ENGLISH IN FOCUS

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I READING AND COMPREHENSION

1 The heart is a hollow, cone-shaped organ. 2 It is about the size of a fist and weighs approximately 230g. 3 The base of the heart, which is directed backwards, lies opposite the borders of the 5th, 6th, 7th and 8th thoracic vertebrae. 4 The apex is directed forwards, downwards, and to the left, and is located below the 5th left intercostal space in the mid-clavicular line. 5 In addition to the base and the apex, three surfaces are usually described: the sterno-costal, the left and the diaphragmatic. 6 The sterno-costal surface is limited by four borders, which are sometimes referred to as the borders of the heart.

(a) The heart lies opposite the borders of the 5th, 6th, 7th and 8th thoracic vertebrae.
(b) The apex of the heart lies above the base.
(c) The borders of the heart = the borders of the sterno-costal surface

7 The heart is essentially a hollow muscle. 8 The wall of the heart is made up of three layers of tissue. 9 A serous membrane, the pericardium, forms the outer covering of the heart. 10 The middle layer, the myocardium, is the heart muscle proper. 11 This consists of specialized cardiac muscle fibres. 12 Internally the heart is lined throughout with a serous membrane known as the endocardium.

13 The cavity of the heart is divided longitudinally into two parts by a thick septum. 14 Each side contains two chambers: a posterior chamber called the atrium, where the blood is received from the veins and collected, and a thickly muscular anterior chamber called the ventricle, which pumps the blood out again into the arteries. 15 The atria lie above the ventricles. 16 The base of the heart is formed mainly by the left atrium, and partly by the right atrium. 17 The apex is formed entirely by the left ventricle.

(d) The wall of the heart consists mainly of specialized cardiac muscle fibres.
(e) A vertical septum divides the heart.
(f) The heart contains four chambers.
(g) The ventricles lie inferior to the atria.
The heart pumps blood round two circuits: the pulmonary and the systemic. Blood flows into the right atrium from the superior and inferior venae cavae. It passes into the right ventricle, which pumps it out along the pulmonary artery to the lungs. There it is cleansed of carbon dioxide and re-oxygenated. It returns along the pulmonary veins to the left atrium, passes into the left ventricle, and is pumped out into the aorta.

The right ventricle pumps blood round the pulmonary circuit. Blood always enters the heart by veins and leaves the heart through arteries.

The pumping action of the heart is effected by rhythmic contraction of the muscle, and valves ensure that the blood is propelled in the right direction. The atria are separated from the ventricles by valves which allow the blood to pass freely from the atria into the ventricles, but prevent the blood from returning into the atria when the ventricles contract. These valves are formed by flaps of endocardium which hang down into the ventricles. When the ventricles are full of blood, the blood pushes the flaps upwards to close the orifices. The right atrio-ventricular orifice is closed by three flaps, known as the tricuspid valve. The mitral valve, which consists of two flaps, closes the left atrio-ventricular orifice. The semi-lunar valves, so called because of the half-moon shape of the flaps, lie at the ends of the ventricles, one between the right ventricle and the pulmonary artery, and one between the left ventricle and the aorta. These valves too prevent the reflux of blood and help to maintain the pressure necessary for circulation. When the blood pressure in the arteries exceeds the blood pressure in the ventricles, the flaps of the semi-lunar valves close.

The atrio-ventricular valves help to retain blood in the atria. There are three valves in the right atrio-ventricular orifice. The mitral valve is composed of a serous membrane. The semi-lunar valves prevent the blood pressure in the arteries from exceeding the blood pressure in the ventricles.

Solutions
(a) The base of the heart lies opposite the borders of the 5th, 6th, 7th and 8th thoracic vertebrae. (3) The base of the heart \( \neq \) the heart.
\( \therefore \) It is not true that the heart lies opposite the borders of the 5th, 6th, 7th and 8th thoracic vertebrae.

(b) The apex is directed downwards. (4) i.e. The apex lies below the base.
\( \therefore \) It is not true that the apex of the heart lies above the base.
(c) The sterno-costal surface is limited by four borders, which are sometimes referred to as the borders of the heart. (6)
\( \therefore \) the borders of the heart = the borders of the sterno-costal surface
(d) The heart is essentially a hollow muscle. (7)
\( \textit{i.e.} \) The wall of the heart consists mainly of muscle. The middle layer, the myocardium, is the heart muscle proper. (10) This consists of specialized cardiac muscle fibres. (11)
\( \therefore \) The wall of the heart consists mainly of specialized cardiac muscle fibres.
(e) The cavity of the heart is divided longitudinally . . . by a thick septum. (13)
\( \textit{i.e.} \) longitudinally = from bottom to top of the organ vertically = from bottom to top, with relation to the anatomical position (see Unit 3)
\( \therefore \) It is not true that a vertical septum divides the heart.
(f) The cavity of the heart is divided . . . into two parts. (13)
\( \textit{i.e.} \) Each side (= each part) contains two chambers. (14)
\( \therefore \) The heart contains four chambers.
(g) The atria lie above the ventricles. (15)
\( \therefore \) The ventricles lie below the atria.
\( \textit{i.e.} \) The ventricles lie inferior to the atria.
(h) The right ventricle . . . pumps it (blood) out along the pulmonary artery to the lungs. (20)
\( \textit{i.e.} \) The right ventricle pumps blood round the pulmonary circuit.
(i) It (blood) returns along the pulmonary veins to the left atrium. (22)
\( \textit{i.e.} \) The left atrium receives blood from the pulmonary circuit.
\( \therefore \) It is not true that the right atrium receives blood from the pulmonary circuit. (The right atrium receives blood from the venae cavae.) (see 19)
(j) Blood enters the right atrium by veins (the superior and inferior venae cavae). (see 19)
Blood enters the left atrium by veins (the pulmonary veins). (see 22)
Blood leaves the right ventricle by an artery (the pulmonary artery). (see 29)
Blood leaves the left ventricle by an artery (the aorta). (see 22). See also (14)
\( \textit{i.e.} \) Blood always enters the heart by veins and leaves the heart through arteries.
The atria are separated from the ventricles by valves which allow the blood to pass freely from the atria into the ventricles. (24)

i.e. The atrio-ventricular valves allow blood to pass freely from the atria.

.: It is not true that the atrio-ventricular valves help to retain blood in the atria.

(l) The right atrio-ventricular orifice is closed by three flaps, known as the tricuspid valve. (27)
   the three flaps = the tricuspid valve

i.e. There are three flaps, or one valve, in the right atrio-ventricular orifice.

.: It is not true that there are three valves in the right atrio-ventricular orifice.

(m) The mitral valve ... consists of two flaps. (28)
   The valves are formed by flaps of endocardium. (25)
   a serous membrane known as the endocardium (12)

i.e. The mitral valve is composed of endocardium, which is a serous membrane.

.: The mitral valve is composed of a serous membrane.

(n) When the blood pressure in the arteries exceeds the blood pressure in the ventricles, the flaps of the semi-lunar valves close. (31)

i.e. The semi-lunar valves close just after the blood pressure in the arteries exceeds the blood pressure in the ventricles.

.: It is not true that the semi-lunar valves prevent the blood pressure in the arteries from exceeding the blood pressure in the ventricles.

II USE OF LANGUAGE

EXERCISE A Contextual reference

Write the following sentences in your notebook, and complete them after studying the reading passage.
1. 'which' in sentence 3 refers to .......
2. 'which' in sentence 20 refers to .......
3. 'it' in sentence 22 refers to .......
4. 'these valves' in sentence 25 refers to .......
5. 'one' in sentence 29 refers to .......
6. 'these valves' in sentence 30 refers to .......

EXERCISE B Rephrasing

Rewrite the following sentences, replacing the words printed in italics with expressions from the reading passage which have the same meaning.
1. The heart is situated between the lungs.
2. The sinu-atrial node initiates heart action.
3. The heart muscle proper is referred to as the myocardium.
4. The endocardium lines the inside of the heart completely.
5. Blood flows along the pulmonary artery to the lungs.
6. Blood is purified in the lung capillaries.
7. The oxygenated blood enters the left atrium.
8. Blood in the contracting ventricle forces upwards the flaps of the tricuspid valve.
9. The arterial valves close when the pressure in the arteries is greater than the pressure in the ventricles.
10. The mitral valve prevents the return of blood into the left atrium.

EXERCISE C Relationships between statements

Place the following expressions in the sentences indicated, making any changes necessary.
(a) it should be noted that (5) (b) in fact (16) (c) on the other hand (17)
(d) then (20) (e) then (22) (f) for (31)

NOTE The arrows indicate the direction of blood flow.
(b) Write out the sentences below, completing them with reference to the diagram. Use the verbs pass or flow, and appropriate prepositions.

1. Blood ...... from the venae cavae into the ......
2. Blood ...... through the ...... the right ventricle.
3. Blood ...... out of the ...... the pulmonary artery.
4. It ...... the pulmonary artery ...... the lungs.
5. It returns ...... the lungs ...... the pulmonary ...... the left ......
6. It ...... valve ...... the left ventricle, which pumps it out ......

EXERCISE B The use of time expressions (i)

Different time expressions can be used to give the same meaning.

EXAMPLE
Blood fills the ventricle. Then the valve closes. (time adverbial)
= After blood fills the ventricle, the valve closes. (time conjunction)
= Blood fills the ventricle before the valve closes. (time conjunction)

Join each of the following pairs of sentences into a single sentence with the same meaning. Omit the time adverbial in italics, and choose a suitable time conjunction from the brackets at the end of the sentences.

EXAMPLE
Blood is pumped out by the left ventricle. Then it is carried to all parts of the body. (while, after)
= After blood is pumped out by the left ventricle, it is carried to all parts of the body.

1. Food is converted in the stomach to chyme. Then it passes through the pyloric sphincter into the duodenum. (after, until)
2. Food remains in the stomach. After some time it becomes chyme. (when, until)
3. Blood passes into the right atrium. Next it flows into the right ventricle. (before, as)
4. The lungs fill with air. At the same time the diaphragm descends and the thorax expands. (as soon as, until)
5. The blood is first reoxygenated and cleansed of carbon dioxide. Then it returns to the heart. (while, after)
6. Fat is absorbed through the wall of the intestine. Afterwards it is carried away in the lymph. (after, until)
7. The glucose is converted into glycogen. After that it remains in the liver until it is required. (after, until)
8. Food passes down the oesophagus in the form of a bolus. At the same time the oesophagus expands. (as, before)

9. The acid chyme is made more alkaline in the duodenum. During this process the pyloric sphincter remains closed. (after, while)
10. Arterial pressure exceeds ventricular pressure. Immediately the semi-lunar valves close. (before, as soon as)

EXERCISE C The use of time expressions (ii)

Compare the following sentences with the sentences in Exercise B. In each case, write 'same meaning' or 'different meaning' in your notebook.

EXAMPLE
Blood is pumped out by the left ventricle as soon as it is carried to all parts of the body.—different meaning.

1. Food is converted in the stomach to chyme before it passes through the pyloric sphincter into the duodenum.
2. Food becomes chyme and remains in the stomach. Before blood passes into the right atrium, it flows into the right ventricle.
3. The lungs fill with air, and simultaneously the diaphragm descends and the thorax expands.
4. Blood returns to the heart and then it is reoxygenated and cleansed of carbon dioxide.
5. As soon as fat is carried away in the lymph, it is absorbed through the wall of the intestine.
6. The glucose is converted into glycogen and it remains in the liver until it is required.
7. After the oesophagus expands, food passes down it in the form of a bolus. When arterial pressure exceeds ventricular pressure, the semi-lunar valves close.

EXERCISE D Listing (ii)

In medical writing, the following is a very common sentence pattern:
There are X parts: a, b, c, and d.

EXAMPLES
(a) There are four valves in the heart: the mitral valve, the tricuspid valve, the pulmonary valve and the aortic valve.
(b) The heart pumps blood round two circuits: the pulmonary and the systemic.
(c) Each side of the heart contains two chambers: a posterior thin-walled chamber called the atrium, and an anterior chamber which is more thickly muscled and is known as the ventricle.

Notice that in this sentence pattern

(i) the first part of the sentence contains a number; this is the number of items listed in the second part of the sentence.
(ii) the first part of the sentence is divided from the second part by a colon.
(iii) the second part of the sentence (i.e. the list) contains no main clause.
   Items may be qualified: e.g. by adjectives, relative clauses or short-form relative clauses.

Make each of the following short paragraphs into a sentence of the pattern illustrated above. Fill in the number and use a colon. Make any changes necessary, so that there are no main clauses within the list.

EXAMPLE

The skin consists of ... layers. The epidermis, or surface layer, is composed of epithelial tissue. The dermis, or deeper layer, is composed of connective tissue.

= The skin consists of two layers: the epidermis, or surface layer, composed of epithelial tissue, and the dermis, or deeper layer, which is composed of connective tissue.

NOTE
If items seem very long, they may be separated by semi-colons instead of commas.

1. The heart is divided into ... cavities. These are the right atrium, the right ventricle, the left atrium and the left ventricle.
2. The adrenal glands consist of ... parts. These are the outer part, or cortex, and the inner part, or medulla.
3. The heart is usually considered to have ... surfaces. These are the sternocostal surface, the left surface, and the diaphragmatic surface.
4. The oesophagus is made up of ... layers of tissue. There is an inner mucous coat. Next there is a submucous coat which contains large blood vessels and nerves. Then there is a layer of muscle. Finally there is a coat of fibrous connective tissue.
5. The stomach consists of ... parts. There is a large vertical portion on the left. A smaller transverse portion lies below it and to the right.
6. ... layers of tissue form the heart wall. A serous membrane, known as the pericardium, forms the outer surface. The myocardium or heart muscle makes up the main part of the wall. The endocardium, another serous membrane, forms the inner surface.

7. The normal skeleton is made up of ... bones. There are 86 pairs of bones. In addition, there are 34 single bones.
8. There are ... kinds of tongue papillae. The filiform papillae are found all over the tongue. The fungiform papillae lie on the top and side of the tongue. The circumvallate papillae are situated at the base of the tongue.
9. The heart is supplied with ... sets of nerve fibres. One set runs from the medulla oblongata in the vagus nerve. The second set runs from the sympathetic ganglion at the base of the neck.
10. There are ... pairs of salivary glands. The parotid glands are in front of each ear. The submaxillary glands are beneath the mandible. The sublingual glands lie beneath the tongue.
11. The stomach wall consists of ... coats. There is an outer serous lining known as the peritoneum. Next is a coat of muscle fibres, and then a submucous coat. The submucous coat connects the muscular layer to the innermost layer, which is a thick coat of mucus.
12. There are ... types of muscular tissue. Plain muscle is the simplest kind. It is found in the walls of hollow viscera and of blood vessels. Striated muscle is composed of more specialized fibres. These are usually arranged in bundles. Cardiac muscle is structurally intermediate between plain muscle and striated muscle.

EXERCISE E Compound adjectives

An important feature of medical terminology is the compound adjective made up from two nouns. The first part usually ends in -o and the second part has an adjectival ending.

EXAMPLES
the atrio-ventricular valves (atrium + ventricle)
the coraco-acromial arch (coracoid process + acromion)
the tracheo-bronchial lymph glands (trachea + bronchi)

Both parts of the compound adjective must be derived from Latin or Greek. Notice that the nouns in the brackets above are all directly derived from Latin or Greek. When the noun is not directly derived from Latin or Greek (e.g. rib, liver) then the corresponding Latin or Greek stem must be used to make up the adjective.

EXAMPLES
the costo-diaphragmatic recess (rib + diaphragm)
rib: Lat. cost-
the hepato-colic ligament (liver + colon)
liver: Gr. hepat-
Write out the following sentences, completing the compound adjective in each case.

1. The surface facing the sternum and ribs is known as the ...-costal surface.
2. The joint between the acromion and the clavicle is called the ...-clavicular joint.
3. The joint between the sternum and the clavicle is called the ... joint.
4. The ligament between the ribs and the clavicle is called the ... ligament. (rib: Lat. cost-)
5. The pouch between the rectum and the uterus is referred to as the ... -uterine pouch.
6. The valve between the ileum and the colon is known as the ... -colic valve.
7. The fold round the stomach and the pancreas is called the ...-pancreatic fold. (stomach: Gr. gastr-)
8. The flexure made by the duodenum and the jejunum is known as the ... -jejunum flexure.
9. The joint between the sacrum and the ilium is referred to as the ... -iliac joint.
10. The joints between the carpals and the metacarpals are known as the ...-metacarpal joints.
11. The joints between the tarsals and the metatarsals are known as the ... joints.
12. The cavity of the nose and the pharynx is named the ... -pharyngeal cavity. (nose: Lat. nas-)
13. The nerve supplying the tongue and the pharynx is known as the ... nerve. (tongue: Gr. gloss-)
14. The fascia of the cheek and the pharynx is referred to as the ... fascia. (cheek: Lat. bucc-)
15. The joint between the sacrum and the coccyx is called the ... -coccygeal joint.
16. The joint between the radius and the ulna is known as the ... -ulnar joint.
17. The junction of the ileum and the caecum is called the ... -caecal junction.
18. The opening between the pleura and the peritoneum is known as the ... -peritoneal opening.
19. The canal between the pericardium and the peritoneum is called the ... canal.
20. The ligament joining the sternum and the pericardium is known as the ... -pericardial ligament.
21. The opening between the pleura and the pericardium is known as the ... opening.
22. The ligaments between the ribs and the pericardium are called the ... ligaments. (rib: Lat. cost-)

III INFORMATION TRANSFER

1. Look at the following diagram. Write out the paragraph and complete it with reference to the diagram.

   **Osmosis in a capillary (systemic circuit)**

   As the blood ... from the arterial ... to the ... of the ..., the ... pressure decreases. In this example, it ... from ... mm of mercury to ... mm. The ..., however, remains constant at ... mm. At the arterial end, the ... exceeds the ... by ... mm, and so fluid passes out of the capillary into the ... At the ... end, the ... is less than the ... by ... mm, and so approximately the same amount of ... passes out of the ... into the ... Thus the difference in pressures causes the ... through the ... 

2. Look at the following diagram. Write out the paragraph and complete it with reference to the diagram. The paragraph you have just written in section 1 should help you.

   **Osmosis in a capillary (in oedema)**
As the blood ...... from ...... to ...... of ......, the hydrostatic pressure ...... In this example, it ...... The ......, however, remains ...... 40 mm. At the ......, the hydrostatic pressure ...... by ...... and so fluid ...... At the ......, the hydrostatic pressure ...... by ......, and so a smaller amount of fluid returns to the ...... Thus excess fluid collects in the ......

3. Look at the following diagram and write a paragraph showing how osmosis in a pulmonary capillary keeps the tissue of the lungs free from fluid. The paragraphs you have just written in sections 1 and 2 should help you.

Osmosis in a capillary (pulmonary circuit)

As ......, the hydrostatic pressure ...... constant at ...... mercury. The osmotic pressure ...... The osmotic pressure ...... the hydrostatic pressure all along the capillary, and so ...... passes out of the ...... No fluid returns ...... Thus the tissue of the lungs is kept free from ......

4. Look at the following diagram and write a paragraph showing how in left ventricular failure the tissue of the lungs becomes saturated in fluid.

Osmosis in a pulmonary capillary (in left ventricular failure)

IV GUIDED WRITING

STAGE 1 Sentence and paragraph building

Make a paragraph from the following list of short sentences. You may retain some sentences as they are; other sentences may be joined together using therefore, when, until or as. Your paragraph should contain about 16 sentences.

The sentences are already in a logical order, but you may want to change the order when you are combining them.

A complete heart beat lasts approximately 0·8 second.
For about 0·4 second the heart is relaxed.
This is known as the period of diastole.
During the period of diastole the atrio-ventricular valves are open.
The arterial valves are closed.
The heart fills with blood.
At the same time the heart expands from its previous contraction.
Blood flows into the two atria.
It flows through the open atrio-ventricular valves.
It flows into the two ventricles.
Then the period of systole begins.
The atria both contract.
They force more blood into the ventricles.
The phase of atrial systole lasts about 0·1 second.
The impulse to contract is conducted along the bundle of His to the ventricles.
The period of ventricular systole begins.
It lasts about 0·3 second.
The ventricles begin to contract.
The atrio-ventricular valves are closed by the upward movement of the blood.
The ventricular pressure rises.
The ventricular pressure is greater than the pressure in the aorta and the pulmonary artery.
Then the arterial valves open.
The contraction continues.
Blood is ejected from the ventricles into the arteries.
At the end of the period of systole, the ventricles begin to relax.
The ventricular pressure drops below the arterial pressure.
The arterial valves close.
Almost immediately the ventricular pressure becomes less than the atrial pressure.
The atrio-ventricular valves open.
The period of diastole begins again.

Re-read your paragraph and make sure it is coherent. Then check it with the relevant paragraph in the Free Reading section. Remember that more than one version is possible.
Certain parts of the myocardium have the special function of controlling heart action. A small collection of these specialized cardiac muscle fibres, known as the sinus-atrial node, is found in the wall of the right atrium, near the entrance of the veins cavae. The sinus-atrial node acts as a pacemaker, initiating the phase of contraction and controlling its regularity. Another collection of specialized heart muscle, often referred to as the bundle of His, passes from the septal wall of the right atrium down the septum into both ventricles, transmitting to the ventricles the impulse from the atrium. Thus the rhythm of ventricular contraction is made to follow the rhythm of atrial contraction.

A complete heart beat lasts approximately 0.8 second. For about 0.4 second the heart is relaxed. This is known as the period of diastole. During the period of diastole, the atrio-ventricular valves are open and the arterial valves are closed. The heart therefore fills with blood at the same time as it expands from its previous contraction. Blood flows into the two atria and through the open atrio-ventricular valves into the two ventricles. Then the period of systole begins. The atria both contract, forcing more blood into the ventricles. The phase of atrial systole lasts about 0.1 second. The impulse to contract is conducted along the bundle of His to the ventricles and the period of ventricular systole, lasting about 0.3 second, begins. When the ventricles begin to contract, the atrio-ventricular valves are closed by the upward movement of the blood. The ventricular pressure rises until it is greater than the pressure in the aorta and the pulmonary artery. Then the arterial valves open and, as the contraction continues, blood is ejected from the ventricles into the arteries. At the end of the period of systole, the ventricles begin to relax, the ventricular pressure drops below the arterial pressure, and the arterial valves close. Almost immediately the ventricular pressure becomes less than the atrial pressure, the atrio-ventricular valves open, and the period of diastole begins again.

Since all of the blood goes round both the pulmonary and the systemic circuits, the same amount of blood must be pumped out by each ventricle. The volume pumped out by one ventricle at a single beat (the stroke volume) varies from about 70 cc at rest to about 200 cc during exertion. The left ventricle, which propels blood round the whole body, has to pump with much more force than the right ventricle, which sends blood only to the lungs and back. The left ventricle in fact pumps at a pressure of about 120 mm of mercury, while the right ventricle pumps at about 25 mm.

Although the stroke volume does increase during exertion, the volume of blood pumped out per minute is more significantly increased by a faster rate of heart beat. The normal heart rate, with each beat lasting about 0.8 second, is about 70 beats per minute. This can be increased when necessary to about 200 beats per minute, with the result that cardiac output can vary from 5 litres per minute at rest to as much as 40 litres per minute. When the heart rate is increased, it is the diastolic phase in particular which is shortened.