Name: Key-DiStefano

SOL. 1abdehj2Bc3b4c5eg

Chapter 12 DNA Page 339

At the turn of the 20th century, scientists began to wonder about what makes up genes.

- Griffith was one of the first scientist to investigate, his main goal was to figure out how bacteria make people sick.
- He injected his two strains of bacteria into mice.
  - Mouse A= got the S strain disease causing bacteria and it died
  - Mouse B= got the R strain of harmless bacteria and it lived
  - Mouse C= got the S strain that was heat-killed and it lives
  - Mouse D= got a mix of heat-killed S strain and live R strain bacteria and it dies
- So how could this be? The 2 bacteria must have mixed genetic content
- This is called transformation: because one type of bacteria had been changed permanently into another disease causing bacteria

AVERY repeated Griffith's experiment

- He proved that DNA is the cause of transformation and that it transmits genetic information from one generation to the next

Bacteriophage: a virus that infects bacteria

Hershey & Chase's experiment proved Avery's results that DNA was the genetic material found in genes of all living organisms

Purpose of DNA

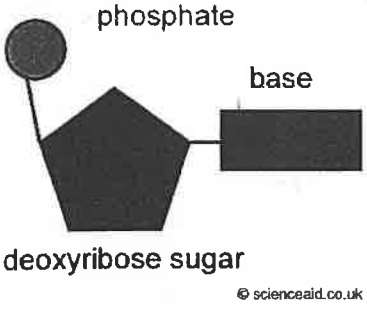
1) Must be capable of storing genetic information
2) Must be able to be copied
3) Must be able to transmit genetic information

~DNA Structure~

Full name: deoxyribonuclere acid

Shape: double helix which resembles a spiral staircase

Base unit: nucleotide

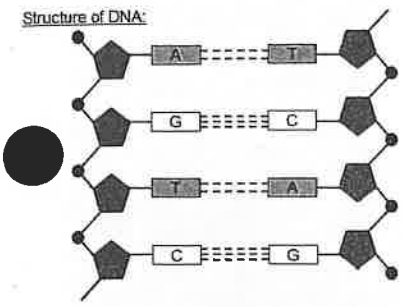


Consists of 3 structures 1) base ▭
2) Sugar ⌂
3) phosphate O

There are 4 types of bases

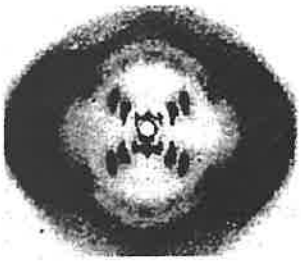
1) Adenine or A
2) Thymine or T
3) Guanine or G
4) Cytosine or C

The bases are held together with Hydrogen bonds



Chargaff's Observations

- He analyzed amounts of bases in various species
- He found that Guanine equaled Cytosine
  Adenine equaled Thymine
- This became known as Chargaff's Rule
- Bases when bonded are complementary to each other
- This is often called Base-pairing rules



X-ray Diffraction

- Rosalind Franklin used this technique to help discover the shape of DNA
- What was the name of the final picture that found it called?
  Photo 51
- This proved that DNA is a double helix which is like a twisted ladder shape that is formed by 2 strands of nucleotides twisted around each other

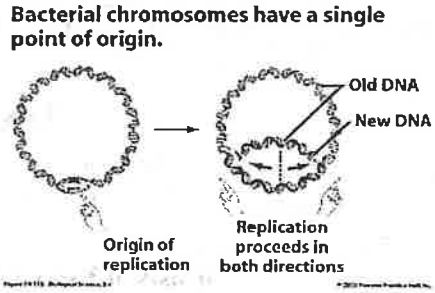
DNA is the genetic material of ALL organisms

Watson and Crick

- These men are credited from history in determining the structure of DNA
- They found that the outside strands are of alternating sugars and phosphate
- Adenine bonds to Thymine by 2 hydrogen bonds
- Guanine bonds to Cytosine by 3 hydrogen bonds
- Antiparallel strands: the 2 strands of DNA run in opposite directions

Prokaryotes

- DNA is held in the cytoplasm
- Made in a ring



Eukaryotes

- DNA is held in the nucleus
- DNA is organized in chromosomes
- The DNA is wrapped around histones and coils into nucleosomes and coils

Section 2 – Replication of DNA Page 351~

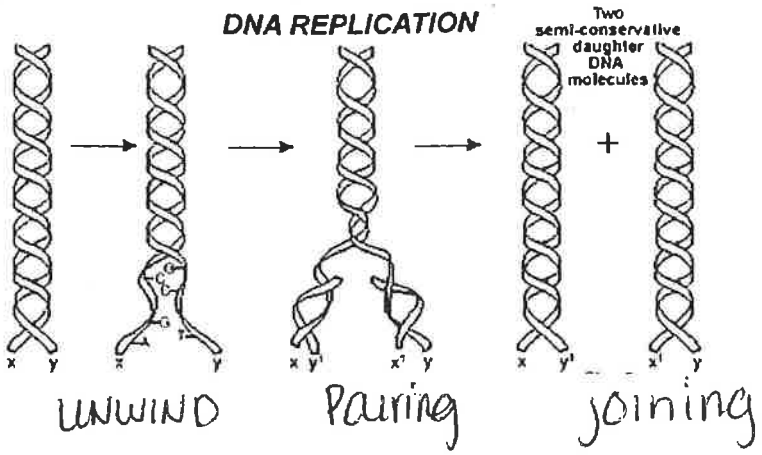
DNA replicates by making a strand that is complementary to each original strand following all Base-pairing rules

When does DNA replication occur? Sphase of interphase

How is DNA Replicated (copied)?

This takes place in 3 stages

- 1) unwinding
- 2) base pairing
- 3) joining



UNWINDING Stage

- DNA helicase (an enzyme) unwinds and unzips the double helix
- The hydrogen bonds are broken between the bases
- This opens up the DNA to start being copied

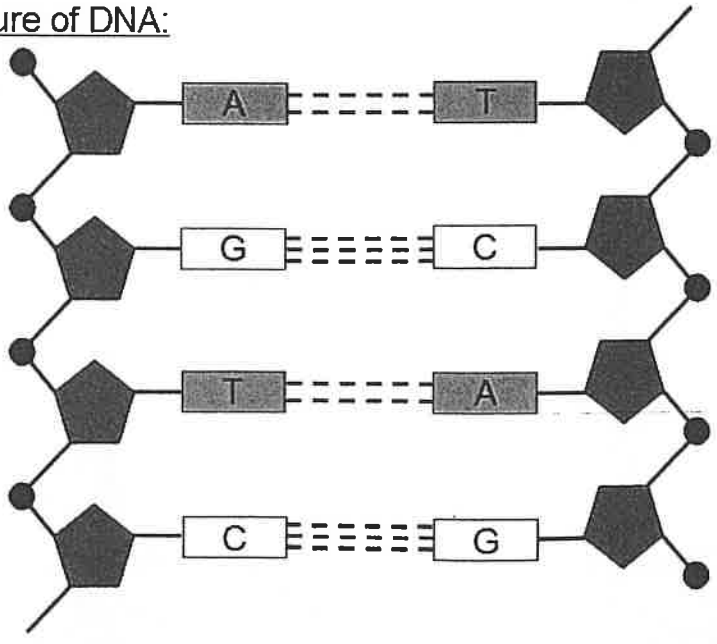
BASE-PAIRING Stage

- DNA polymerase (an enzyme) joins individual nucleotides to its complement on the new strand
- It connects only to its compiement
  - A bonds to G
  - G bonds to C
- This allows identical copies of the original double strand to be produced

INING Stage

- The DNA strand is pict back together
- Eukaryotes have many origins of replication on a chromosome and will replicate in both directions until the entire chromosome is copied
- Prokaryotes have 1 origin of replication but will replicate in both directions until each chromosome is completely replicated
- Telomeres are placed on the ends of the chromosomes. This is a difficult place for replication to occur so these "caps" are needed to hold the DNA in place

Structure of DNA:



Chapter 13 – RNA & Protein Synthesis Pg 360

Central Dogma

DNA codes for RNA which guides protein synthesis

DNA → RNA → proteins

Protein synthesis (or the making of proteins) occurs in ALL living organisms

~RNA~

Full name: ribonucleic acid

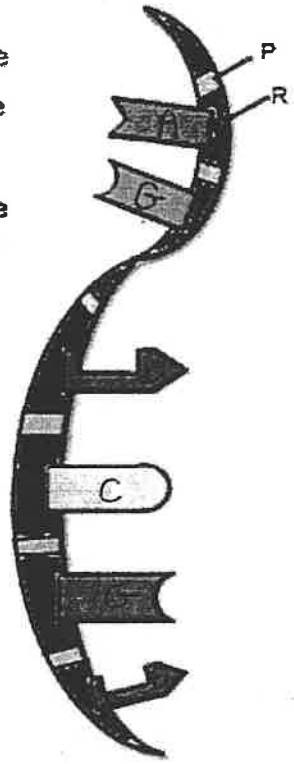
Shape: single helix (strand)

Base unit: nucleotide

Consists of 3 structures ribose sugar
base
phosphate group

There are 4 types of bases Uracil (U)
Guanine (G)
Cytosine (C)
Thymine (T)

Adenine
Guanine
Uracil
Cytosine
P= phosphate
R= Ribose



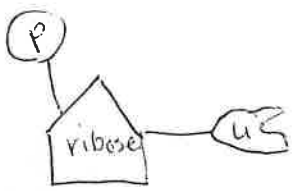
3 major differences between RNA and DNA

	Sugar	Bases	Structure
DNA	deoxyribose	ATGC	double helix
RNA	ribose	AUGC	single helix

There are 3 types of RNA

	Nickname	Function
Messenger RNA	mRNA	carries instructions from DNA to make proteins
Ribosomal RNA	rRNA	helps to form ribosomes in cytoplasm
Transfer RNA	tRNA	transfers amino acids to the ribosome as specified in mRNA

nucleotide



~The Process of Protein Synthesis~

2 main Stages
1) Transcription
2) Translation

TRANSCRIPTION

- Segments of DNA serve as templates to produce complementary mRNA molecules
- DNA template is complementary to the RNA
- This occurs in the cytoplasm of Prokaryotes
- This occurs in the nucleus of Eukaryotes
- Need the enzyme RNA polymerase
  - This will bind to DNA
  - unwinds the DNA
  - Uses DNA as a template to make RNA
    - Example: DNA= TACGGGAGCCCUAACUGA
    - RNA= AUG CCC UCG GGA UUG ACU
- How does RNA polymerase know when to start and stop making RNA?
  - The enzyme (RNA polymerase) binds to specific sequences on the DNA called promoters
  - There are portions of the DNA that DO NOT code for anything, they are "fillers" or nonsense these are called Introns
  - The actual part that is a coded sequence is called exons

THE CODE

We need to figure out the code so that we can make an amino acid sequence

So far we had DNA in the language of nucleotides make RNA in the language of nucleotides in the process of transcription but how do we get from nucleotide language to protein language????

- So we need a "dictionary" to find this genetic code
- We need to find the "coded language" to make proteins
- We read 3 letters at a time
- Each 3 letter word corresponds to a specific amino acid
  - This 3 letter word is called a codon
  - It is found on mRNA
  - It corresponds to a particular amino acid

How to Read Codons

- Must use the Genetic Cod Table
- Start with the 1st base in the middle
- Move to 2ND ring for the 2ND base
- Move to the outermost ring for the 3RD base

Practice

START - only has 1
PROLINE - has 6
STOP - has 3

TRANSLATION (2nd step of Protein Synthesis)

- The sequence of nucleotides bases on a mRNA molecule is a set of instructions that give the order in which amino acids should be joined to produce polypeptides (AKA proteins)
- Need to have ribosome

STEPS

- After transcription, mRNA leaves the nucleus and enters the cytoplasm
- ribosome attach to the mRNA
- codons pass through the ribosome as it is read codons
- tRNA will bring in the proper amino acids into the ribosome
- The tRNA matches its anticodon to the codon on the mRNA = these are complementary
- The tRNA also brings in the corresponding amino acid
- The tRNA leaves the amino acid behind as another tRNA enters the ribosome
- This will continue this way until the entire "code" is read to creating the protein
- It will cease when it reaches the STOP codon
- The protein then is released and goes off to do its job

Central Dogma

Information is transferred from DNA to RNA to make proteins

Practice

~Mutations~

Mutations : heritable changes in genetic information

2 types

1) Gene mutations: this is a change in 1 gene

Examples

Point Mutations : this is a change in 1 or a few nucleotides

Substitution : when 1 bases is changed into another

CCC → CCA How did the amino acid change? proline → proline

CCC → ACC How did the amino acid change? proline → Threonine

Frameshift Mutation : the entire message is shifted and all amino acids are changed

deletion : 1 bases is deleted AUG CCC UGA → AUC CCU GA

Insertion : 1 bases is inserted AUG CCC UGA → AUG GGC CUG A

2) Chromosome mutations: change in number or structure of a chromosome

deletion : loss of all or part of a chromosome

duplication : extra copies

inversion : reverse direction of part of a chromosome

translocation : part of 1 breaks off and attaches to a different chromosome

Effects of Mutations

Causes include:

1) errors in DNA replication (1 in a million)
2) environmental conditions
3) mutagen : something that can cause mutations = UV rays, acid, smoke, tobacco, Xrays

Effects can vary

1) no effect
2) Beneficial
   a. Produce new functions
   b. Ability to evolve and adapt
   c. Increase of resistance of insects/bacteria
3) Harmful
   a. Lead to genetic diseases, cancer

Polyploidy : having extra sets of chromosomes

3 or 4 sets of chromosomes

Examples:

What is the difference between a **body cell mutation** and a **sex cell mutation**?

↓ not passed on - only in body cells

↓ passed on since in gametes

CODON CHART

Codons in mRNA

First base	Second base U	Second base C	Second base A	Second base G	Third base
U	UUU, UUC – Phenylalanine UUA, UUG – Leucine	UCU, UCC, UCA, UCG – Serine	UAU, UAC – Tyrosine UAA, UAG – Stop	UGU, UGC – Cysteine UGA – Stop UGG – Tryptophan	U C A G
C	CUU, CUC, CUA, CUG – Leucine	CCU, CCC, CCA, CCG – Proline	CAU, CAC – Histidine CAA, CAG – Glutamine	CGU, CGC, CGA, CGG – Arginine	U C A G
A	AUU, AUC, AUA – Isoleucine AUG – Start	ACU, ACC, ACA, ACG – Threonine	AAU, AAC – Asparagine AAA, AAG – Lysine	AGU, AGC – Serine AGA, AGG – Arginine	U C A G
G	GUU, GUC, GUA, GUG – Valine	GCU, GCC, GCA, GCG – Alanine	GAU, GAC – Aspartic acid GAA, GAG – Glutamic acid	GGU, GGC, GGA, GGG – Glycine	U C A G