



Syllabus Checklist

This is the knowledge that you should understand upon completing this section:

11.1 DNA

- DNA occurs bound to proteins in chromosomes in the nucleus and as unbound DNA in the mitochondria.
- DNA stores the information for the production of proteins that determines the structure and function of cells.
- the structural properties of the helical DNA molecule, including double-stranded, nucleotide composition and weak bonds involved in base pairing between the complementary strands, allow for its replication.

11.2 PROTEIN SYNTHESIS

- protein synthesis involves the transcription of a gene on DNA into messenger ribonucleic acid (RNA) in the nucleus and translation into an amino acid sequence at the ribosome with the aid of transfer RNA.

11.3 EPIGENETICS

- epigenetics is the study of phenotypic expression of genes, which depends on the factors controlling transcription and translation during protein synthesis, the products of other genes, and the environment.

11.1 DNA



Terminology

These are some of the terms from this section which you should know. Write the meaning of each term in the space provided.

(i) base pair

(ii) chromosome

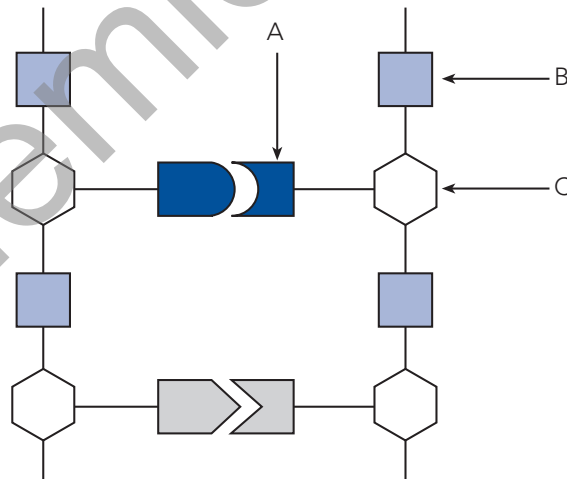
(iii) complimentary DNA strand

(iv) DNA replication

(v) histone

Review Questions

1. The following diagram represents a short segment of DNA.



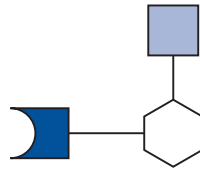
Name the substances labelled A, B and C.

A _____

B _____

C _____

2. If a small part of the molecule is isolated, it could be represented by:

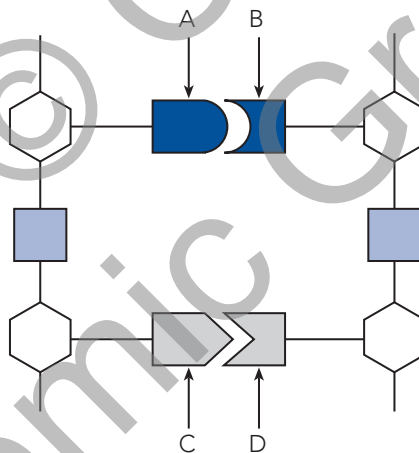


(i) What is this unit called? _____

and (ii) where might it be found in this separated form?

3. There are four different nitrogenous bases in DNA. What are they called?

4. In the following diagram:



If A is cytosine, then B is _____

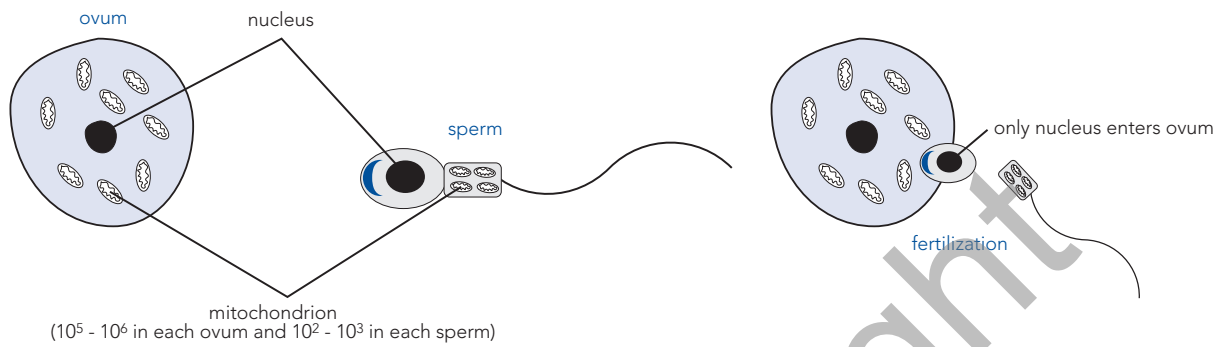
If C is thymine, then D is _____

5. Explain briefly why the *sequence* of nitrogenous bases in DNA is important.

6. Name the **two** organelles where DNA is found in a normal cell.

7. What is the importance of mitochondrial DNA?

8. Study the following diagrams carefully (cells not drawn to scale).



(i) Explain which cell contributes most of the mitochondria to the new zygote.

(ii) Which organelles contain DNA?

(iii) Mitochondrial DNA is believed to control the production of proteins which are involved in respiration. Which sex contributes this DNA to the offspring?

11.2 PROTEIN SYNTHESIS



Terminology

These are some of the terms from this section which you should know. Write the meaning of each term in the space provided.

(i) anticodon

(ii) codon

(iii) m RNA

(iv) ribosome

(v) t RNA

(vi) transcription

(vii) translation

Review Questions

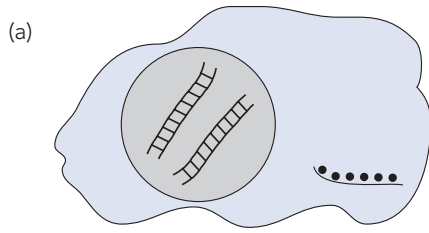
1. Proteins have important roles in the body. Name five of these roles.

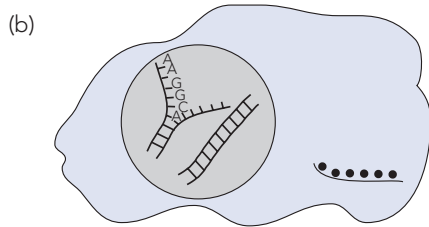


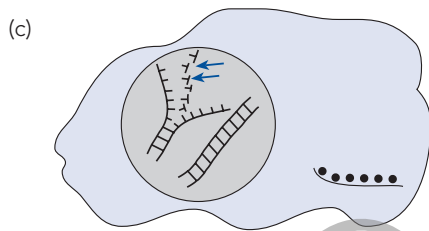
2. (i) What do DNA and RNA stand for?

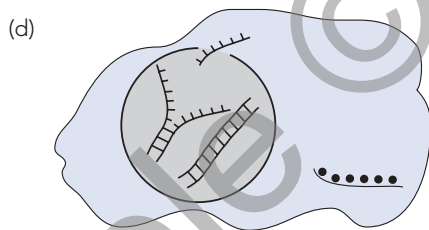
(ii) List four differences between them.

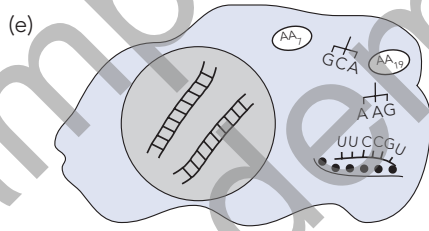
3. The series of diagrams below show diagrammatically how protein synthesis occurs in cells. Beside each diagram write down what is occurring in that stage.

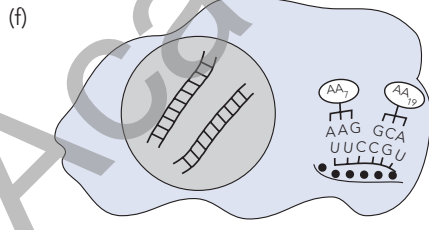


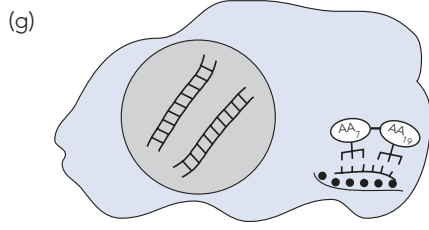












4. For a protein to be made or synthesised, the information has to be taken off the DNA molecule and used to link amino acids together in a specific sequence. This involves two processes—transcription and translation. Distinguish between transcription and translation by completing the table below.

TRANSCRIPTION	TRANSLATION

5. The genetic code is described as a triplet code, and degenerate. Why?

6. Use the genetic code below to answer the questions that follow.

		SECOND BASE OF CODON					
		U	C	A	G		
FIRST BASE OF CODON	U	phe phe leu leu	ser ser ser ser	tyr tyr STOP STOP	cys cys STOP trp	U C A G	THIRD BASE OF CODON
	C	leu leu leu leu	pro pro pro pro	his his glu glu	arg arg arg arg	U C A G	
	A	ile ile ile met+start	thr thr thr thr	asp asp lys lys	ser ser arg arg	U C A G	
	G	val val val val	ala ala ala ala	asp asp glu glu	gly gly gly gly	U C A G	

(i) What would be the sequence of amino acids that the following strands of mRNA represent?

(a) AUGCAUGGCAAAAUCCUAGAUUAG

(b) GGGCAUAUCGUUAUAUGAUCUGGC

(ii) Complete this table

STRAND OF DNA THAT IS 'READ'	TRANSCRIBED mRNA STRAND	tRNA ANTICODONS
G	C	
	C	G
	C	
T	A	
A	C	A
G	C	
T	A	
	A	U
	U	

(iii) What amino acids does the strand of DNA code for?

11.3 EPIGENETICS



Terminology

These are some of the terms from this section which you should know. Write the meaning of each term in the space provided.

(i) epigenome

(ii) genome

(iii) inheritable

(iv) methyl group

(v) nucleosome

Review Questions

1. Explain what is meant by 'gene expression'.

2. Name two things that could permanently change the expression of the genes in a cell.

3. Explain why epigenetics is an expanding new area of research.

4. Gene expression can be modified by the environment. Two examples are:

(i)

(ii)

5. Explain how UV light affects melanin production.

6. Describe how DNA and histones are bound together in a chromosome. Illustrate this with a simple labeled diagram below.

7. (i) Explain why histone modification is important in gene expression.

(ii) How does DNA methylation affect gene expression?

(iii) The methyl tags which attach to DNA can be passed on to offspring. What is the significance of this discovery?

(iv) Some scientists have described a person's genome as being like the hardware of a computer while the person's epigenome is like the computer's software. Briefly discuss what this analogy means.

(v) An individual's DNA may not change during his or her lifetime but his or her epigenome must change. What does this statement mean and what evidence is there to support it?

(vi) How can epigenetics explain the differences between identical twins?

(vii) How might epigenetics explain why identical twins appear to become more different as they become older?
