

# BIOLOGY

LEVELS OF LIFE

AUSTRALIAN CURRICULUM EDITION

An underwater photograph showing various types of seaweed and coral. The top part features green and yellowish-brown seaweed with leaf-like structures. The bottom part shows more complex, branching coral structures with small yellowish-brown polyps. The background is a clear blue water with light rays filtering through.

SAMPLE  
PAGES

WORKBOOK

BRIAN LECORNU

TONY DIERCKS

# Contents

To the Student	iv
Acknowledgements	iv

## TOPIC 1

### DNA and Proteins

01 Chromosomes and DNA	1
02 The Language of Life	4
03 Proteins	9
04 Genes and Phenotypic Expression	13
05 The Use of Genetic Information	16
06 Biotechnology (Human Manipulation of DNA)	20

## TOPIC 2

### Cells as the Basis of Life

07 Living Things are Made of Cells	25
08 Cell Structure and Function	27
09 Living Cells Need Energy	31
10 Movement In and Out of Cells	36
11 Cell Metabolism	44
12 New Cells from Old	48
13 Sexual Reproduction and Meiosis	52
14 Control of Cell Division	56

## TOPIC 3

### Homeostasis

15 Organisms Have Tolerance Limits	60
16 Homeostasis	61
17 The Nervous System	64
18 The Endocrine System	68
19 Homeostatic Control Mechanisms	72

## TOPIC 4

### Evolution

20 How Cells Have Evolved	76
21 Defining Species	78
22 Evidence for Evolution	80
23 Gene Pools and Natural Selection	83
24 Speciation and Evolution	87
25 Human Impact	90

## Science as a Human Endeavour

Science as a Human Endeavour Questions	94
Science as a Human Endeavour Investigation	102

# 1

# Chromosomes and DNA

Subject Outline  
terms and  
phrases

**DNA, double-stranded, helical, cytosol, prokaryote, nucleotide, genetic information, eukaryote, chromosome (linear, circular), nucleus**

1. Organisms are made of one or more cells and cells are made of chemicals.  
Define the following chemical terms:

element:

compound:

molecule:

organic compound:

2. (a) Describe how DNA stores and transmits genetic information.

(b) DNA functions in the same way in all living things. Explain what this means.

7. Write the chromosome number on which the gene is located for the following human genetic diseases. (see textbook chapter 1 and 2)

haemophilia

red-green colourblindness

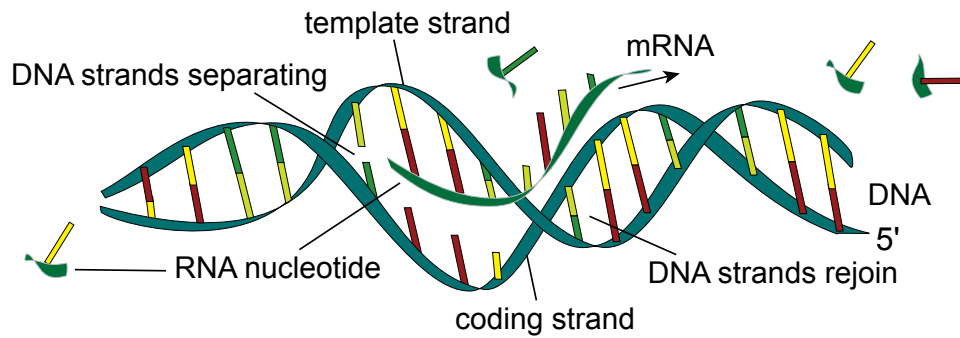
Huntington's disease

cystic fibrosis

Duchenne muscular dystrophy

retinitis pigmentosa

8. (a) On the diagram label the the coding strand, the template strand of DNA, the mRNA, the weak hydrogen bonds, and the ends of the strands



(b) Explain the meaning of 3' to 5' when referring to DNA.

9. Distinguish between DNA codons, RNA codons, and RNA anticodons.

DNA codons:

RNA codons:

RNA anticodons:

# 8

# Cell Structure and Function

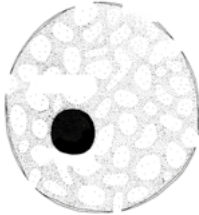




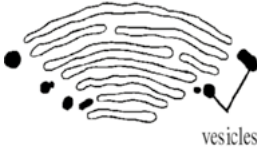
Subject Outline terms and phrases

**organelle, nucleus, nucleolus, mitochondrion, chloroplast, vacuole/vesicle, Golgi body, endoplasmic reticulum(rough and smooth), ribosome, lysosome, cytoskeleton**

1. For each of the following terms, state whether it refers to the **structure** or **function** of a cell:

- |                 |                     |                  |
|-----------------|---------------------|------------------|
| microscopic     | metabolic           | cell wall        |
| reproduces      | synthesises protein | contains DNA     |
| synthesises DNA | spherical           | photosynthesises |
| respires        | cell membrane       |                  |

2. Complete the table below which shows features of organelles in eukaryotic cells.

Organelle	Diagram	Function	Distinguishing feature(s)
		controls cell activities	
		rRNA synthesis	
		photosynthesis	
			
			inner membrane folded to form cristae
			

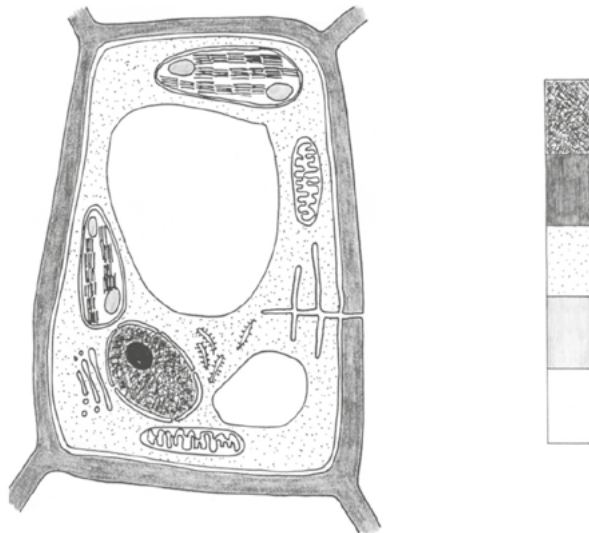
CONTINUED NEXT PAGE

2. The membrane of a human muscle cell maintains different concentrations of materials inside and outside the cell. Give an example of a substance that has a higher concentration inside a human muscle cell than outside, and an example of a substance that has a higher concentration outside a human muscle cell than inside.

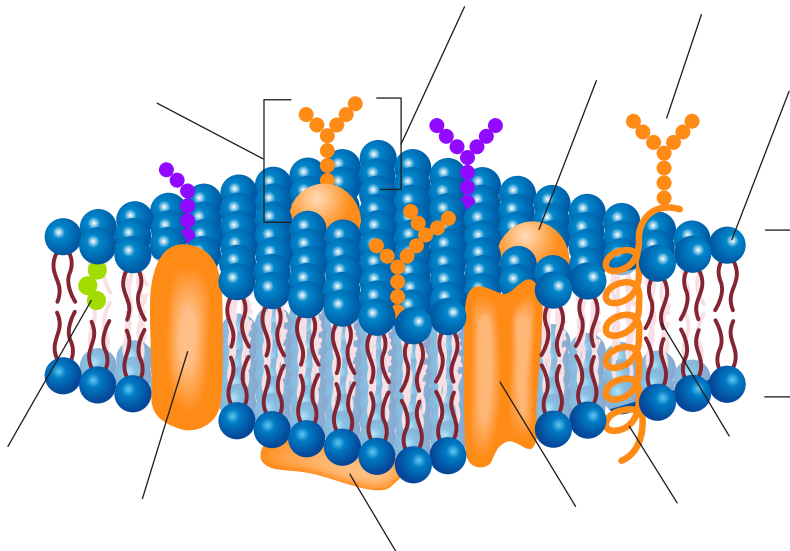
Substance that has a higher concentration inside

Substance that has a higher concentration outside

3. Label the key next to the diagram below to show the location of *starch*, *cellulose*, *water*, *protein* and *nucleic acids* in the cell. On the cell diagram label the location of *lipids*.



4. (a) Label the features of the fluid mosaic model of the Cell membrane shown below.



- (b) State 3 functions of the cell membrane.

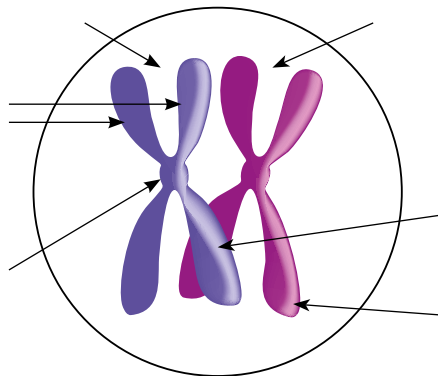
# 13

## Sexual Reproduction and Meiosis

Subject Outline terms and phrases

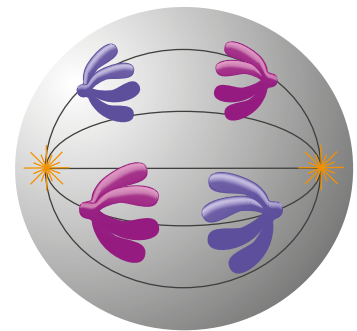
**diploid, haploid, homologous, meiosis, crossing over, independent assortment, fertilisation, genetic variation, sexual reproduction**

- How many types of autosome are present in a normal **diploid** human cell?
  - How many of each type of autosome are present in a normal diploid human cell?
- Label the diagram below showing a pair of homologous chromosomes as they would appear while crossing over during late prophase I. Label the following features on your diagram: *centromere, sister chromatids, chiasma, maternal chromosome and paternal chromosome*



- Describe what is happening during anaphase I.

- Describe how a second diagram could be drawn (and compared to the diagram in part (a)) to illustrate the idea of independent assortment.



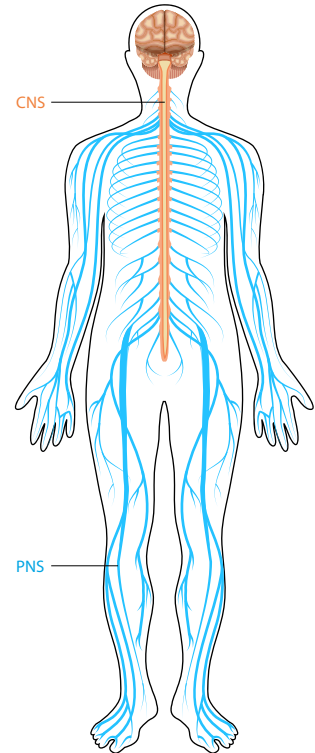
# 17

## The Nervous System

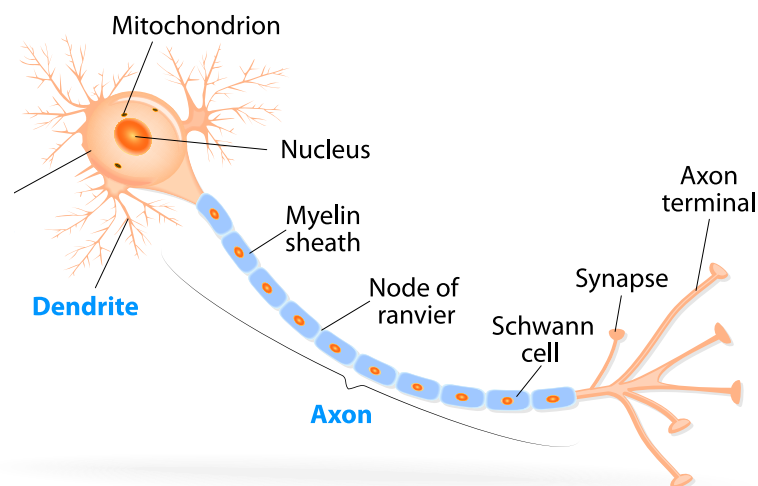
Subject Outline terms and phrases

**central nervous system (CNS), peripheral nervous system (PNS), sensory neuron, interneuron, motor neuron, nerve pathway, synapse, neurotransmitter, reflex response**

- On the diagram label the **central nervous system (CNS)** and the **peripheral nervous system (PNS)**.
  - State three functions of the CNS.
  - Name the two parts of the PNS and state which part of the body each one controls.



- On the diagram below, label the following structures:  
*cell body, dendrite, nucleus, axon, axon terminal*

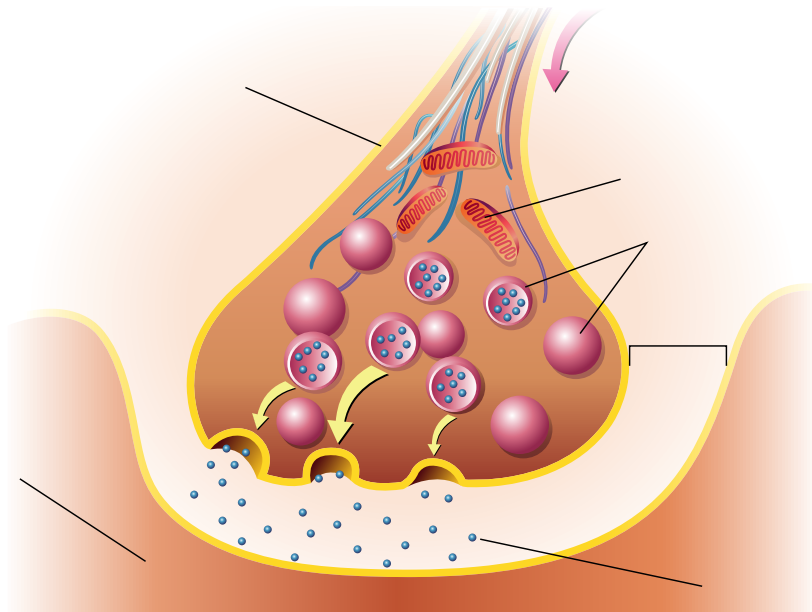




5. (a) What is a **synapse**?

(b) What is a **neurotransmitter**? Give two examples.

(c) Label the Synapse diagram below with the following: *Nerve Impulse*, *Mitochondria*, *Synaptic Cleft*, *Neurotransmitter*, *Axon*, *Vesicle*, *Dendrite*,



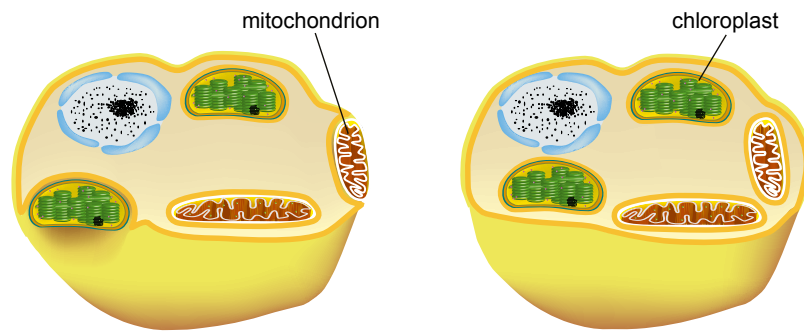
(d) (i) Why is it important that neurotransmitters do not remain in the synaptic cleft?

(ii) How are neurotransmitters removed from the synaptic cleft?

6. (a) What is meant by the term **reflex response**?

(b) State three examples of a reflex response in humans.

- (b) Explain how endosymbiotic events may have led to the formation of the first eukaryotic cells. In your answer you should refer to the following diagram, on which you should put suitable labels.



- (c) State four pieces of evidence that support the idea that the first eukaryotic cells were formed by endosymbiotic events.

- (1)
- (2)
- (3)
- (4)

4. (a) Explain how the first membranes may have formed spontaneously, eventually giving rise to simple cells.

- (b) Describe the possible roles of RNA and **ribozymes** in the first simple cells.

- (c) Explain why proteins were not used as enzymes in the first primitive cells.

# 23

## Gene Pools and Natural Selection

Subject Outline terms and phrases

**gene pool, natural selection, adapted, selection pressure, frequency of alleles, genetic drift, genetic diversity**

1. Define the term **gene pool**. (review Chapter 21)
2. What reasoning did Thomas Malthus use to show that not all offspring in natural populations survive to reproduce?
3. State why most natural populations of organisms do not increase in size, but remain fairly constant from one year to the next.
4. List four factors that restrict the size of a natural population.
  - (1)
  - (2)
  - (3)
  - (4)
5. Explain why genetic variability is an advantage to a population.
6. (a) State one example of a genetically controlled characteristic that may *increase* an individual *human's* chances of survival and reproduction.  
  
(b) State one example of a genetically controlled characteristic that may *decrease* an individual *rabbit's* chances of survival and reproduction.