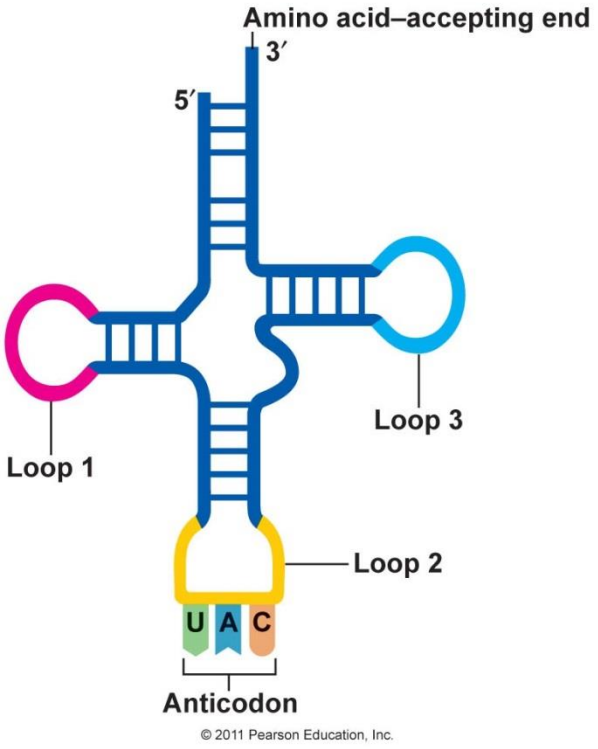
Three types of RNA

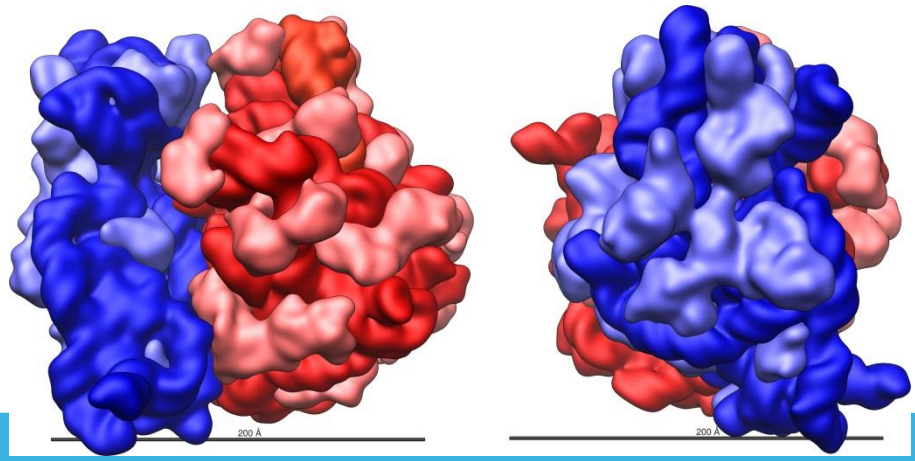
Messenger RNA-mRMA

Ribosomal RNA-rRNA

Transfer RNA-tRNA







12-3 RNA AND PROTEIN SYNTHESIS

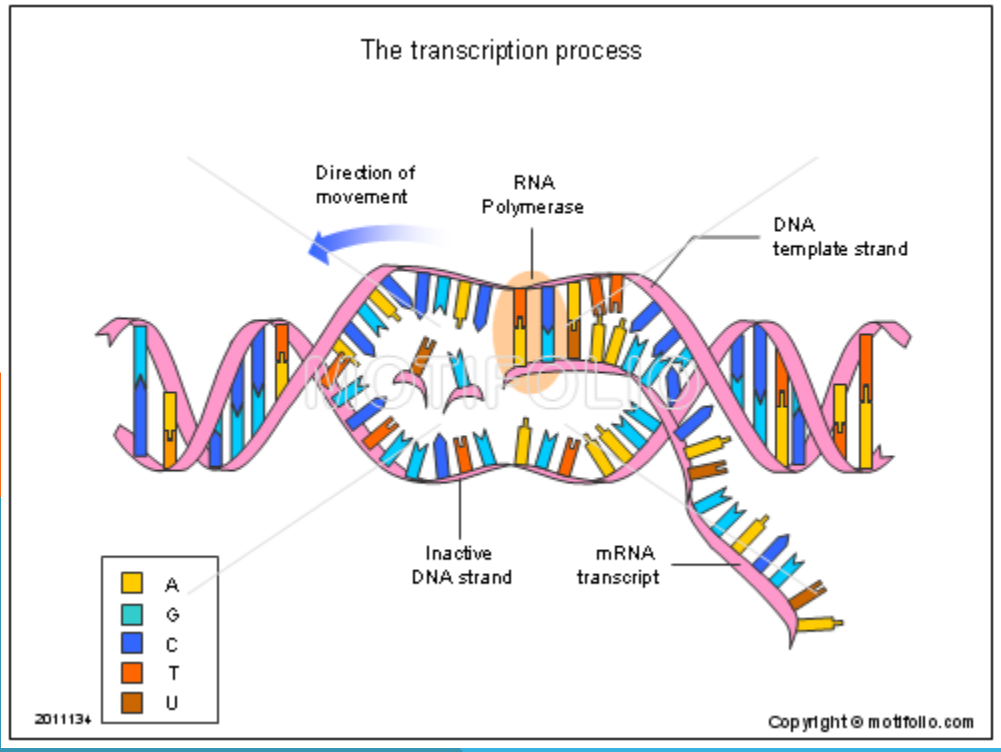
Transcription-mRNA copy of DNA

Complementary to DNA

RNA polymerase

mRNA-Uracil(U) instead of thymine (T)

RNA binds to regions of DNA near or within the gene-promoters

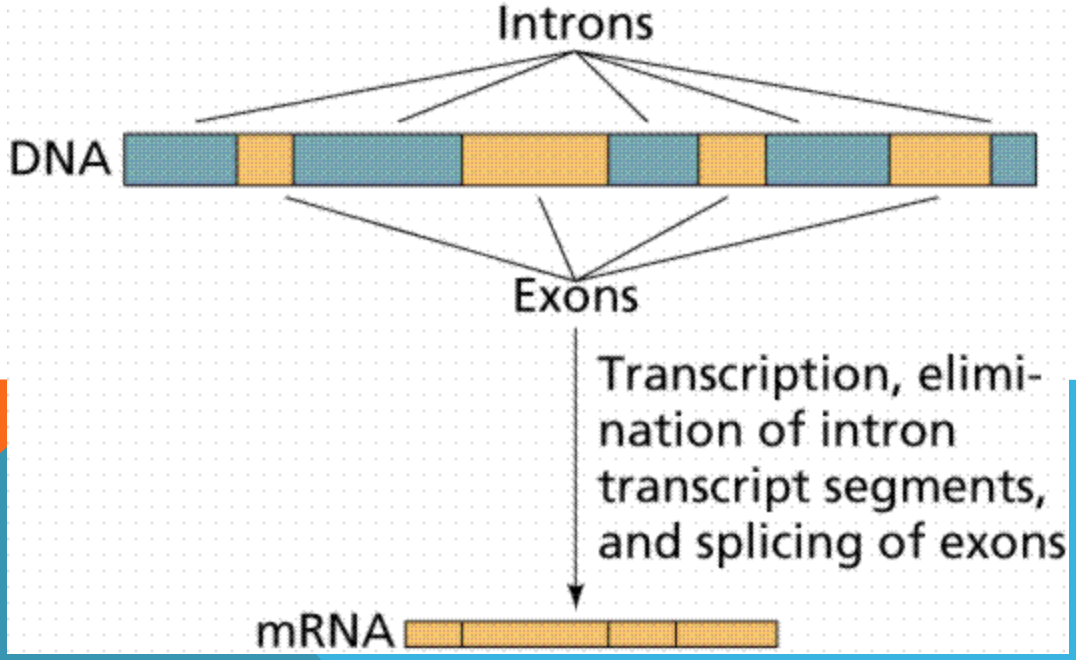


12-3 RNA AND PROTEIN SYNTHESIS

mRNA is edited after transcription

Introns are cut out, exons are used to make the final mRNA

Purpose of introns not understood-regulation of transcription (gene expression), evolutionary advantage, may allow RNA to be spliced in different ways in different tissues



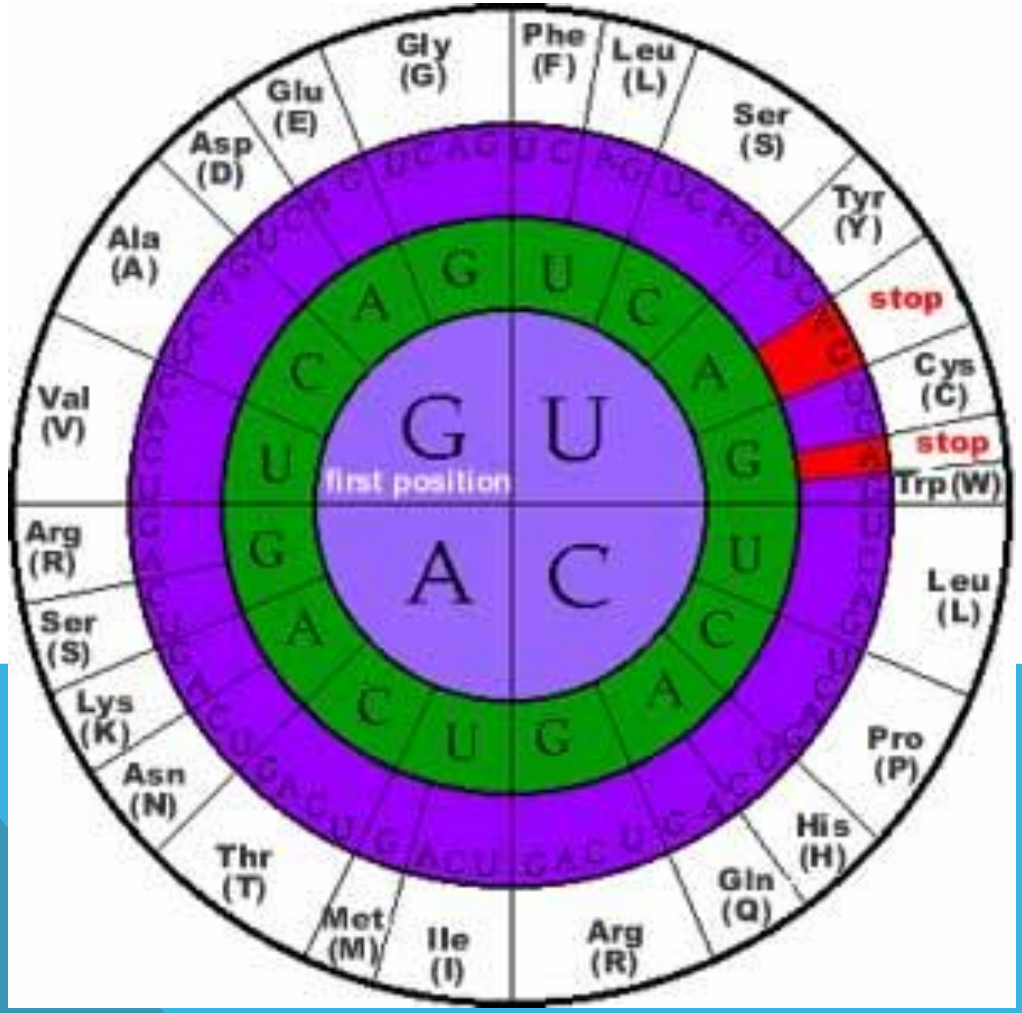
12-3 RNA AND PROTEIN SYNTHESIS

The genetic code

Three bases (codon) codes an amino acid

UCGCACGGU

Ser-His-Gly



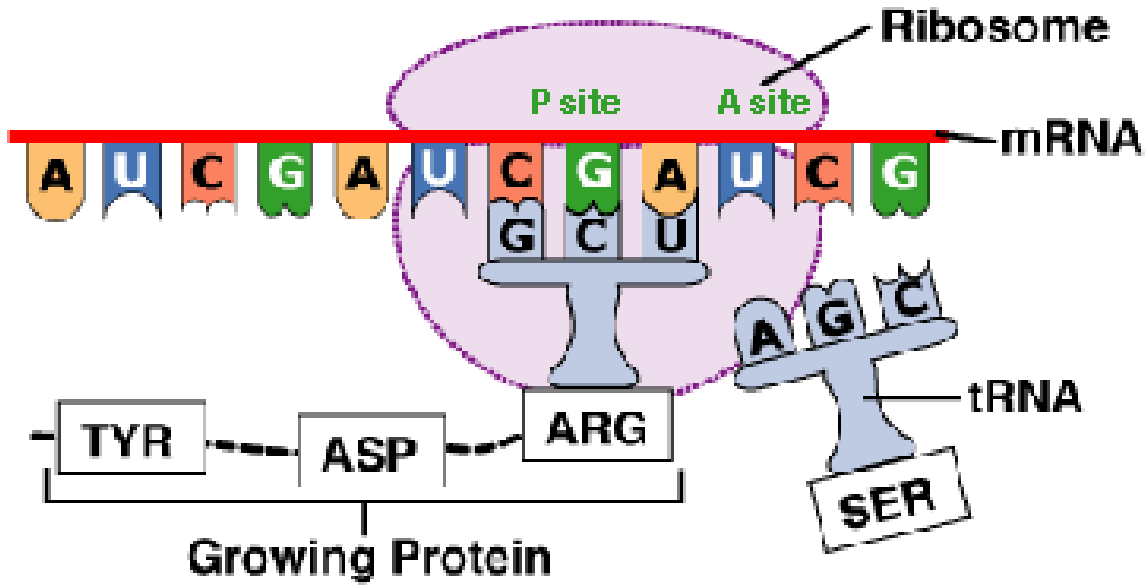
12-3 RNA AND PROTEIN SYNTHESIS

Translation

mRNA is made into protein on the ribosomes

tRNA anticodon is complementary to the mRNA codon

Amino acid end accepts amino acid that matches the codon



12-3 RNA AND PROTEIN SYNTHESIS

Transcription

http://www.dnalc.org/resources/3d/13-transcription-advanced.html

Translation

http://www.hhmi.org/biointeractive/translation-basic-detail

12-4 MUTATIONS

Gene mutation-changes of DNA sequence in a single gene

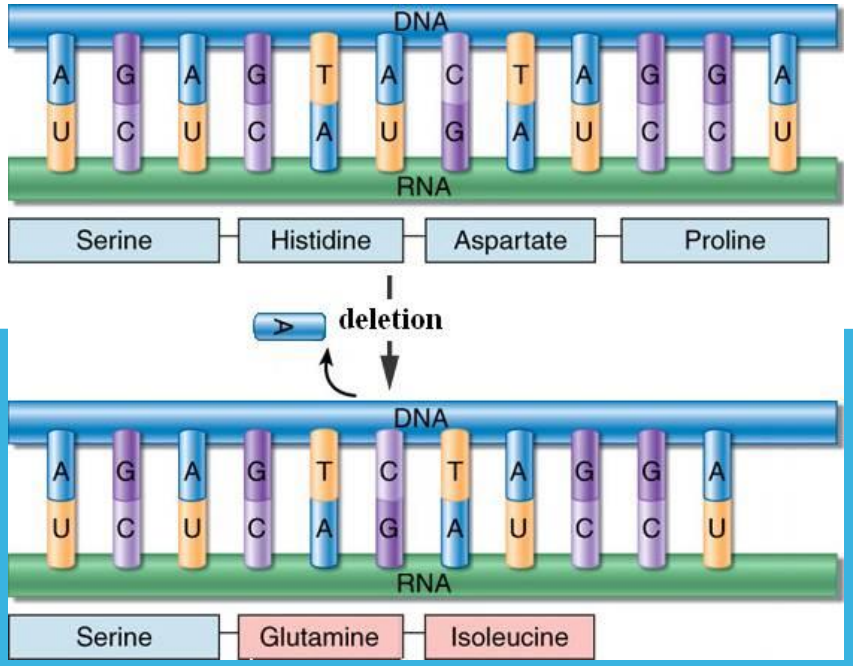
Gene mutations

Point mutations-single nucleotide

Frameshift mutation-inserted or deleted bas that chabnes the reading frame of the codons

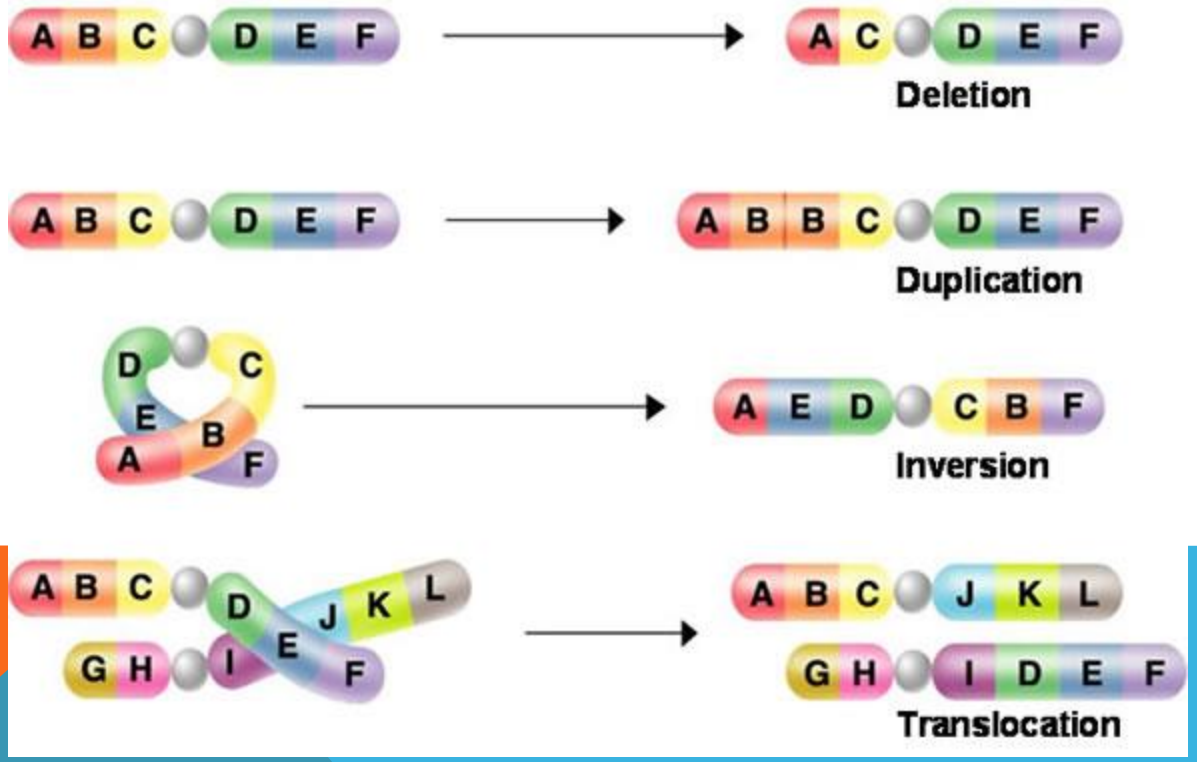
	No mutation	Point mutations			
		Silent	Nonsense	Missense	
				conservative	non-conservative
DNA level	TTC	TTT	ATC	TCC	TGC
mRNA level	AAG	AAA	UAG	AGG	ACG
protein level	Lys	Lys	STOP	Arg	Thr

basic
polar



12-4 MUTATIONS

Chromosome mutation-DNA changes that affect multiple genes in a region of a chromosome

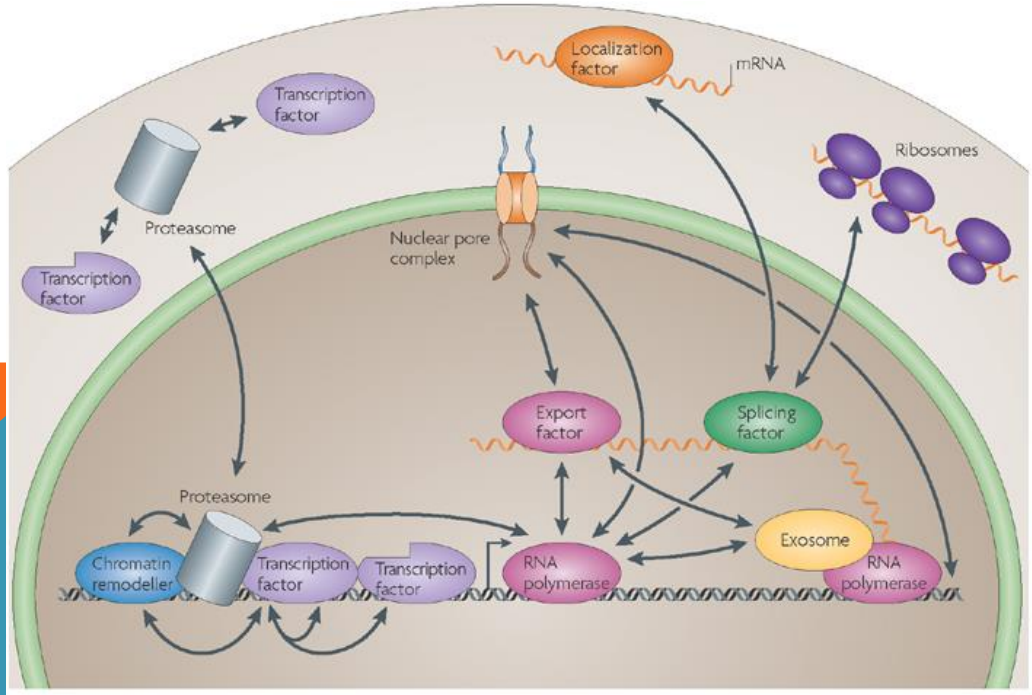


12-5 GENE REGULATION

Only a fraction of genes are transcribed and translated (expressed) at any time

Gene expression is regulated and genes are expressed only when they are needed in a certain cell type

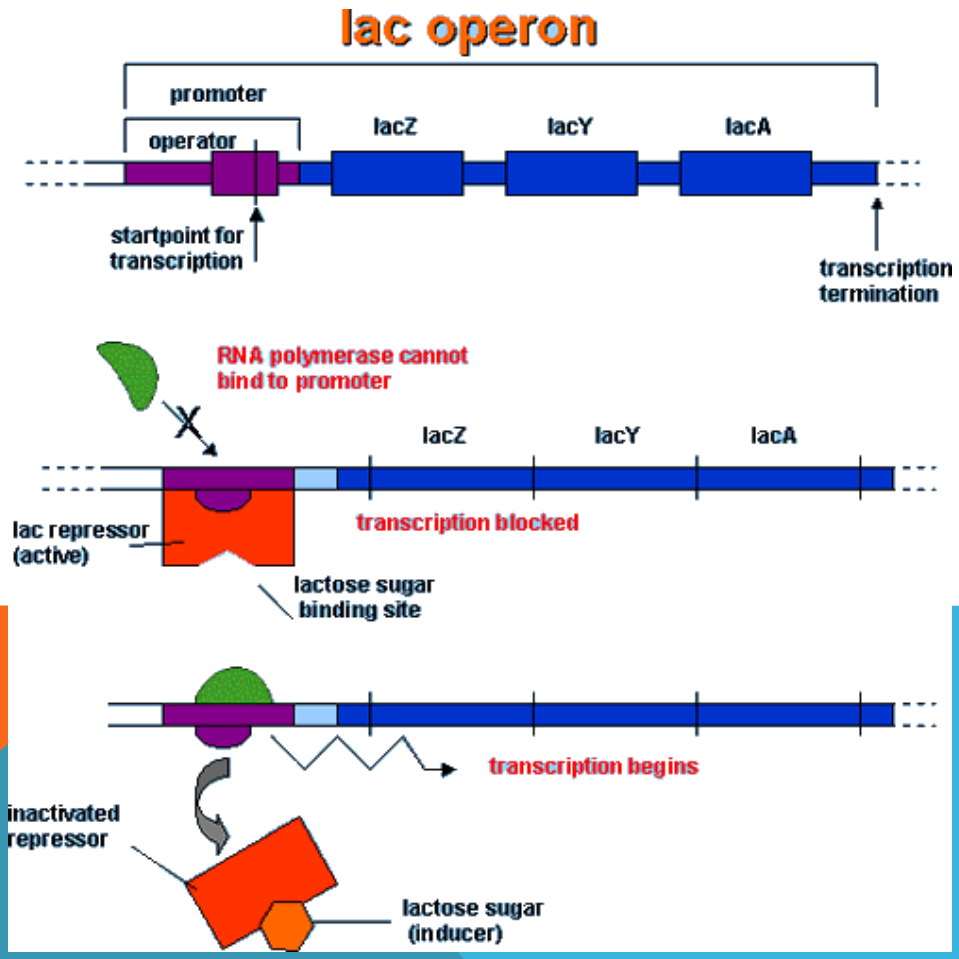
Involves promoter regions (RNA polymerase binds to them) and enhancer regions



12-5 GENE REGULATION

Genes regulated together are called operons

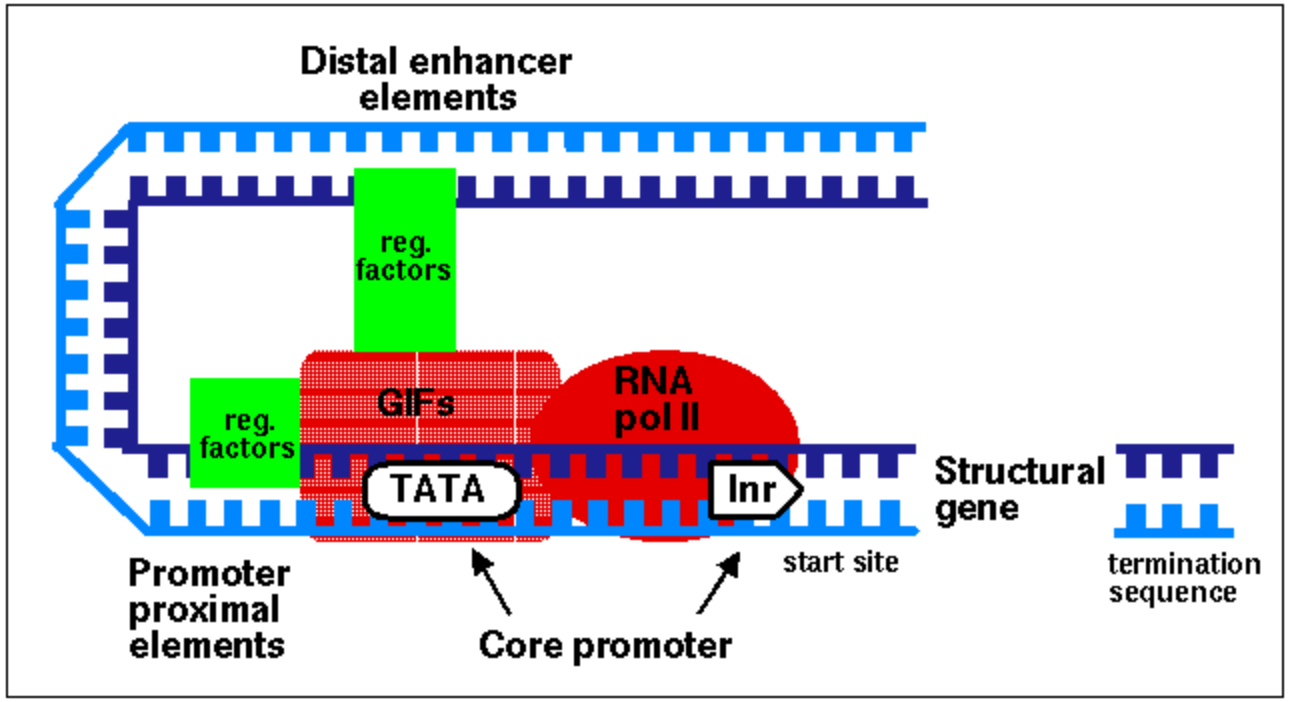
Example lac operon in E. coli



12-5 GENE REGULATION

Eukaryotic Gene Regulation

Most eukaryotic genes are controlled individually and have more complicated regulatory sequences compared to prokaryotic genes



12-5 GENE REGULATION

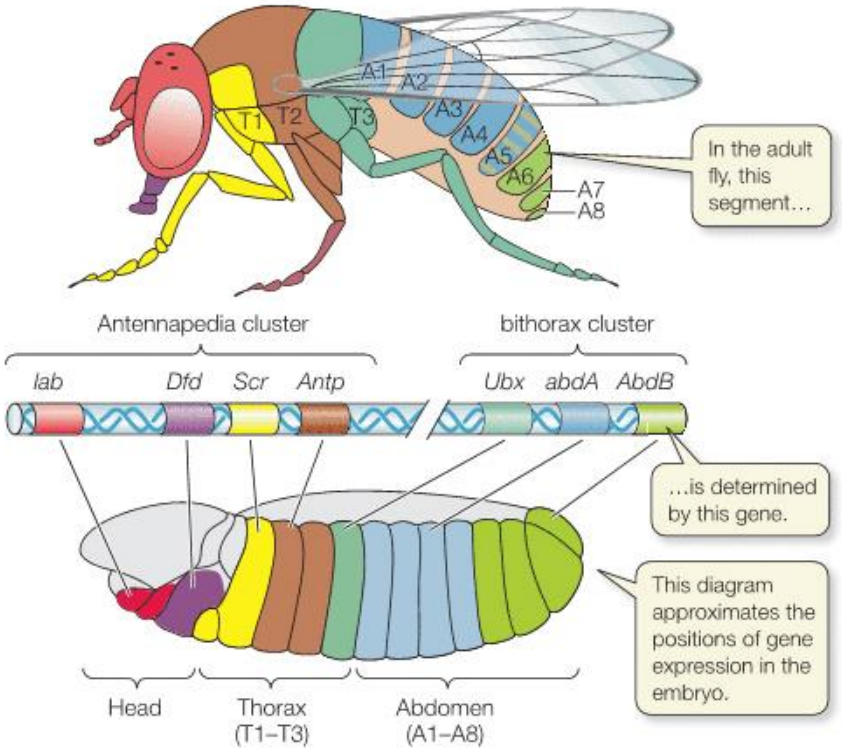
Why is gene regulation important?

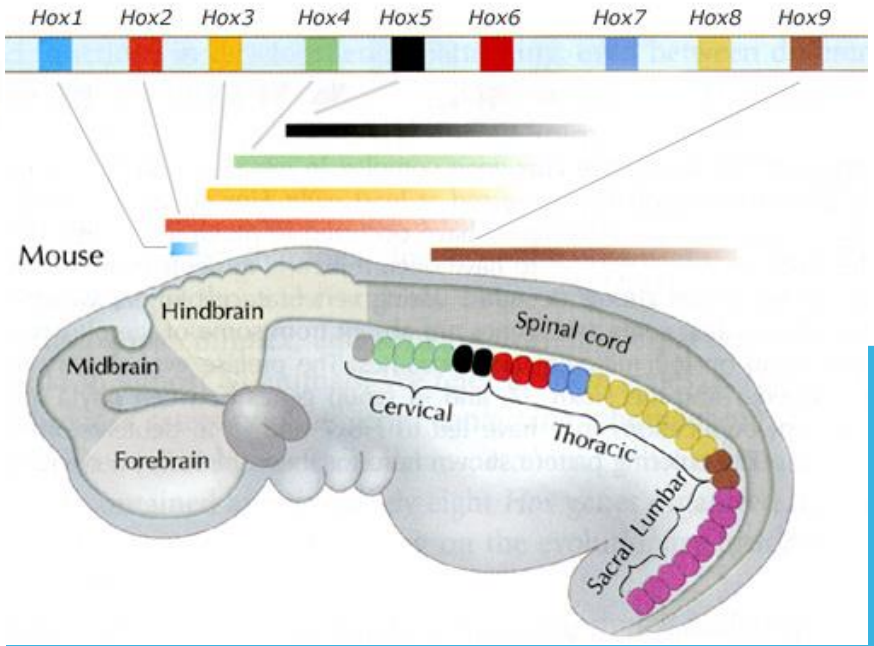
Different proteins needed in different cell types

Development of an organism from a fertilized egg

Hox genes control tissue and organ development

Similar in all organisms from flies to humans





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