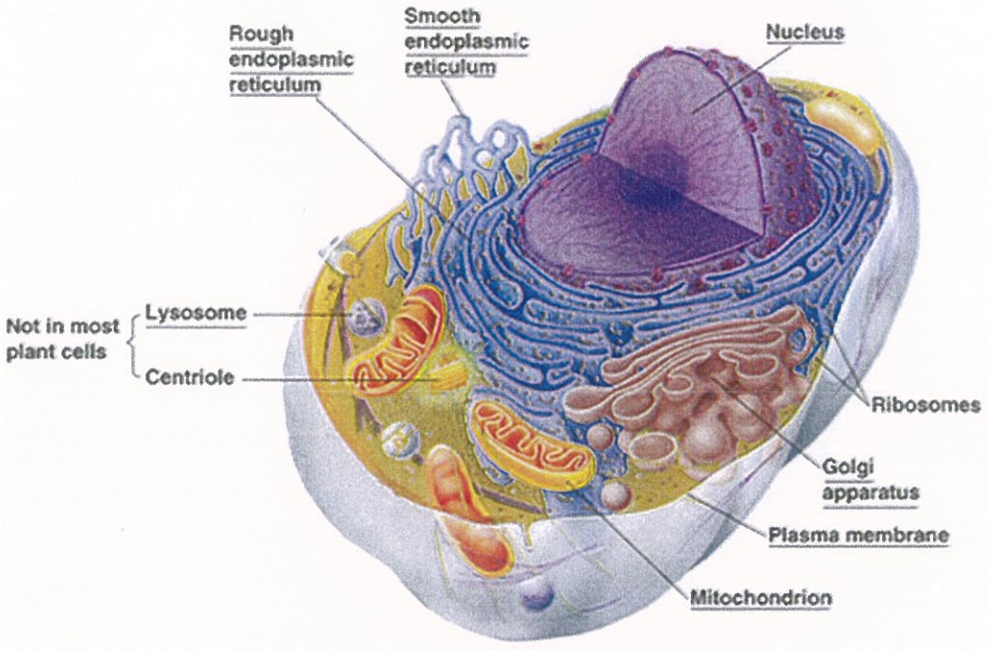
Human Biology
ATAR Unit 1



Chapter 1: Human Biological Science

Chapter 2: Scientific Inquiry

Scientific Method

Hypothesis	
Variable	
Independent Variable	
Dependent Variable	
Controlled Variable	
Uncontrolled Variable	

CELLULAR PROCESSES

Metabolism: All chemical reactions that takes place in cells.

- Catabolism: _____
  _____
- Anabolism: _____
  _____

Cellular Respiration: Process where food is broken down in cells to release energy for cell activities.

➢ Equation:

- Glucose is obtained from breaking down carbohydrates, amino acids and fatty acids.
- Remaining energy is used to form compound **Adenosine Triphosphate** (ATP).
- ATP is formed when a phosphate is joined to molecule of **Adenosine Diphosphate** (ADP).
- Removal of third phosphate releases the energy in the bond. ADP is then reused to store some more of the energy.
- Formation of ATP takes place in the cytoplasm of the cell and inside the mitochondria.

Cellular Respiration

Aerobic Respiration: _____
_____
_____

Anaerobic Respiration: _____
_____
_____

Uses of Energy by the cell-

1) _____
2) _____
3) _____
4) _____
5) _____
6) _____
7) _____

THE SCIENTIFIC METHOD

Independent Variable *(Manipulated, experimental variable):* The variable that the Scientist changes.

Dependent Variable *(Responding variable):* Changes as a result of the independent variable being changed, depends on changed variable.

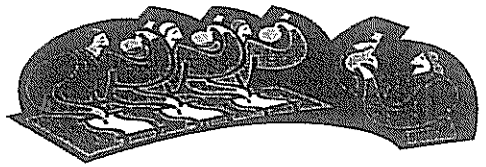
Controlled Variables *(Constant variables)*: Other variables that are held constant during the experiment. Variables that we keep the same.

Dependent Variable depends on the Independent Variable

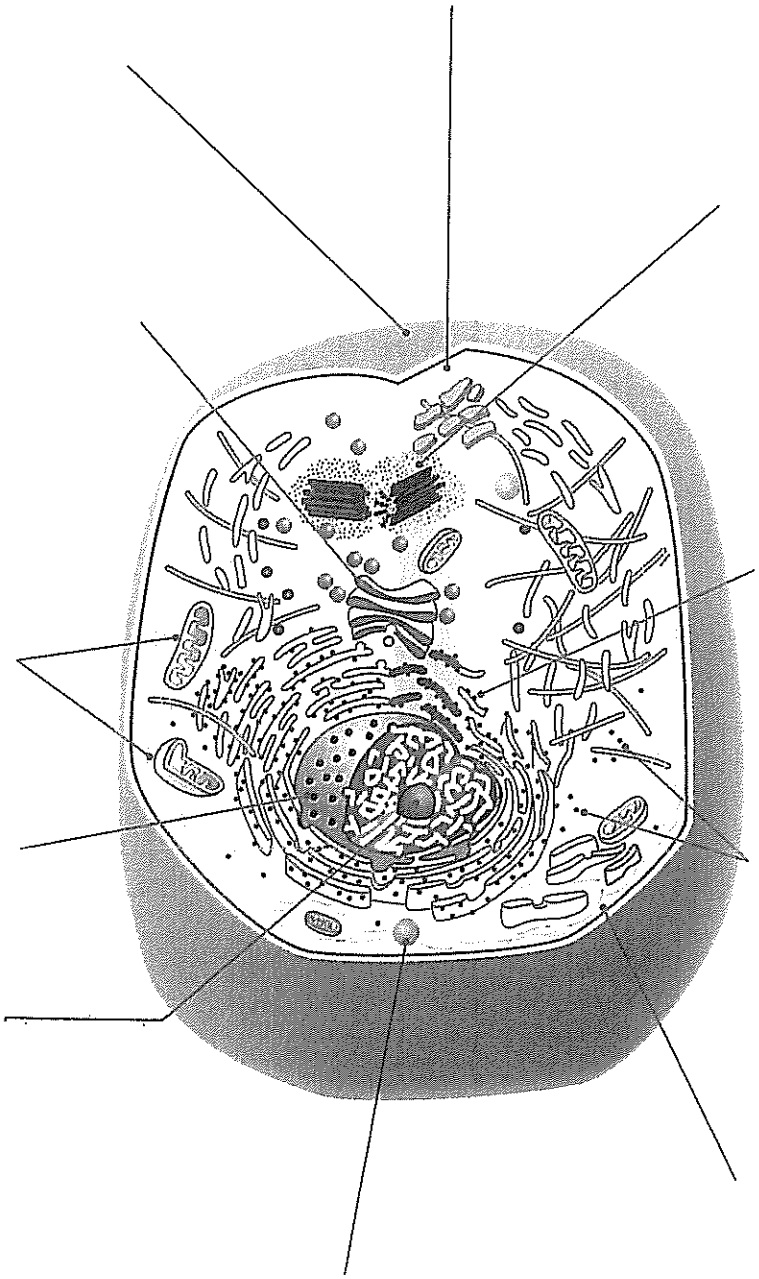
Control Experiment or Group: Reduce chances of results being a "one-off." It is a group that is subjected to a procedure identical in every respect to the experiment set up to test the independent variable except, in this case, the independent variable is not allowed to change.

Experimental Error: When designing and carrying out experiments, there are many potential sources of error. *Instrument error* can occur if an instrument is faulty or not calibrated properly. A *personal error* can result from the observer making inaccurate observations. *Sampling errors* can occur because samples are either not large enough or are not truly random.

As a general rule, the more data you obtain, the more **reliable** your results become.



Chapter 3: Cells



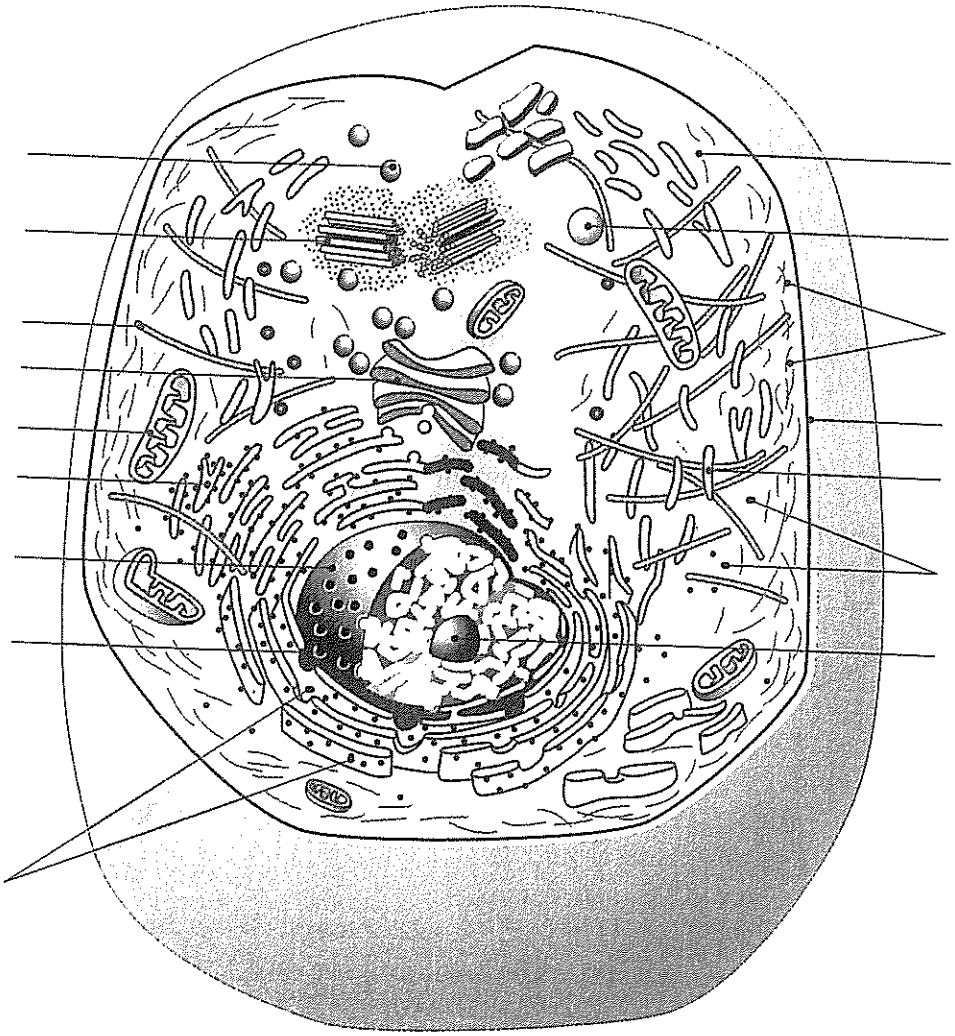


Fig. 15.2 *A generalised animal cell showing the components found in many cells*

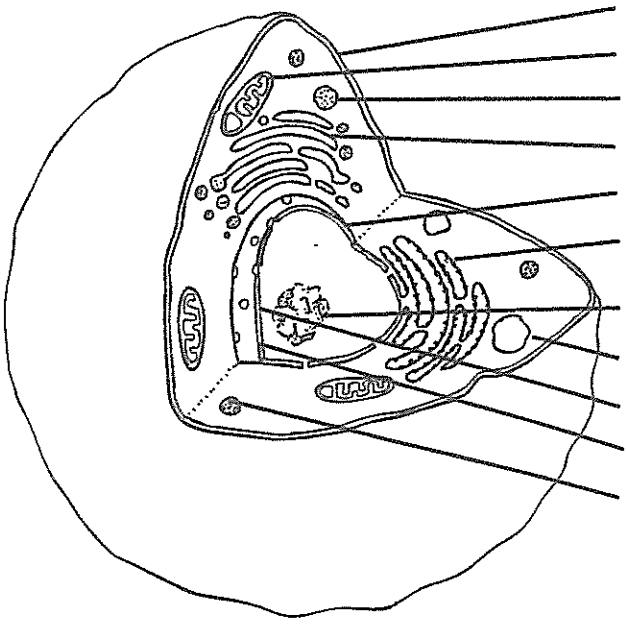
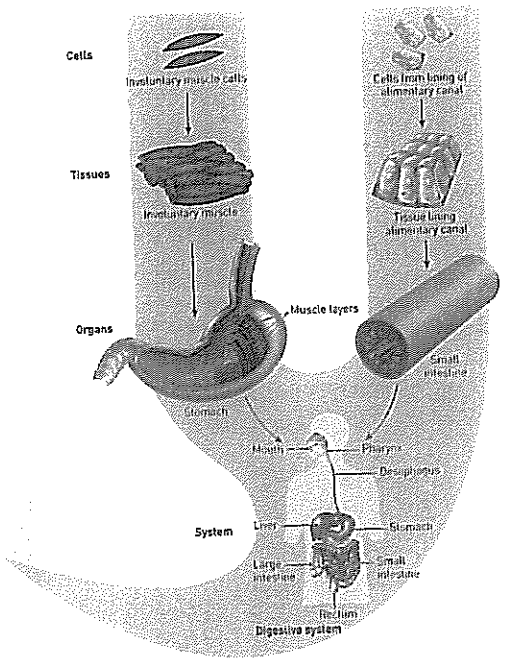


Figure 2 – The sturcture of an animal cell

Parts of a Cell

Nucleus	
Mitochondria	
Golgi body	
Endoplasmic Reticulum	
Ribosome	
Lysosome	
Centrioles	
Cytoplasm	
Cytoskeleton	
Cell Membrane	
Inclusions	

Functions of a cell membrane

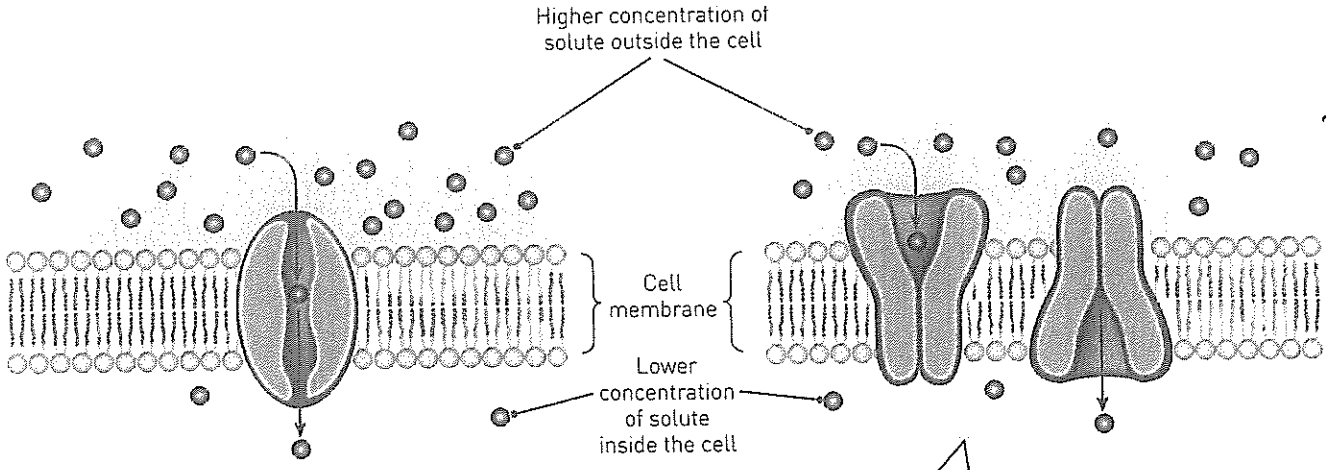


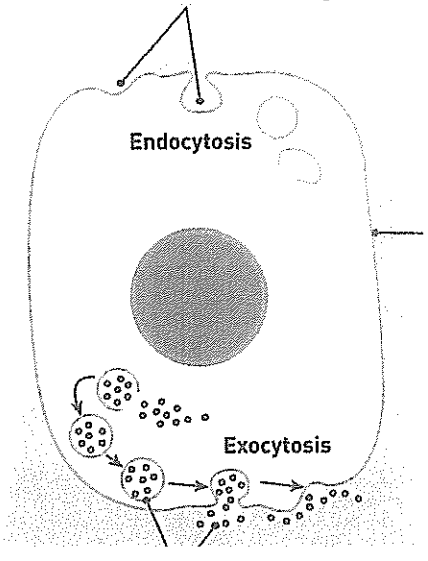
Organism

Chapter 4: Cells exchange materials

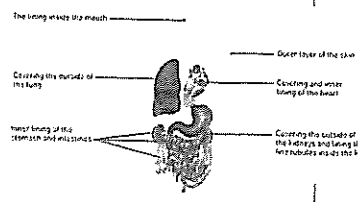
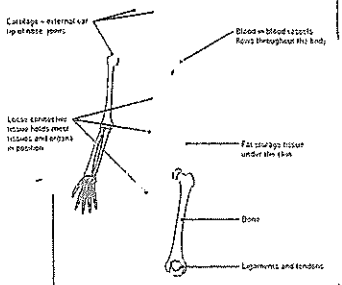
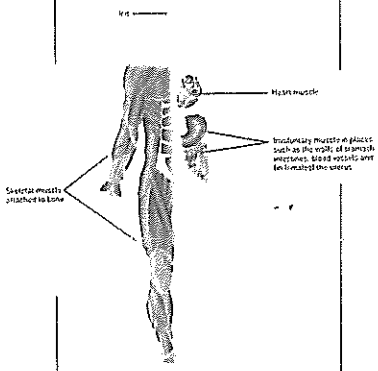
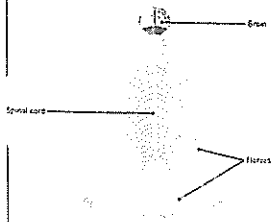
Types of transport across cell membrane

Type of Transport	*Passive or active*	*Substance transported*	*Diagram*
Diffusion			
Diffusion			
Osmosis			
Carrier-mediated			
Facilitated Diffusion			
Active Transport			
Vesicular Transport			
Endocytosis			
Exocytosis			





Chapter 5: Tissues

Tissue Type	Where found	Structure	Function	Diagram
				
				
				
				

Tissues make up **organs** that make up **systems** that make up **the organism.**

Table 5.1 The major systems of the body and their functions

Body system	Main function
Digestive	Intake, breakdown and absorption of food
Respiratory	Intake of oxygen and removal of carbon dioxide
Circulatory	Transport of nutrients, oxygen and wastes to and from cells
Excretory	Removal of wastes
Nervous	Detection of changes in the environment and coordination of body activities
Endocrine	Regulation and coordination of many body functions
Skeletal	Support and protection of body parts
Muscular	Movement and support
Immune	Protection against infection by micro-organisms
Reproductive	Production of new individuals

Chapter 6: Cells at work- cell metabolism

Organic Compound	Made up of	Broken down into	Where is it broken down?	Use in body
Carbohydrate				
Protein				
Lipid				
Nucleic Acid				

Factors affecting enzyme activity

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Cellular Respiration Equation:

CELL PROCESSES

Many of the metabolic reactions of cells are part of the following major cell processes:

1. **Cellular respiration:** The process by which cells obtain energy from food (catabolic).
2. **Protein synthesis:** The assembly of proteins from amino acids using the DNA plans.
3. **Growth:** This involves CELL DIVISION followed by an increase in cell size.

These processes are dealt with in turn, followed by a study of the enzymes that control the metabolic reactions involved. This information sheet only deals with cellular respiration.

1. Cellular Respiration

Cellular respiration is the process by which cells release the energy they need from food molecules. Glucose (a monosaccaride carbohydrate) is usually used. All cells respire in this way.

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{ENERGY}$$

This breakdown (catabolic reaction) occurs in about 20 steps, with small amounts of energy released as the reaction proceeds. Each reaction is catalyzed by a different enzyme.

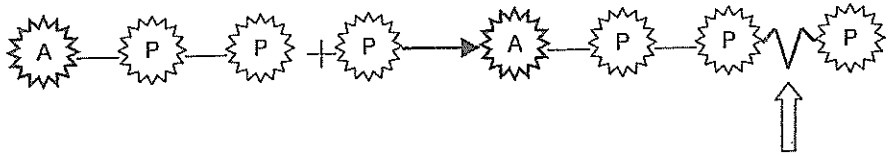
The process is inefficient – about 60% of the energy released is lost as HEAT ENERGY. Humans, being mammals,use this heat to maintain a warm body temperature of 37°C.

ATP and ADP

The energy released by cellular respiration is not used directly to power cell processes. It is stored in an energy carrier molecule called ATP, Adenosine triphosphate.

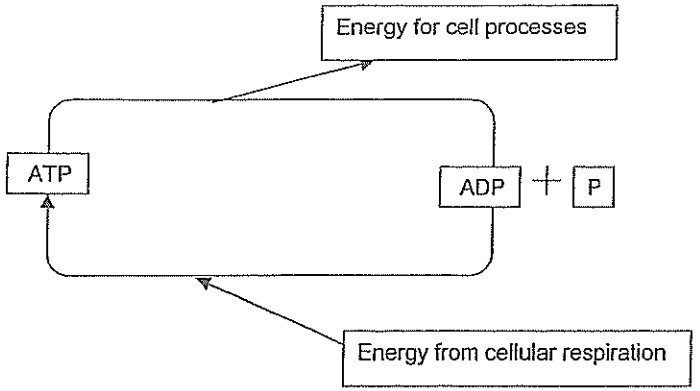
ATP is formed by joining a phosphate ion to ADP, Adenosine diphosphate using some energy from cellular respiration.

ADP + P ⟶ ATP (energy rich)



Energy Rich Bond

The energy is stored in the chemical bond between the last two phosphate groups. This bond is easily broken to release the energy to do work in the cell. Because ATP is small, it can travel to all parts of the cell, transferring energy to parts where it is needed. Furthermore, the ADP+P formed when the energy rich bond is broken are recycled indefinitely using further energy from cellular respiration to combine them into ATP.



Under ideal conditions, each molecule of glucose can provide enough energy to produce 38 ATP molecules in a 3 stage process.

Stage 1: Glycolysis, occurs in the cytoplasm. No oxygen is needed. Two ATP molecules are produced.
Stage 2: Kreb's cycle, occurs in the mitochondrion, as does;
Stage 3: The electron transfer chain. Upto 36 ATP molecules are produced, but oxygen is needed. This is AEROBIC RESPIRATION.

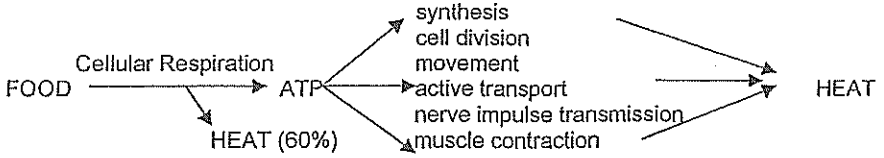
Aerobic	= with O_2
Anaerobic	= without O_2

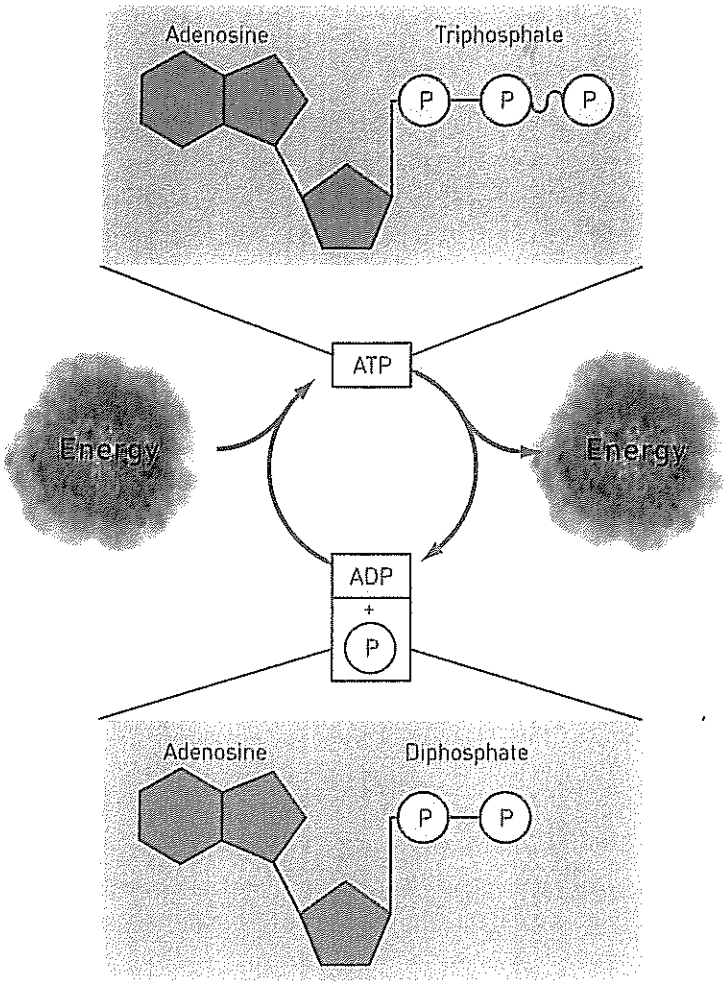
Glycolysis produces pyruvic acid. During aerobic respiration the pyruvic acid enters the mitochondria for further breakdown. However, if oxygen is unavailable, e.g. during vigorous exercise, all the energy needed for cell activities must come from glycolysis – the only stage that functions in the absence of oxygen. This is called ANAEROBIC RESPIRATION. The pyruvic acid is converted to LACTIC ACID in the muscle tissue that causes muscle fatigue and cramps.

GLUCOSE ⟶ PYRUVIC ACID ⟶ LACTIC ACID
PYRUVIC ACID ⟶ 2 ATP

After exercise stops, the lactic acid is transported to the liver for reconversion into glucose. This requires a lot of O_2 and explains why heavy breathing continues for a time after exercise stops.

The diagram below illustrates some of the energy uses of the cell. All energy is eventually lost as HEAT and has to be replaced by consuming more food.





$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$$

$$38\ ADP + 38\ P \longrightarrow 38\ ATP$$

A summary of the processes of anaerobic and aerobic respiration is given in Figure 6.7.

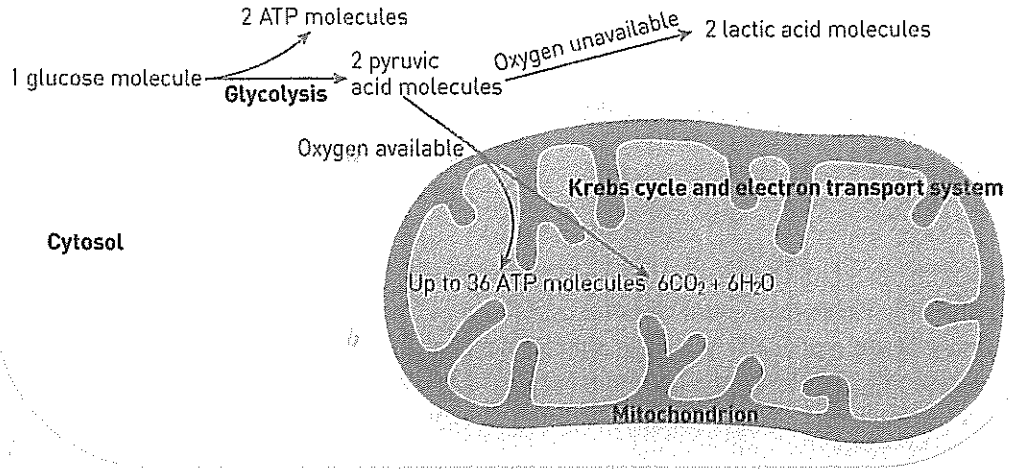


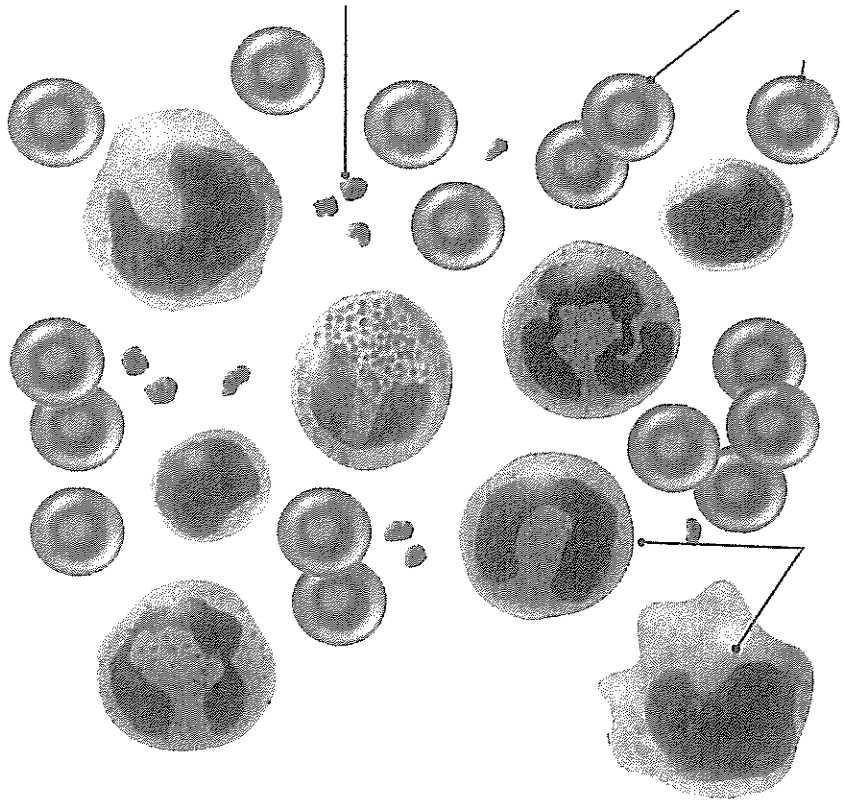
Figure 6.7
A summary of the processes of anaerobic and aerobic respiration in a cell

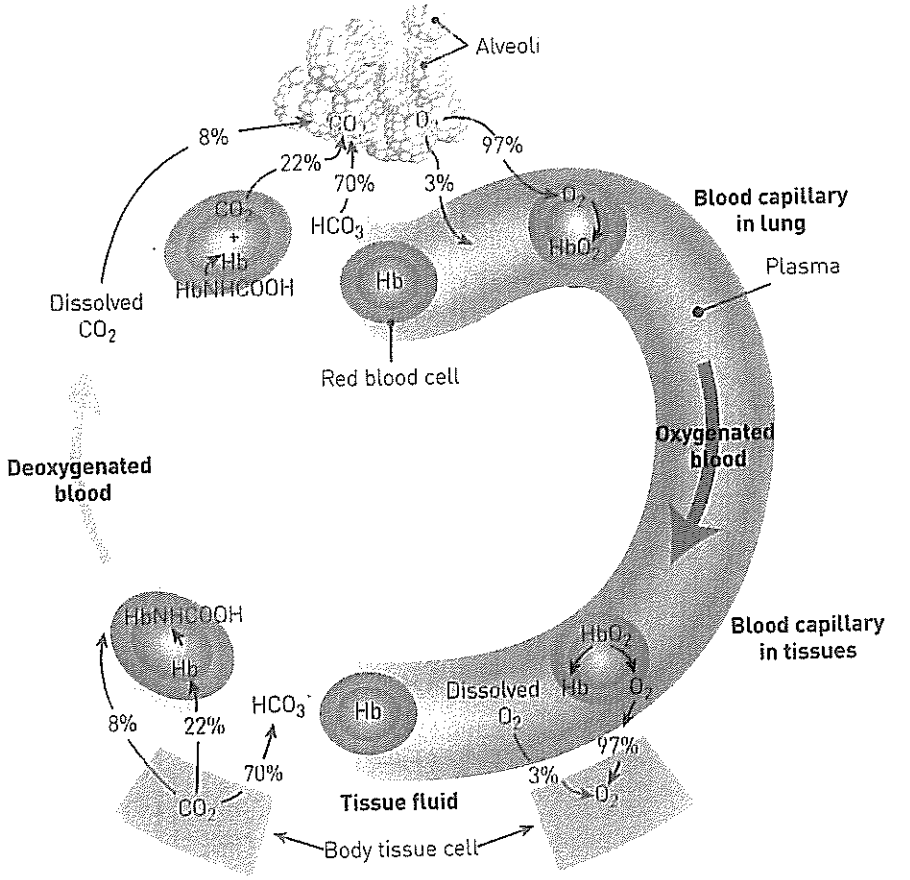
Energy use by the cell

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Chapter 7: Blood and circulation

Blood component	Other name	Origin (where are they produced?)	Number of cells (mm^3)	Fate (how long do the last?)	Function
Red Blood Cell					
White Blood cell					
Platelets					





Blood Vessels

Vessel	Structure	Function

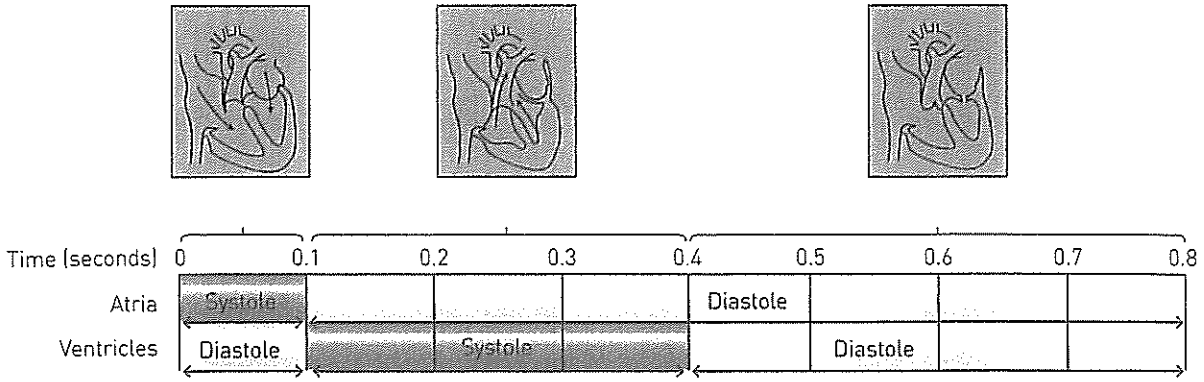
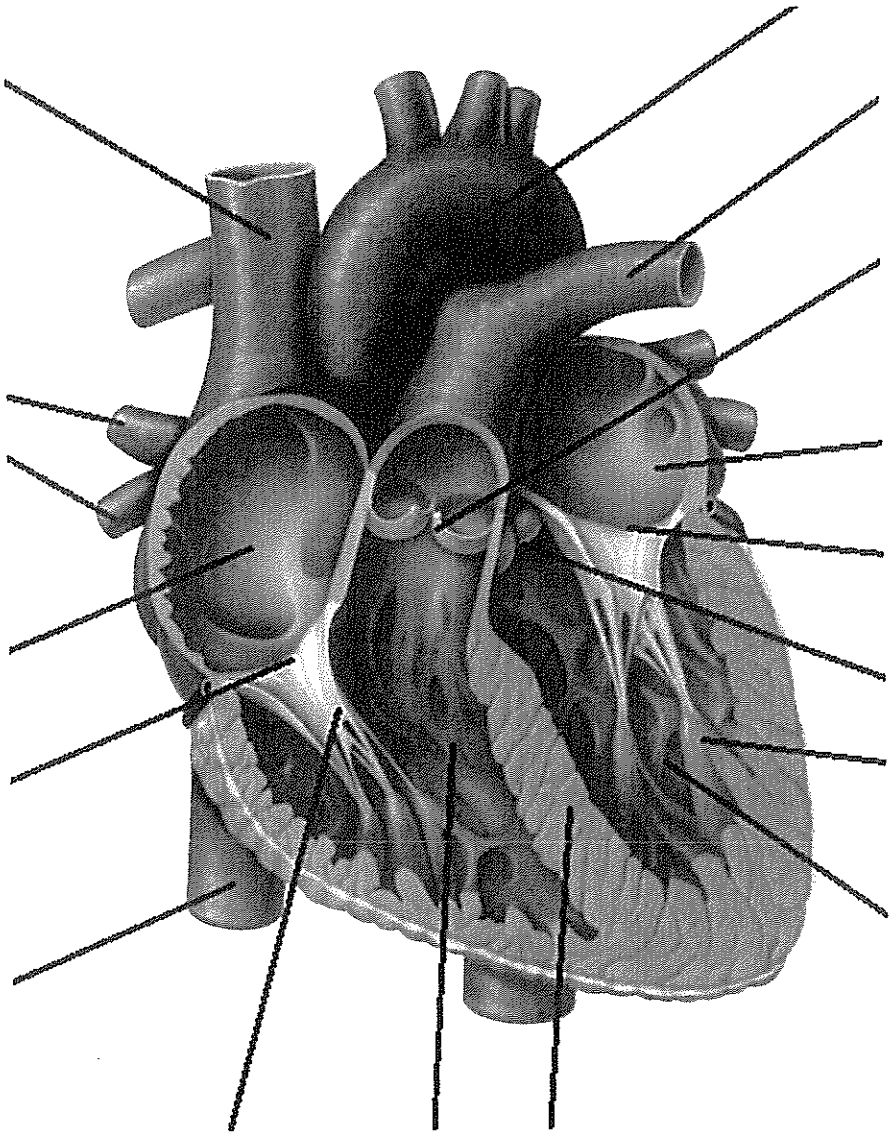
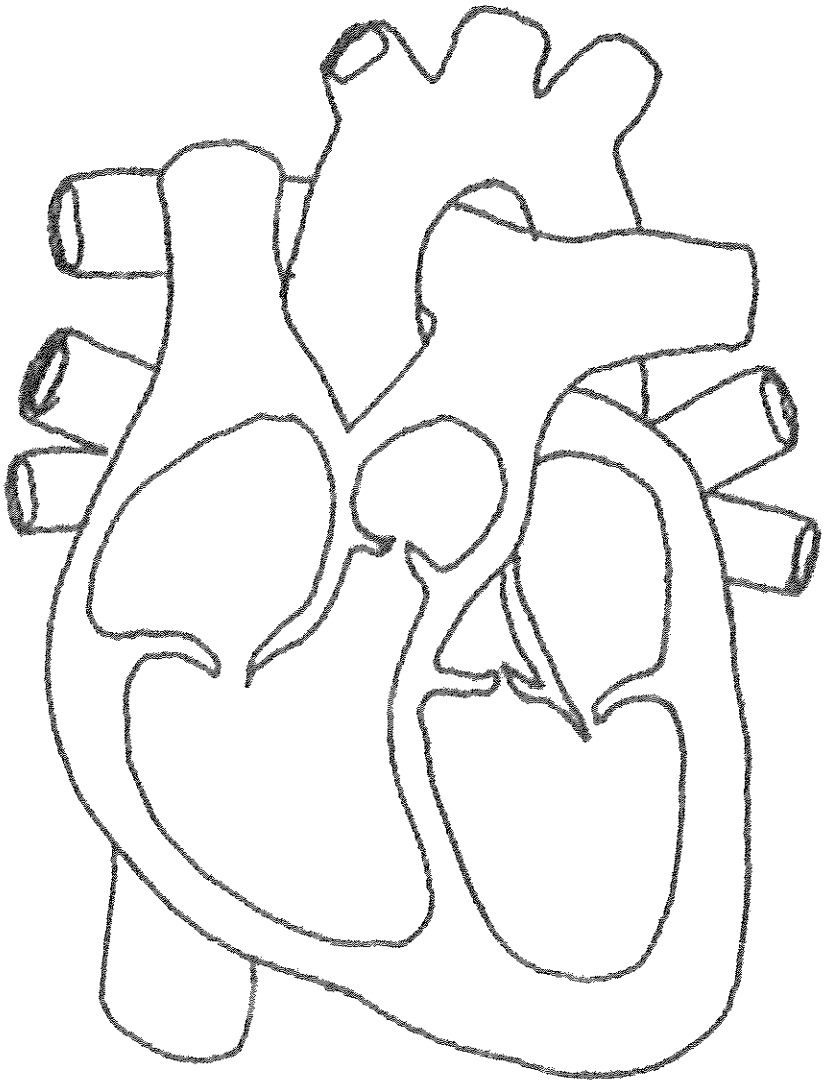


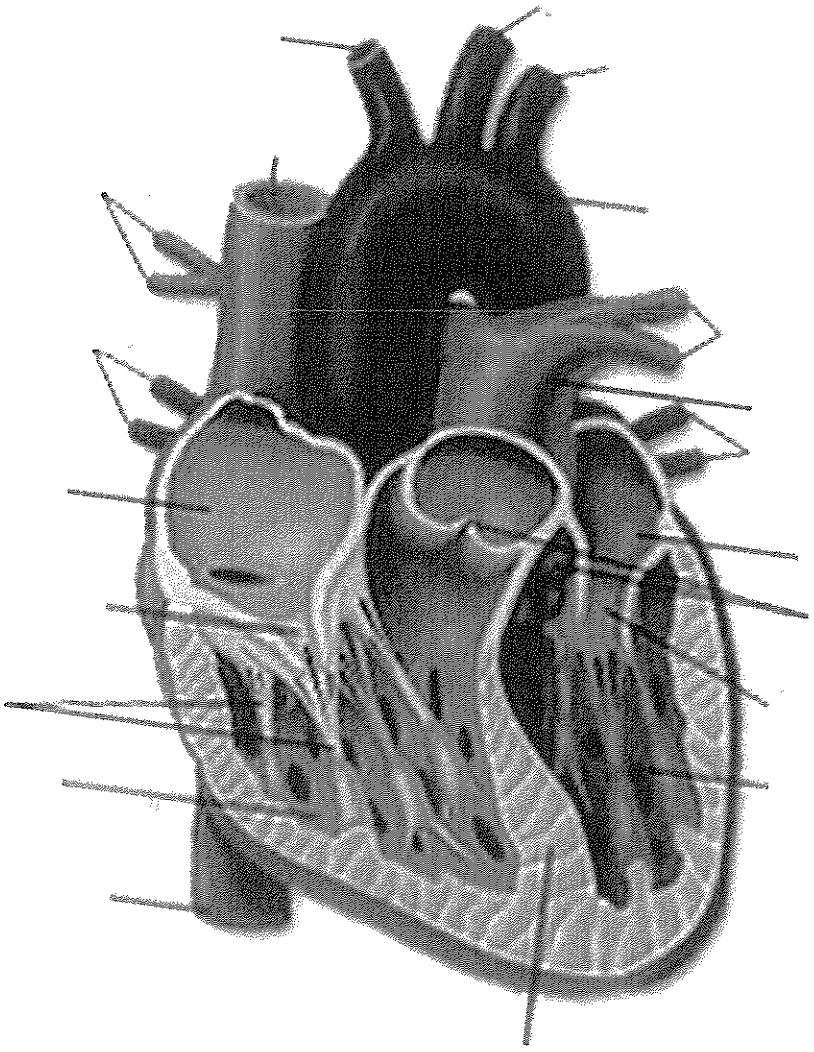
Figure 7.9 The cardiac cycle



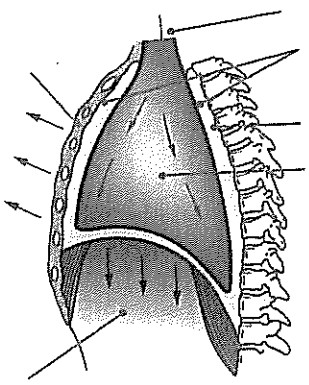


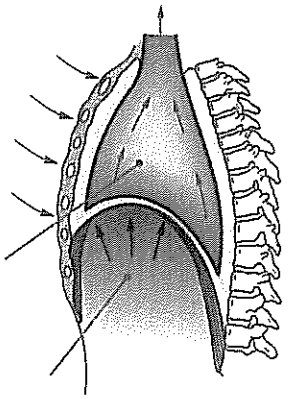
	Caused by	Effect on body
Hypertension		
Arteriosclerosis / Atherosclerosis		
Heart Attack		
Angina		
Stroke		
Diabetes		
Anaemia		

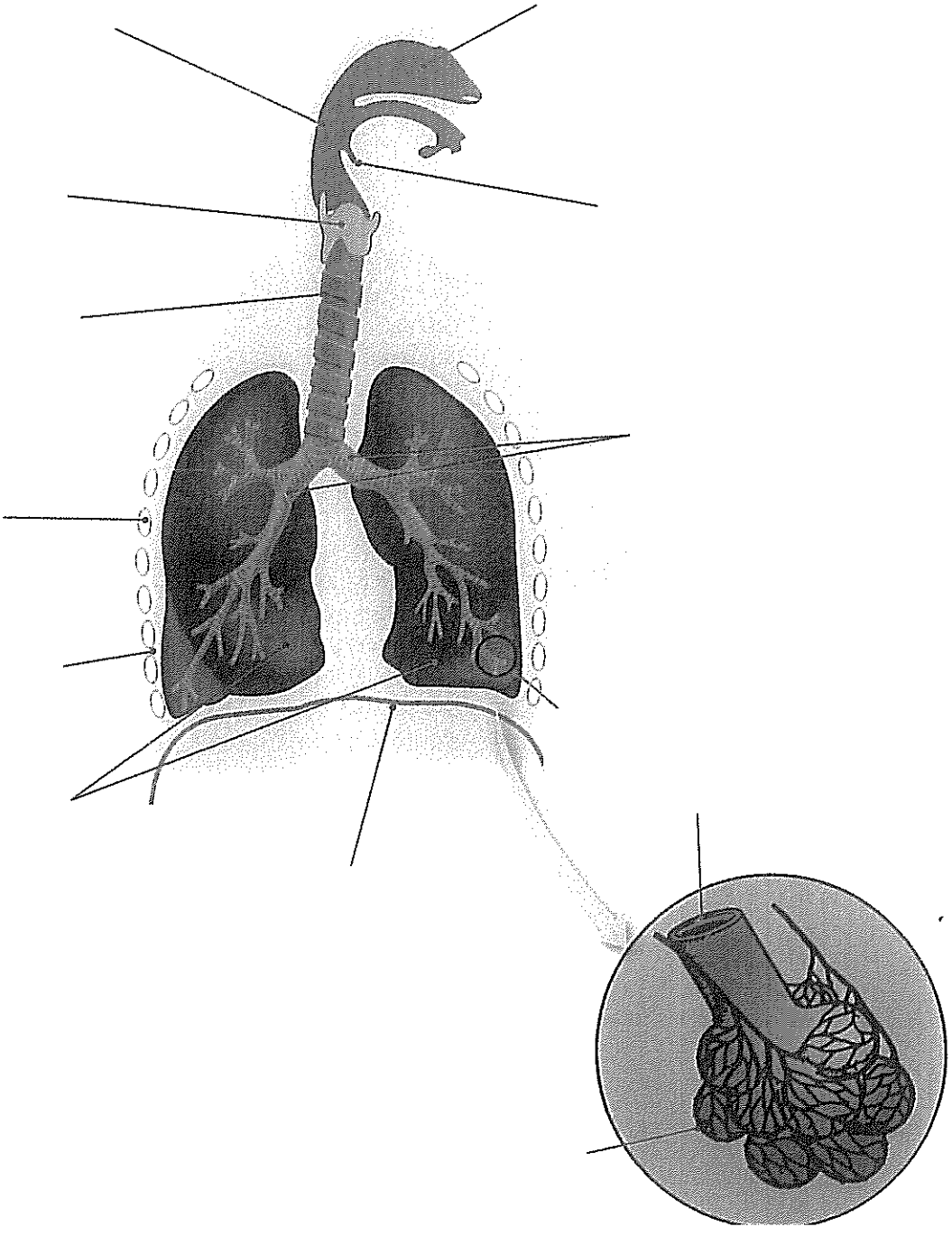
Role of lymphatic system



Chapter 8: The Respiratory System







Gas Exchange

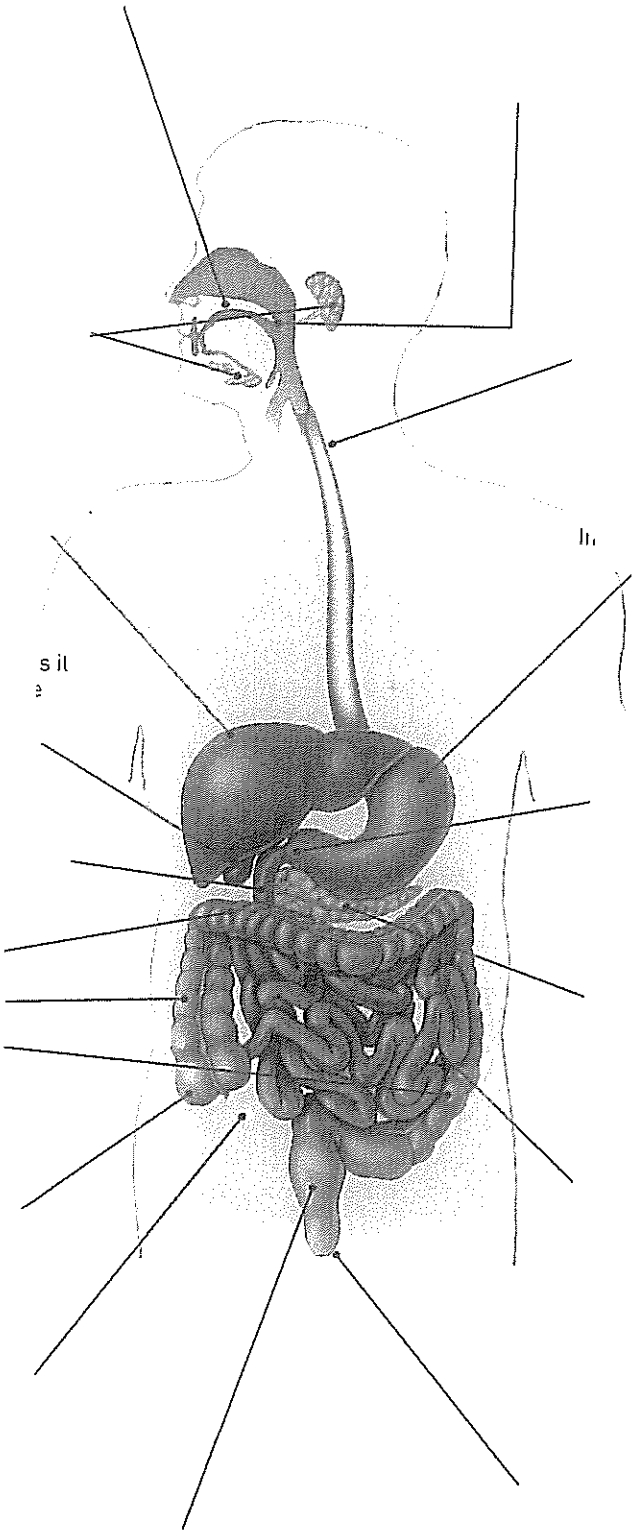
Effects of lifestyle and environment on gas exchange

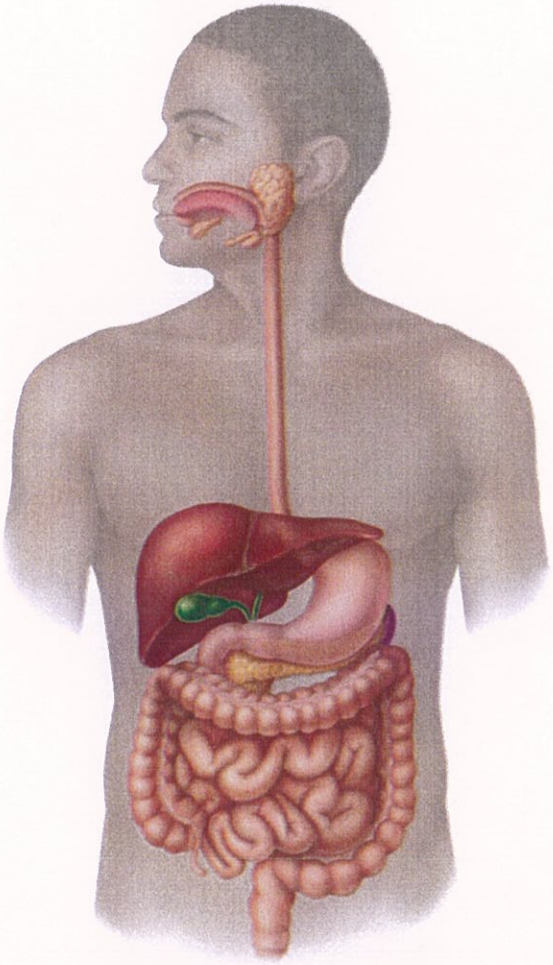
	Description
Emphysema	
Lung Cancer	
Lung Infections • Pneumonia • Tuberculosis	
Asthma	

Chapter 9: The Digestive System

Roles of digestive system

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____





DIGESTION OF NUTRIENTS

	ENZYME	ORIGIN	SUBSTRATE	END PRODUCT
Carbohydrates	Salivary Amylase	Mouth	Polysaccharide	Disaccharide
	Pancreatic Amylase			
	Intestinal enzymes: maltase, sucrase, lactase			
Protein/amino	Pepsin			
	Pancreatic Protease (trypsin)			
	Intestinal enzymes: peptidases			
Lipids/fats	Pancreatic Lipases			
	NON ENZYME Bile Salts			

Questions

1. Summarise the main nutrients that can be absorbed by the small intestine.

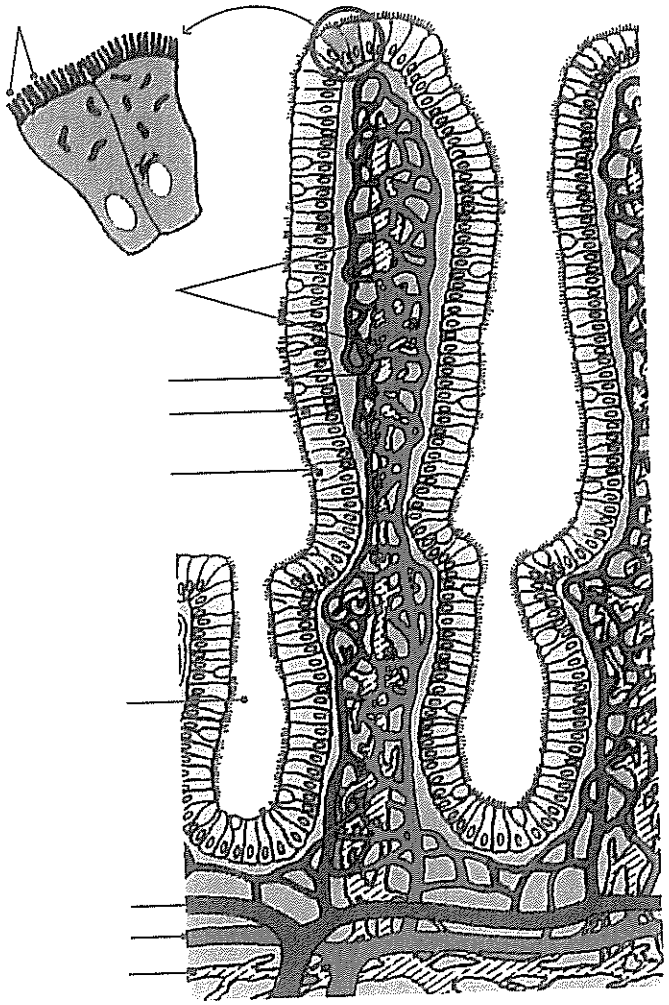
2. Describe how the nutrients are absorbed in the small intestine.

3. Describe where the nutrients go once they are absorbed and explain what happens when they reach their destination.

Required nutrients

Using your text book, pages 38-39 fill in the table below

Nutrients	Source	Function	Other information	Energy yield
Simple sugars				
Amino Acids				
Fatty acids				
Vitamins				
Minerals				
Water				



Villi absorb the digested food. Each villus is about 1 mm long. Inside the villus is a lymph capillary, called a lacteal, which is surrounded by a network of blood capillaries. Absorption is helped by muscular movements of the intestinal wall that keep the villi moving.

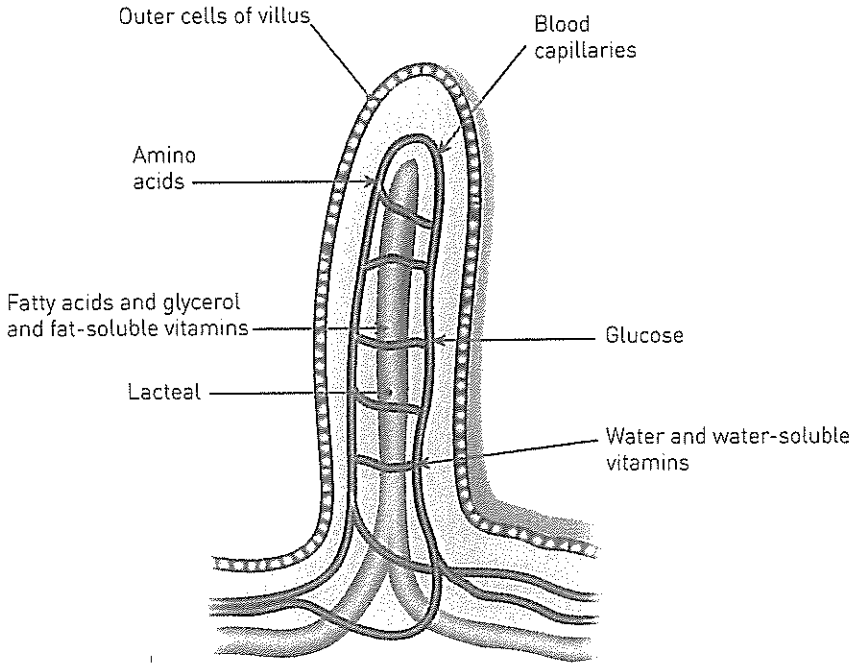


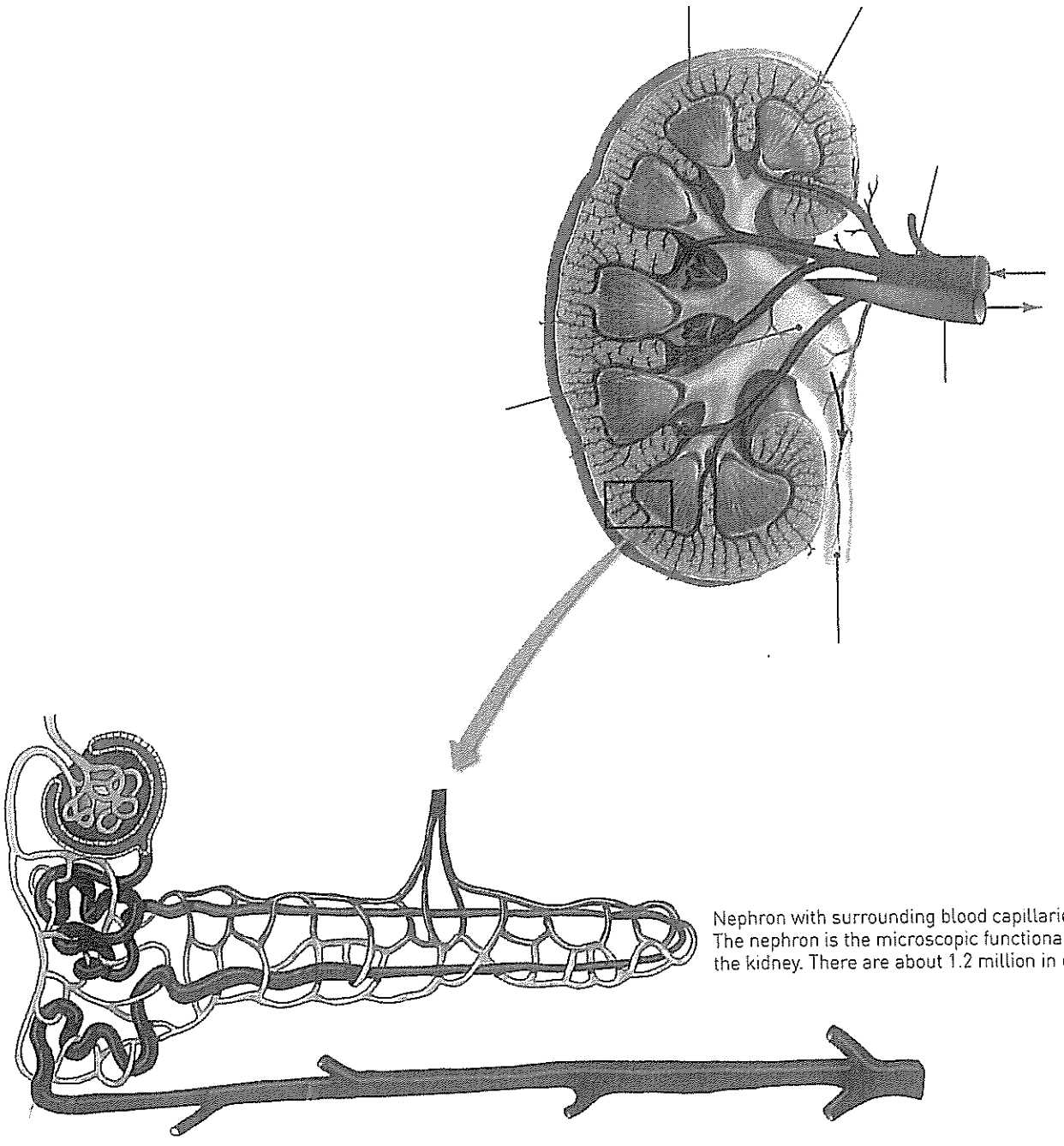
Figure 9.11 Some nutrients are absorbed into the blood capillaries and some into the lymph

Chapter 10: Removal of waste

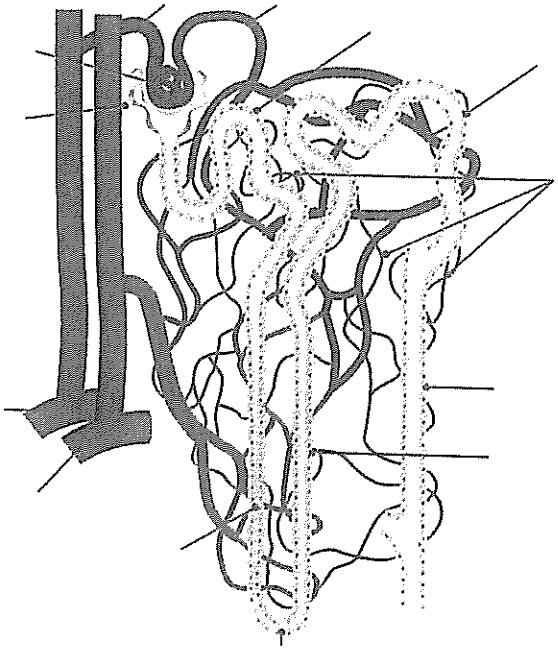
Organs involved in excretion

- _____
- _____
- _____
- _____
- _____

Liver Function



Nephron with surrounding blood capillaries.
The nephron is the microscopic functional unit of the kidney. There are about 1.2 million in each kidney.



Chapter 11: The musculoskeletal system- muscles

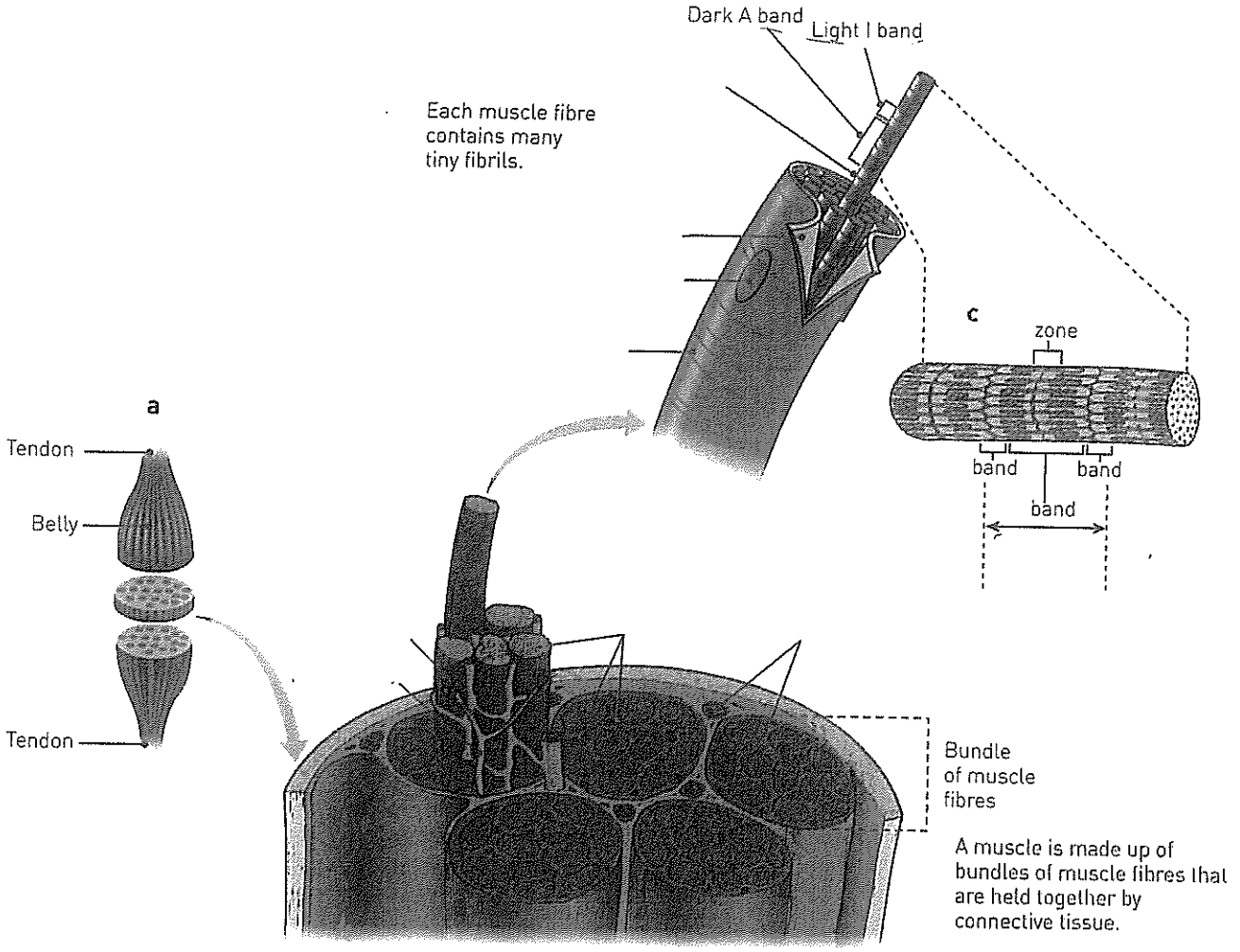
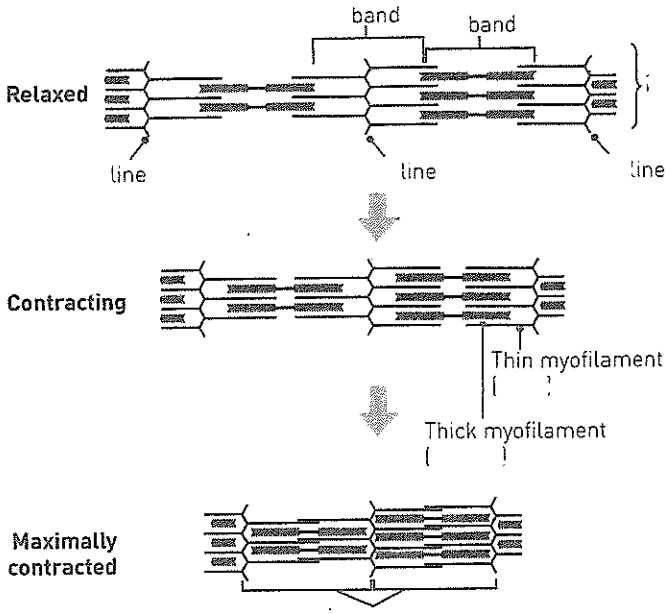


Figure 11.3 Skeletal muscle. **a** The entire muscle with the belly sectioned. **b** The section shown magnified. **c** Microscopic structure of an individual muscle fibre, showing the striated appearance of the fibre and myofibrils

Properties of skeletal muscles

1. _____
2. _____
3. _____

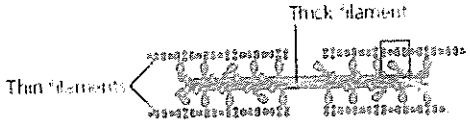
Sliding Filament Model

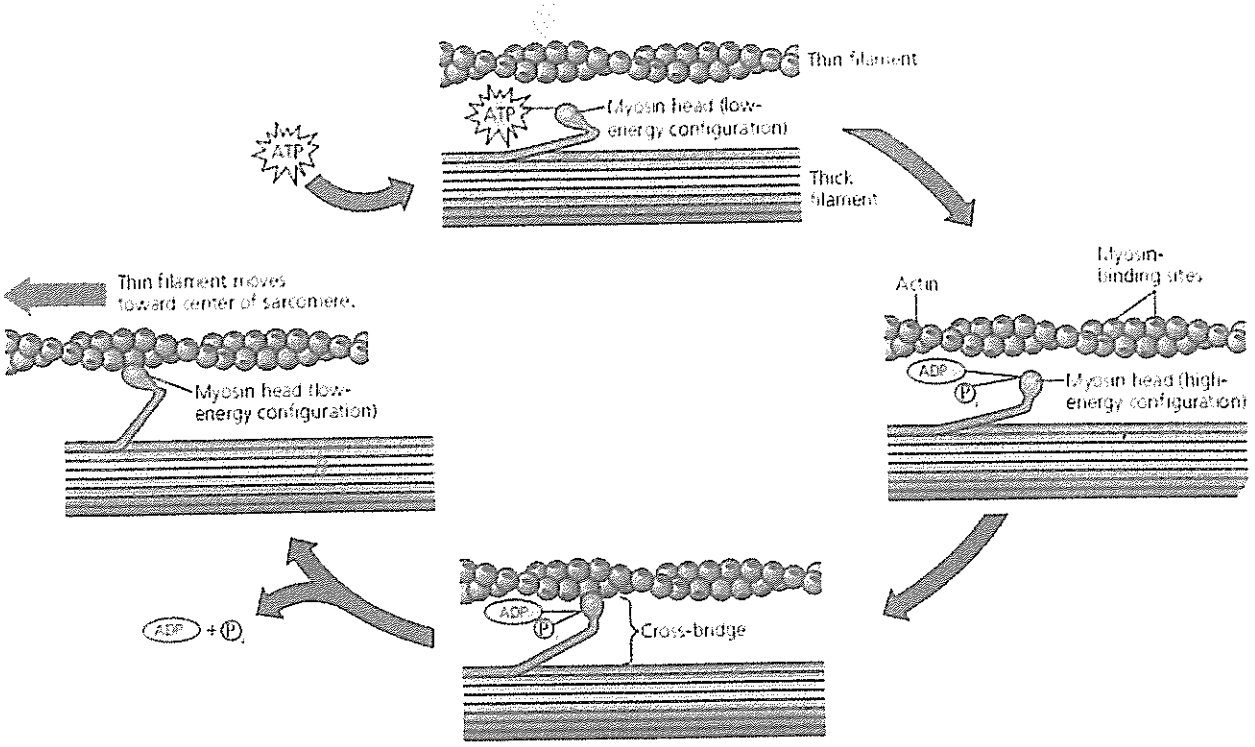


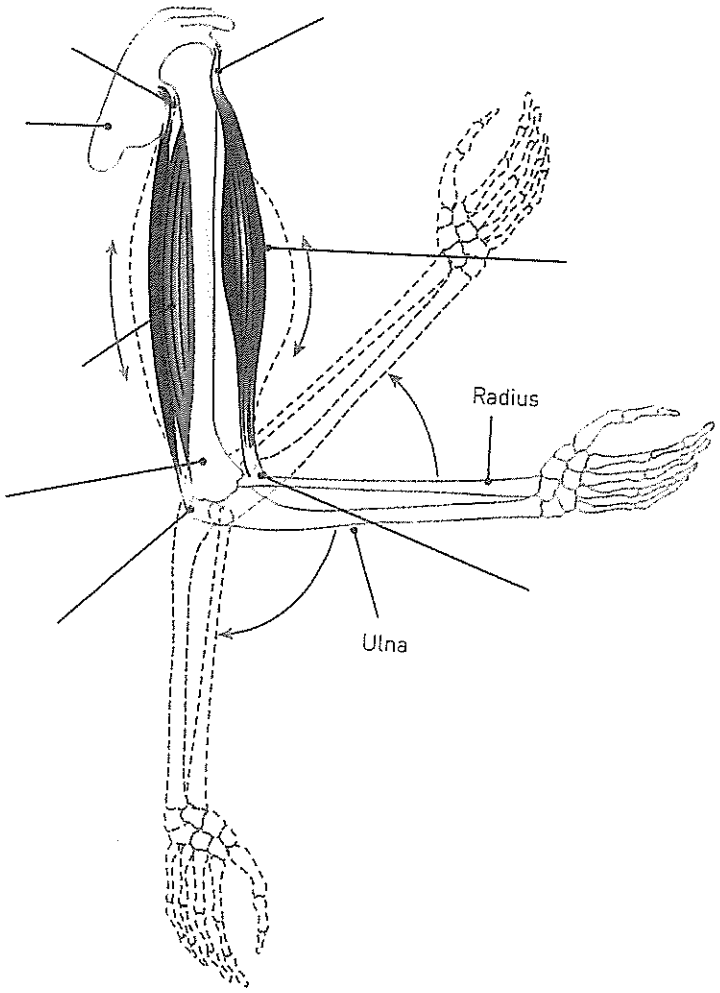
Two sarcomeres of a myofibril in a muscle in the relaxed position

As the muscle contracts, the actin and myosin filaments slide past one another. Notice how the Z lines are moving closer together.

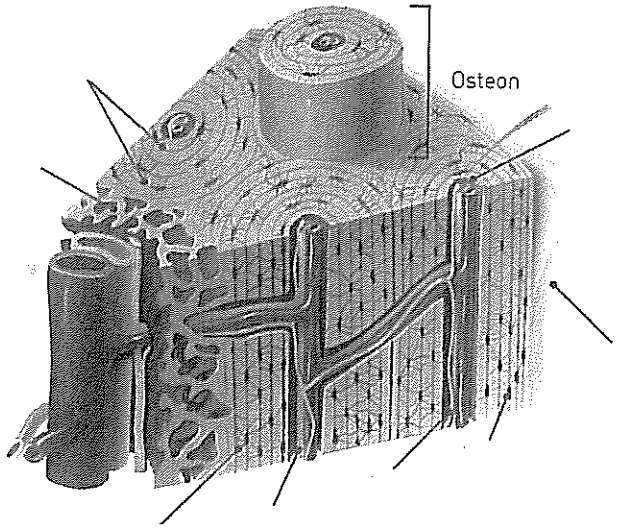
When the myofibril is at maximum contraction, the Z lines are much closer together but the actin and myosin filaments have not changed their length.

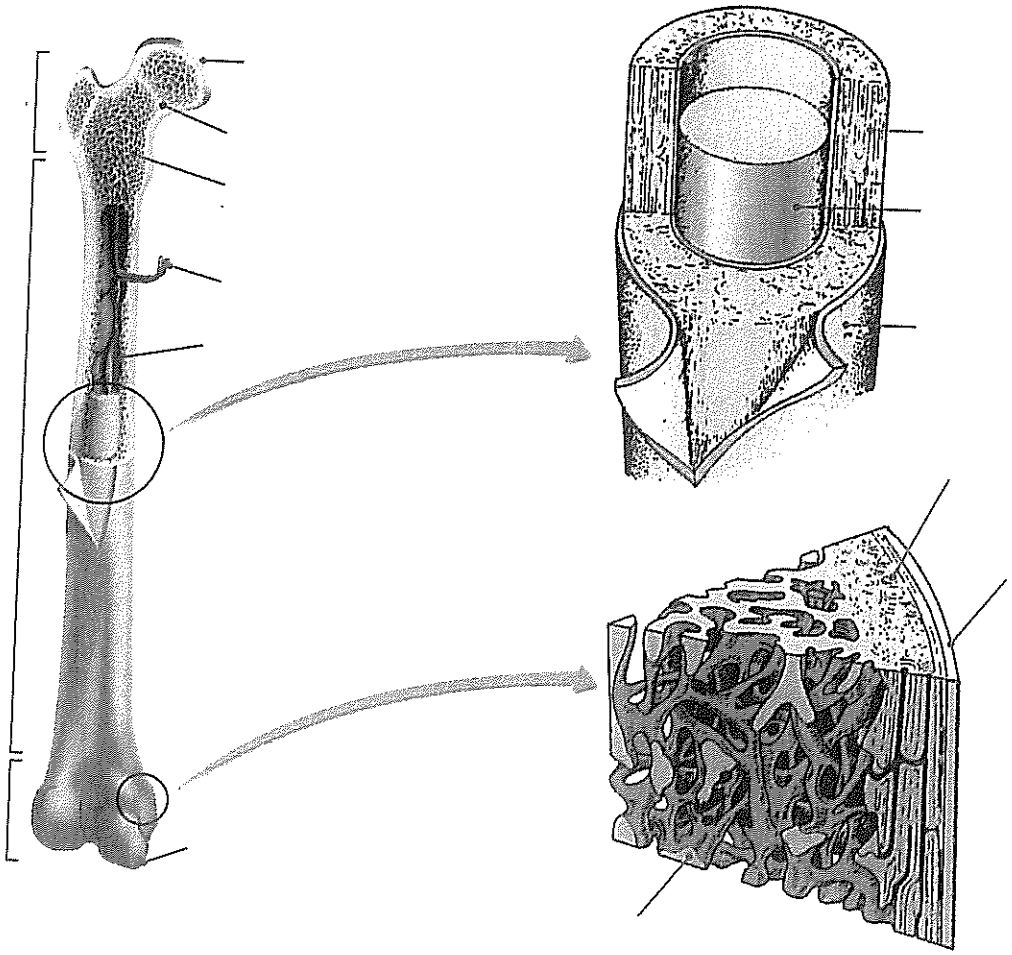




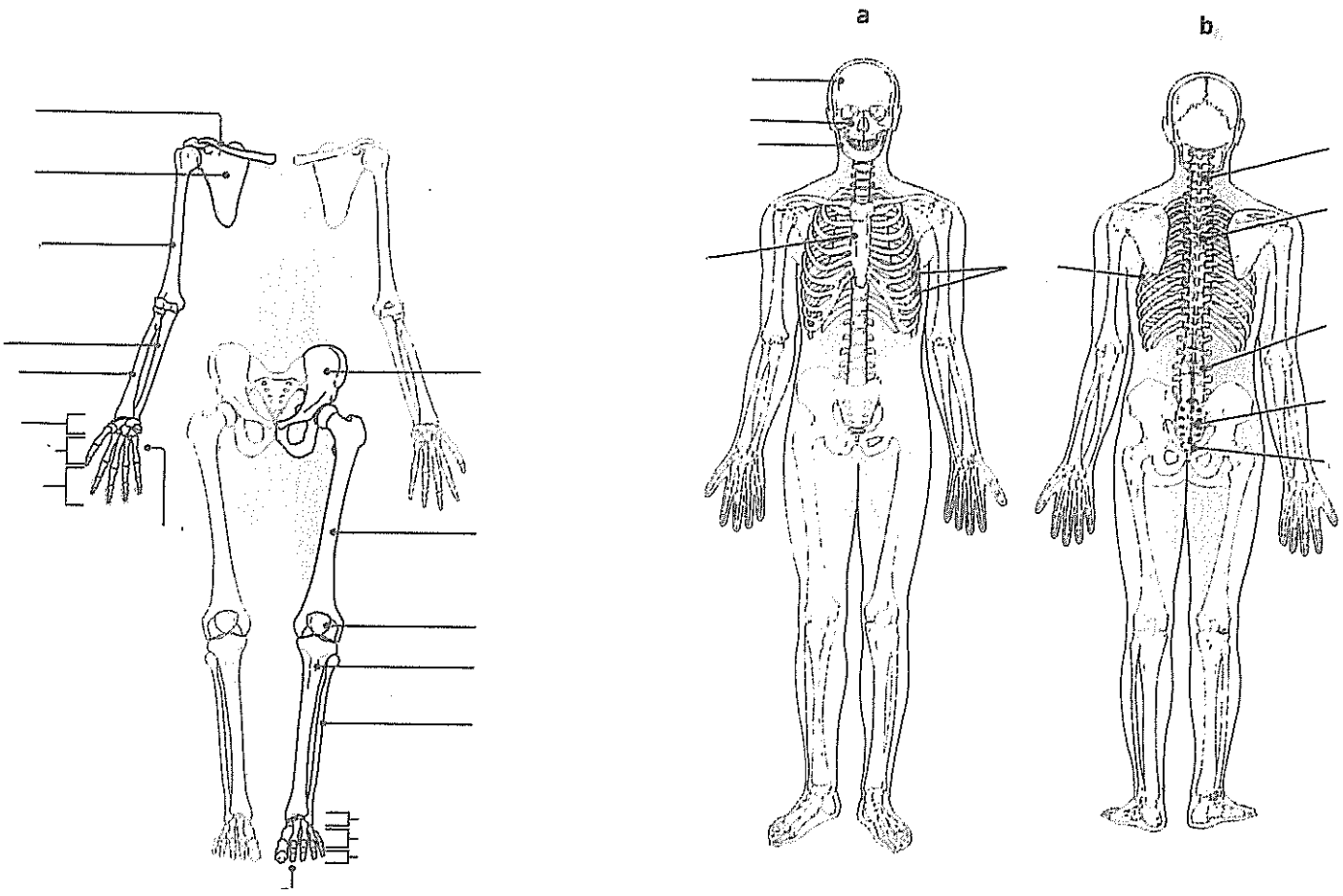


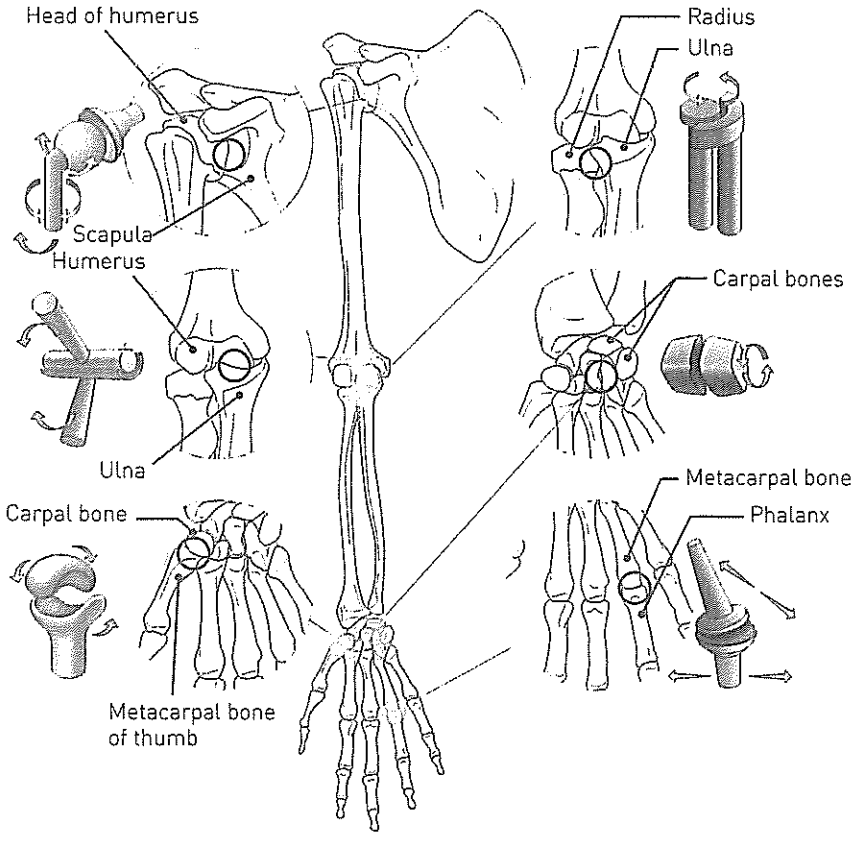
Chapter 12: The musculoskeletal system- skeleton





Cartilage	Structure	Function

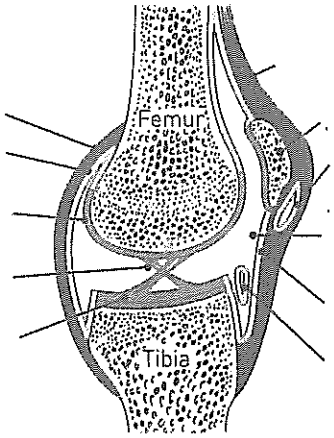

a
b


Head of humerus
Radius
Ulna
Scapula
Humerus
Carpal bones
Ulna
Metacarpal bone
Carpal bone
Phalanx
Metacarpal bone of thumb

Synovial Joints

Joint	Structure (Diagram)	Function	Where found

a



b