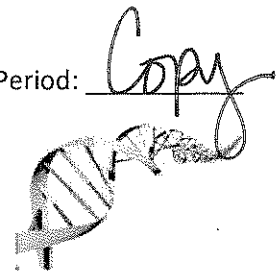


Chapter 13 Section 1: The Structure of DNA



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Define genes: THE INSTRUCTIONS FOR INHERITED TRAITS

Genes are made of small segments of DNA.

DNA is the primary material that causes recognizable, inheritable CHARACTERISTICS in related groups of organisms.

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The two scientists that pieced together the structure of DNA were JAMES WATSON and FRANCIS CRICK at CAMBRIDGE University.

A DNA molecule is shaped like a SPIRAL STAIRCASE and is composed of two parallel strands of linked SUBUNITS. This spiral shape is known as a DOUBLE HELIX.

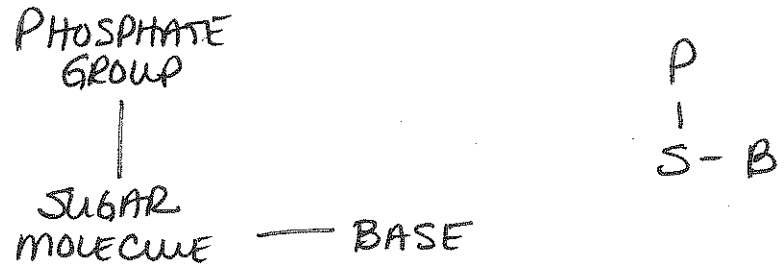
The linked subunits are called NUCLEOTIDES.

Each nucleotide is made of three parts: a PHOSPHATE group, a FIVE carbon sugar molecule, and a nitrogen containing BASE.

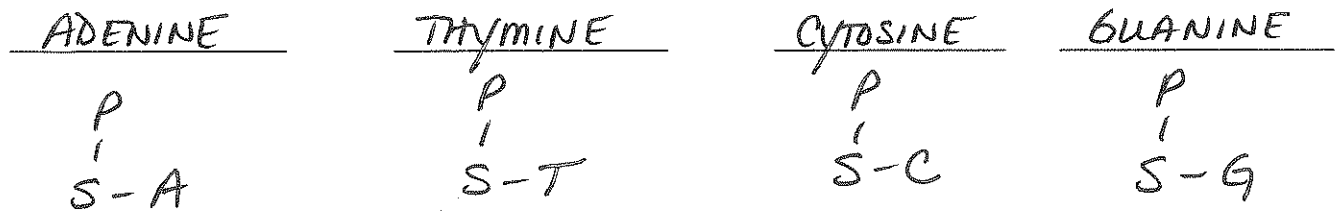
What two parts make up the "backbone"? PHOSPHATE GROUPS AND SUGAR MOLECULES

What part pairs together to connect the two strands? NITROGEN CONTAINING BASES

Draw a nucleotide below.



Four bases that make up the four types of nucleotides found in DNA.

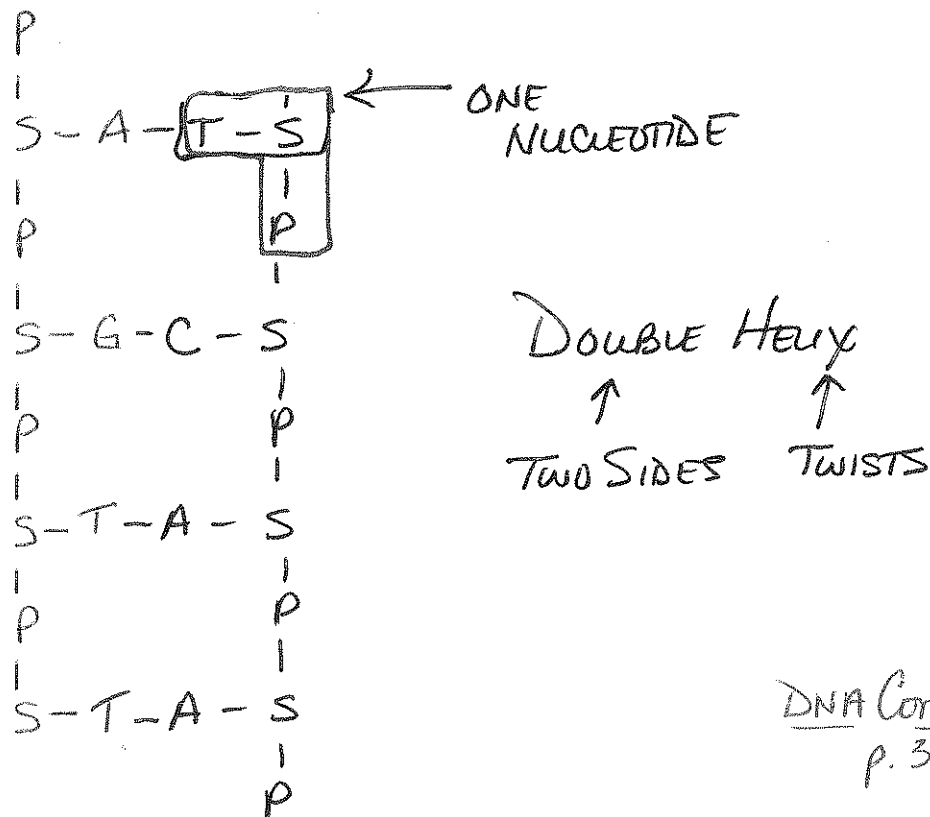


Adenine and Guanine have two rings of carbon and nitrogen atoms and are called PURINES.

Thymine and Cytosine have one ring of carbon and nitrogen atoms and are called PYRIMIDINES.

nucleotide bases fit together like puzzle pieces. Adenine always matches with THYMINE and Cytosine always matches with GUANINE.

If A=T and C=G, complete the other side of the DNA strand below.



What did Erwin Chargaff observe? IN ANY ORGANISM'S DNA, THE AMOUNT OF ADENINE = THYMINE AND CYTOSINE = GUANINE; CHARGAFF'S RULE ^{A-T} _{C-G}

What did Rosalind Franklin discover? FRANKLIN'S X-RAY PHOTO OF DNA SUGGESTED THAT IT HAD A HELICAL (TWISTED) SHAPE

What did James Watson and Francis Crick do? USED CHARGAFF'S RULES AND FRANKLIN'S PHOTO TO BUILD THE FIRST MODEL OF DNA; WON NOBEL PRIZE IN 1958 FOR DISCOVERY OF DNA'S STRUCTURE

Chapter 13 Section 2: Replication of DNA

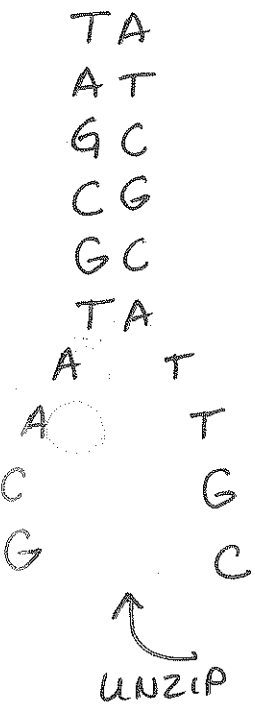
Pages 300-301

Before a cell can divide to make more cells, a copy of that cell's DNA must be made so that each new cell has a complete set of genetic information.

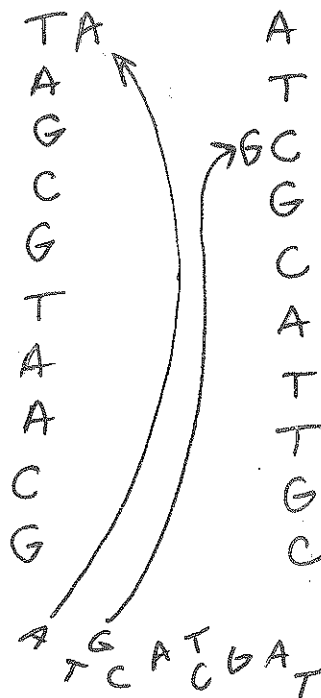
The process of making a copy of DNA is called DNA REPLICATION.

Three Steps of Replication:

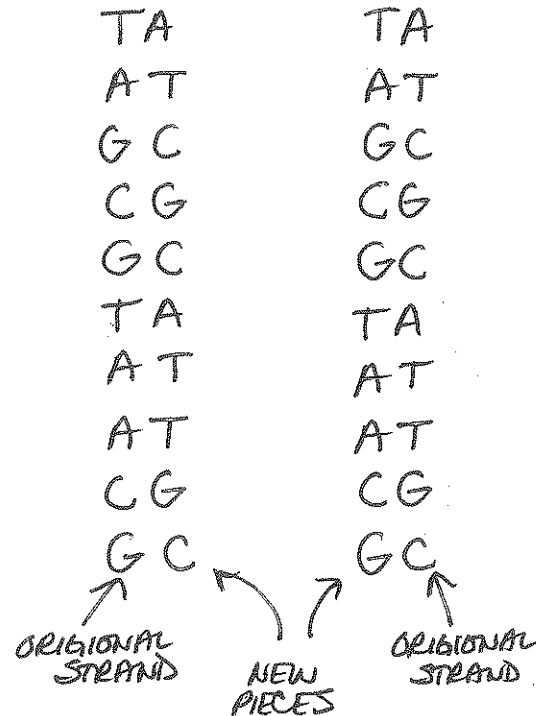
Step 1



Step 2



Step 3



Step 1: DNA UNWINDS AND UNZIPS WITH THE HELP OF A PROTEIN

CALED DNA HELICASE.

Step 2: "FREE FLOATING" NUCLEOTIDES THAT HANG OUT IN THE NUCLEUS

GO UP THE MIDDLE OF THE UNZIPPED STRAND AND ATTACH TO THE EXPOSED STRAND WITH THE HELP OF A PROTEIN CALLED DNA POLYMERASE.

Step 3: TWO IDENTICAL STRANDS OF DNA ARE MADE. THEY ARE

IDENTICAL TO EACH OTHER AND TO THE ORIGINAL STRAND

Replication Proteins:

DNA Helicase: UNWINDS AND UNZIPS THE DNA

DNA Polymerase: ADD "FREE FLOATING" NUCLEOTIDES TO MIDDLE OF UNZIPPED STRAND

Chapter 13 Section 3: RNA and Gene Expression

Pages 304-307

Proteins perform most of the FUNCTIONS in cells.

DNA provides the "recipe" or INFORMATION, from which PROTEINS are made in the cell.

DNA doesn't directly make the proteins (DNA cannot leave the nucleus!), but gets the help from a second type of nucleic acid called RNA.

Define gene expression: THE MANIFESTATION OF GENES INTO SPECIFIC TRAITS

DNA → RNA → PROTEINS → TRAITS
 (NUCLEUS) (RIBOSOMES) (CELL/BODY)

Gene expression (Which I often call Protein Synthesis.) is broken into two steps called TRANSCRIPTION and TRANSLATION.

The step in which the information on DNA is copied to RNA is called TRANSCRIPTION.

The step in which the information on RNA is used to make a protein is called TRANSLATION.

	DNA	RNA
Number of Strands	2	1
Type of Sugar Molecule	<u>DEOXYRIBOSE</u>	<u>RIBOSE</u>
Four Types of Nucleotides	ADENINE THYMINE GUANINE CYTOSINE	ADENINE URACIL * GUANINE CYTOSINE

Identify the type of RNA by its description.

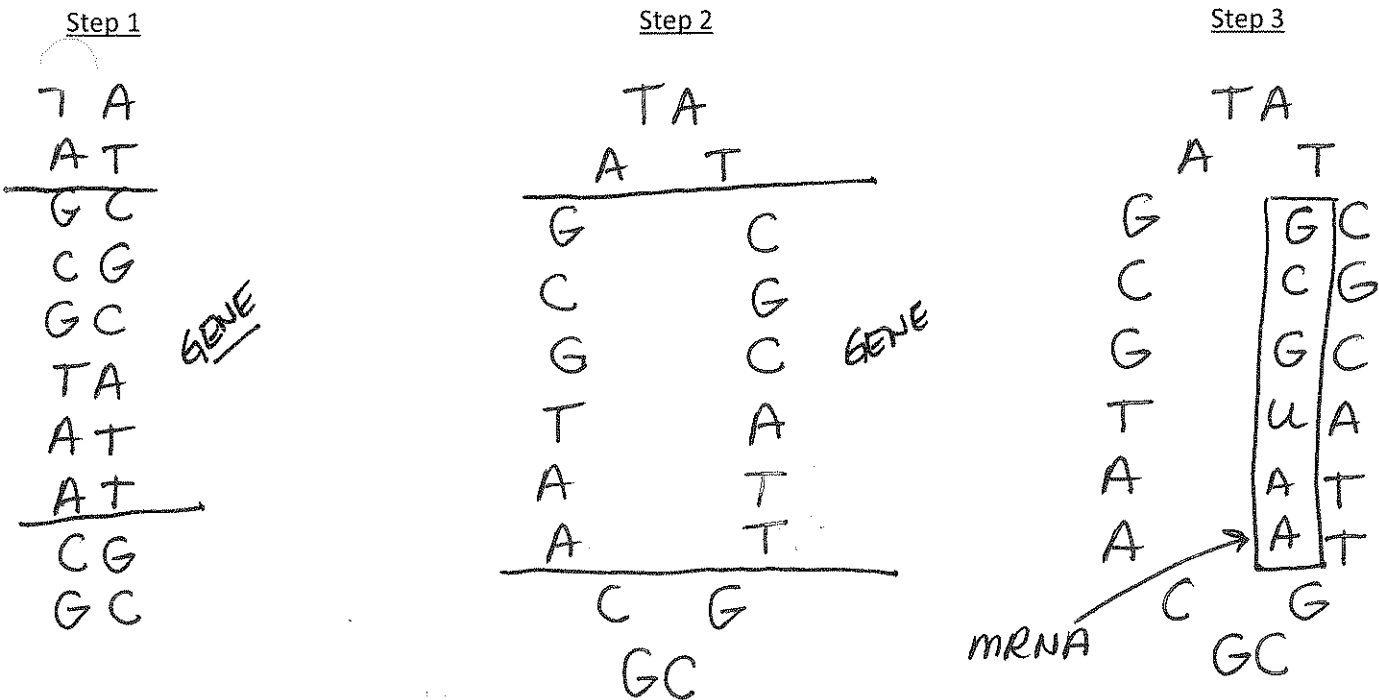
mRNA (MESSENGER) Carries instructions for making a protein from the nucleus and delivers them to the ribosomes.

tRNA (TRANSFER) Reads the instructions from mRNA and transfers the needed amino acids to the ribosome so that the protein can be constructed.

rRNA (RIBOSOMAL) Type of RNA that makes up the ribosome. This is the place where proteins are made.

During TRANSCRIPTION, the information in a specific region of DNA (a GENE) is transcribed, or COPIED, into mRNA. The protein that helps with transcription is called RNA POLYMERASE.

Three Steps of Transcription:



Step 1: RNA POLYMERASE FINDS THE SECTION OF DNA IT NEEDS TO BUILD A SPECIFIC PROTEIN; LOCATES THE BEGINNING OF THE GENE

Step 2: RNA POLYMERASE UNWINDS THAT SECTION OF DNA THAT CONTAINS THE NEEDED GENE.

Step 3: RNA NUCLEOTIDES (A, U, C, G) ATTACH TO ONE SIDE OF THE EXPOSED DNA STRAND MAKING A COPY OF ITS INFORMATION.

A gene can be thought of as a "SENTENCE" of "WORDS" that is at first transcribed (copied) then translated (made sense of). Transcription happens in the NUCLEUS of the cell and translation occurs at the RIBOSOME.

Each three-nucleotide sequence of mRNA is called a CODON. Each codon is matched to one of 20 different AMINO ACIDS or acts as a START or STOP signal for translation.

For the DNA sequence below, turn it into mRNA then circle each three letter codon.

DNA: T A C G G A A C C A C T
mRNA: A U G C C U U G G U G A

Each codon is then translated into one of the 20 possible amino acids that will be needed to build the needed protein.

Use either Figure 13 from the book or the wheel below to practice translating the given codons.

		Second letter				
		U	C	A	G	
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA } STOP UAG } STOP	UGU } Cys UGC } UGA } STOP UGG } Trp	Third letter
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	
	A	AUU } AUC } Ile AUA } AUG } Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	

Key:

Ala = Alanine (A)
Arg = Arginine (R)
Asn = Asparagine (N)
Asp = Aspartate (D)
Cys = Cysteine (C)
Gln = Glutamine (Q)
Glu = Glutamate (E)
Gly = Glycine (G)
His = Histidine (H)
Ile = Isoleucine (I)
Leu = Leucine (L)
Lys = Lysine (K)
Met = Methionine (M)
Phe = Phenylalanine (F)
Pro = Proline (P)
Ser = Serine (S)
Thr = Threonine (T)
Trp = Tryptophan (W)
Tyr = Tyrosine (Y)
Val = Valine (V)

Translation

mRNA Codon

Amino Acid

GGC

GLYCINE

AUG

METHIONINE (START)

CGG

ARGININE

UUU

PHENYLALANINE

GGU

GLYCINE

AGU

SERINE

CCU

PROLINE

Now let's try it from the beginning. We will start with a strand of DNA, unzip the DNA and use one side (DNA Template) to copy its genetic information onto mRNA. Then the mRNA will be translated into an sequence of amino acids that will become a protein.

DNA Template: ATG CAG CGA AAC ATT GGG TGA

mRNA: UAC GUC GCU UUG UAA CCC ACC

amino acids: TYROSINE - VALINE - ALANINE - LEUCINE - / STOP - END OF PROTEIN

Gene Expression Review

What are the three differences between DNA and RNA? NUMBER OF SIDES (DNA 2 RNA 1)

TYPE OF SUGAR (DEOXYRIBOSE - RIBOSE), 4 BASES (ATCG, AUCG)

What is the goal of gene expression? USE DNA INFORMATION TO MAKE A PROTEIN

What is the goal of transcription? DNA → mRNA; DNA CANNOT LEAVE NUCLEUS

Where does transcription take place? NUCLEUS

What is the goal of translation? mRNA → PROTEIN

Where does translation take place? CYTOPLASM & RIBOSOME

What does tRNA do? TRANSFERS NEEDED AMINO ACIDS FROM CYTOPLASM TO RIBOSOME

NOTE: ANABOLIC. REQUIRES ENERGY. USES ATP!