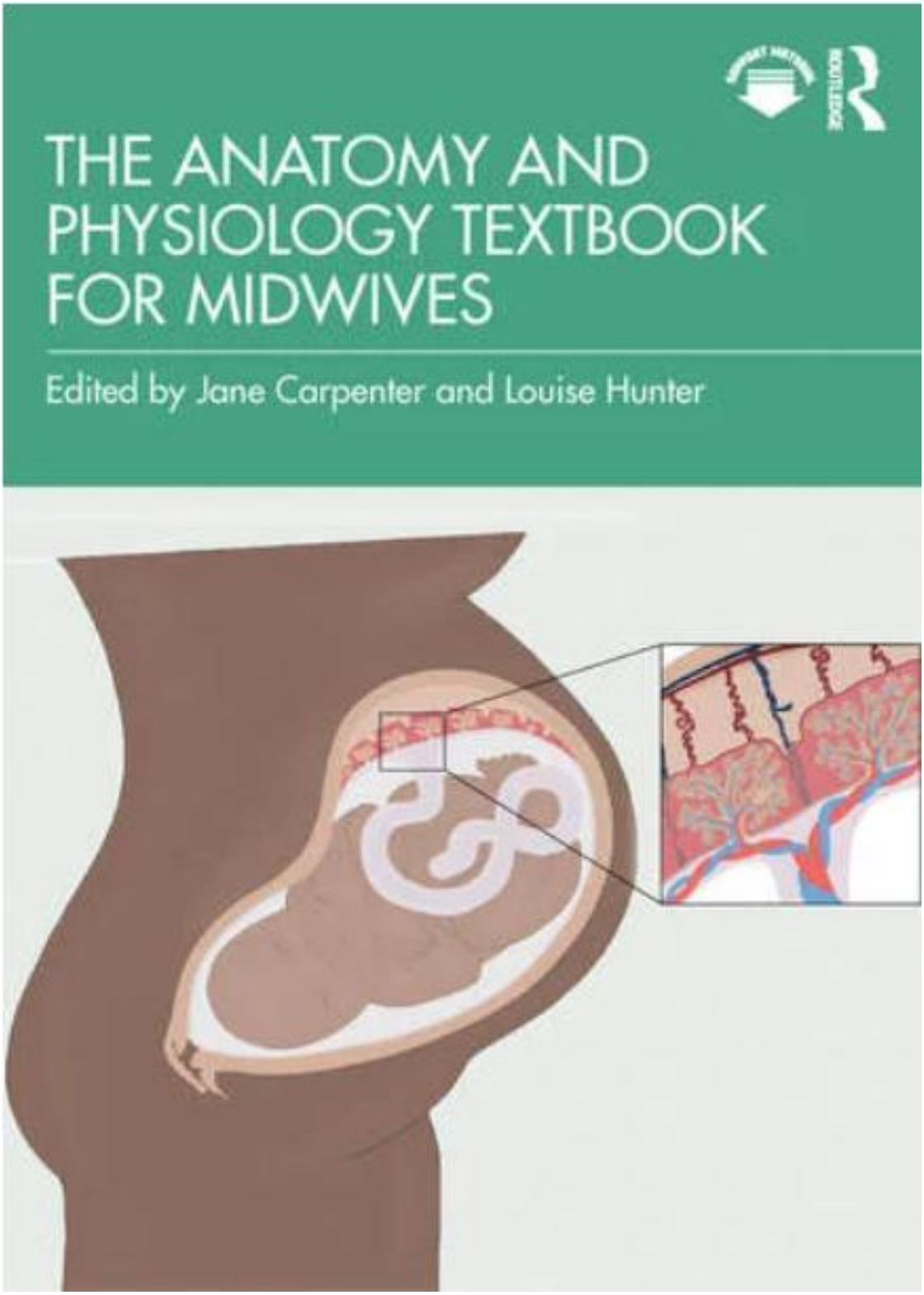
Name / Student Number:



Accompanying Workbook

Dr Jane Carpenter and Dr Louise Hunter

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Introduction to the Workbook

This workbook is intended to be used alongside the Anatomy and Physiology Textbook for Midwives by Carpenter and Hunter (2025). For ease, the workbook follows the Section and Chapter headings of the book, but here, each section or chapter number is prefaced with a W. This workbook will help you to consolidate your learning from the textbook by giving you various activities to complete based on its content.

A similar workbook has been in use for the midwifery programmes at Oxford Brookes University for several years alongside the Year 1 module covering the content. This enables students to have an additional means by which to embed their learning after the taught sessions. It has been very highly evaluated each and every year, so when writing the textbook, it seemed natural to create a workbook for use alongside the textbook. In order to ensure that *all* students who access the textbook can also benefit from the workbook, it is not sold as a separate entity. Instead, it is freely available to download from the book's webpage. We are passionate midwifery educators, and passionate about the anatomy and physiology of childbearing – therefore we want all students to benefit from as much support as possible for *your* learning on your journey into midwifery!

The workbook has been very carefully designed to work alongside, and in conjunction with, the main textbook. It may be possible to complete sections using other texts – but the idea is that you use the textbook, alongside any taught lectures, seminars and practical sessions, to complete the workbook content and consolidate your learning. There are various activities for you to complete, from labelling diagrams to filling in the gaps, or explaining concepts in your own words. Interrupters in the main textbook will direct you to complete tasks in the workbook as you go.

The main textbook and this accompanying workbook are mainly aimed at midwifery students in the UK and more widely. However, it is also expected that content will be useful to practicing midwives as well as many other health professions as well.

We hope you enjoy the main textbook, and learning the key anatomy and physiology for midwifery. We also hope that this accompanying workbook is a useful way for you to consolidate your learning – and that it travels with you throughout your future studies and throughout your midwifery (or other) career!

Jane Carpenter and Louise Hunter

SECTION W1:
The foundations for life

W1.1: The Human Cell

Use pages 3-8 of the main textbook to help you with this section.

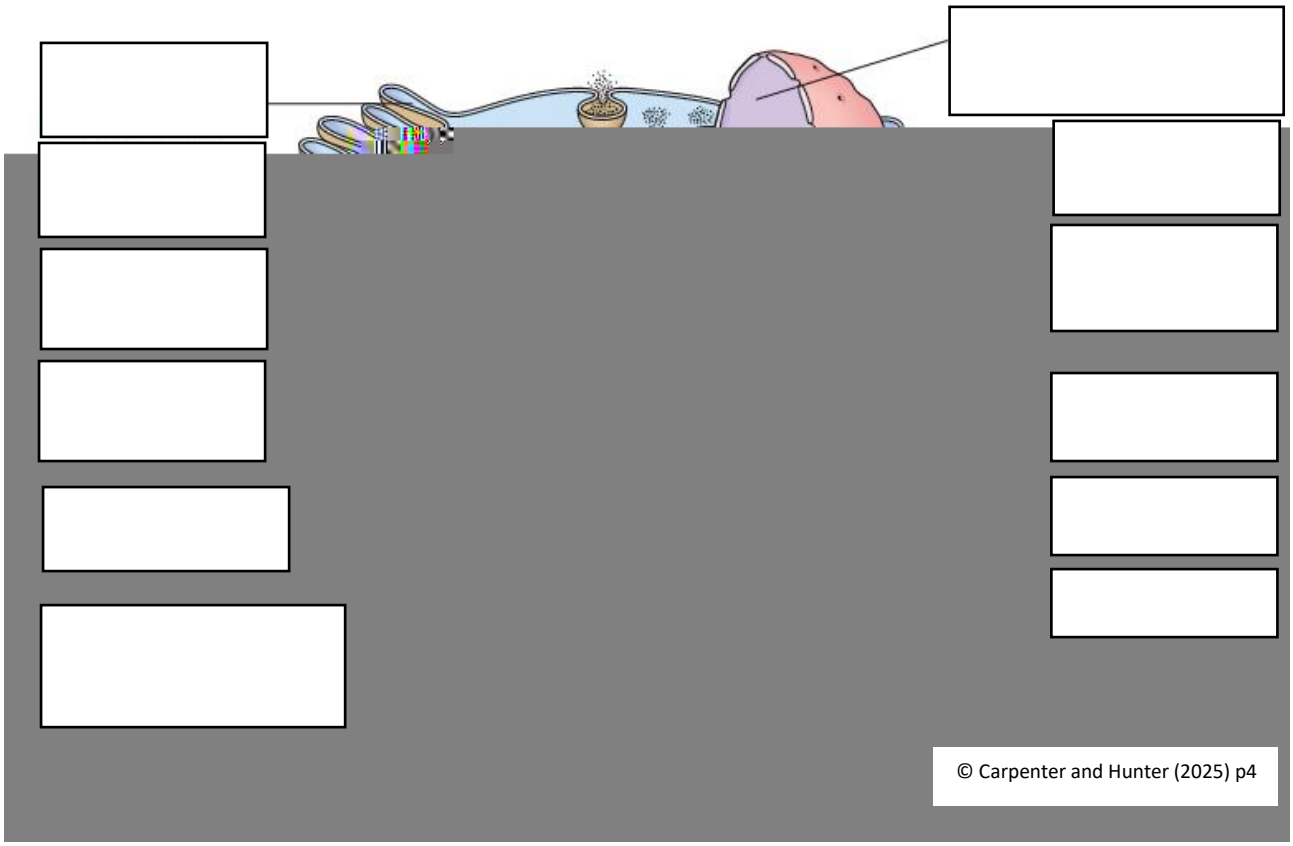
The Cell

The cell is the most fundamental structural and functional unit of any living organism. All living organisms are made up of at least one cell, making them the essential requirement for life.

Cells which make up animals, plants and fungi are _____.

Cells of bacteria are _____.

Label the key structures and organelles in the diagram of a **composite cell** below:



Female reproductive system

Label the figure of the external female genitalia, below:

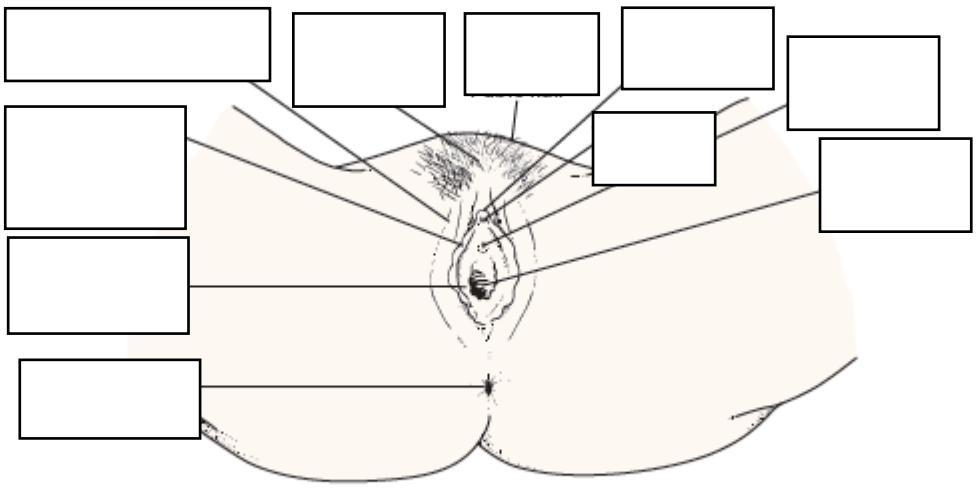


Figure 2.3.5 External female genitalia
Source: Figure 14.6, p.258, David Sturgeon (2018)

© Carpenter and Hunter (2025) p60

Label the figure of the internal reproductive organs, below. Also familiarise yourself with the sagittal view shown on page 61 of the main textbook to understand the location of these organs (outside of pregnancy):

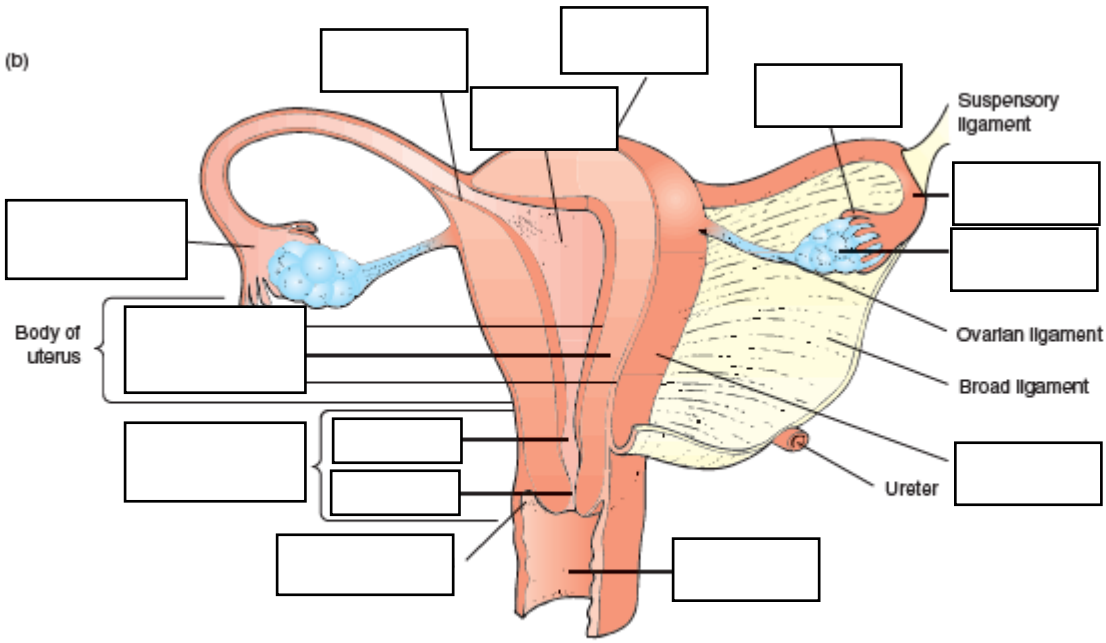


Figure 2.3.6 The female reproductive organs: a) sagittal section; b) frontal section
Source: Figure 18.7, p.494, Clancy and McVicar (2009)

© Carpenter and Hunter (2025) p61

Make your own key notes on the main components of the female reproductive system below:

Component	**Notes**
Uterus	
Cervix	
Vagina	
Uterine tubes	
Ovaries	

The female reproductive cycle

Within the female reproductive cycle there are two cycles at play, the

o_____ c_____ and the u_____ c_____

- both of which are controlled by h_____.

Fill in the gaps in the table below to understand the hormones of the female reproductive cycle. Use page 68 of the main textbook to help you:

Hormone	Source	Initiation	Main effects
Gonadotrophin releasing hormone (GnRH)			Stimulates FSH synthesis and secretion, stimulates LH synthesis
		Stimulated by GnRH, inhibited by inhibin	Stimulates follicle development, oestrogen production, oocyte maturation
Luteinising hormone (LH)	Anterior pituitary gland		
	Ovarian follicles, corpus luteum		Stimulates LH secretion and increases GnRH pulses (at high levels), maintains secondary sex characteristics and behaviour, stimulates endometrial growth
Progesterone	Ovarian follicle, corpus luteum		
Inhibin			Inhibits FSH secretion
	Corpus luteum	Stimulated by LH	

Process of oogenesis and follicle development in the ovary

The figure below gives an overview of oogenesis and maps this against the development of follicles in the ovary. Use the blank column to explain this process in your own words. Pages 65-67 of the main textbook will help you.

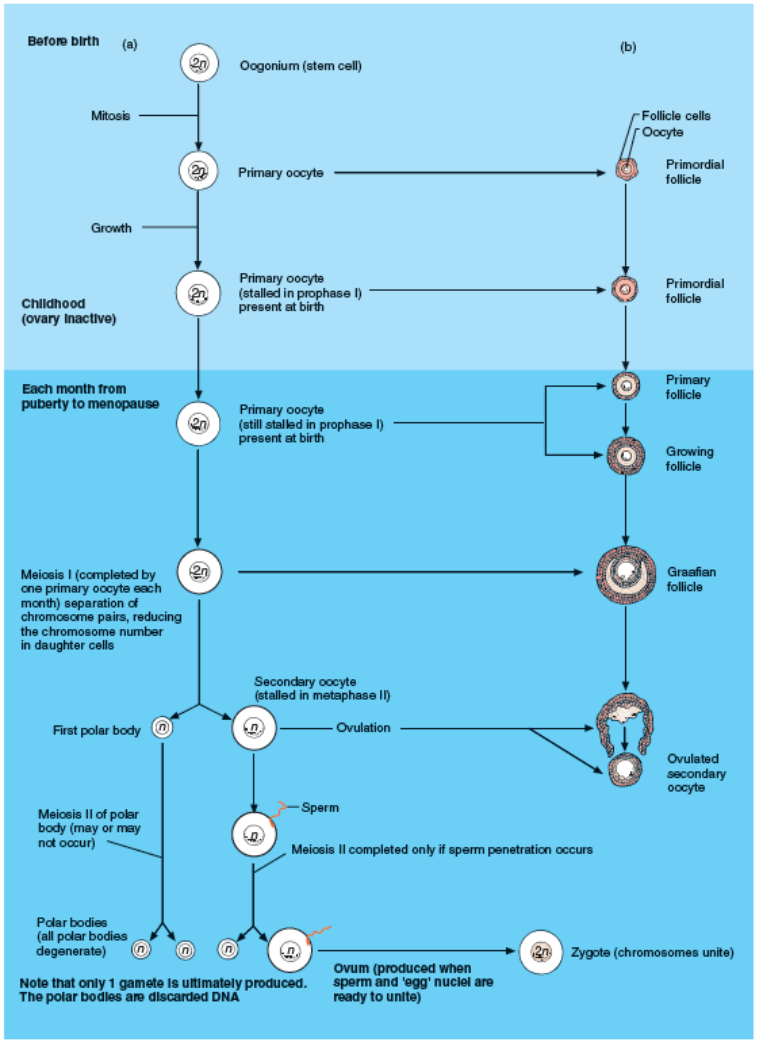


Figure 2.3.8 a) Process of oogenesis (2n = diploid, n = haploid); b) Follicle development in the ovary
Source: Figure 18.13(a), (b), p.504, Clancy and McVicar (2009) © Carpenter and Hunter (2025) p66

The ovarian cycle

There are three phases of the ovarian cycle.

What is the main function of the ovaries?

Use the boxes below to **briefly** describe what happens during the three phases. Include the terms written in bold in each of your dfescriptions. Use pages 68-70 of the main textbook to help you.

Phase 1: Follicular phase

Oestrogens, progesterone, gonadotropin releasing hormone (GnRH), hypothalamus, Follicle stimulating hormone (FSH), Luteinising hormone (LH), antrior pituitary gland, tertiary follicles, inhibin

Phase 2: Ovulation

Surge, LH, day 12-13, meiosis I, meiosis II, rupture, expulsion

Phase 3: Luteal phase (with fertilisation)

Proliferate, corpus luteum, oestrogen, progesterone, placenta

Phase 3: Luteal phase (without fertilisation)

Corpus luteum, corpus albicans, progesterone, oestrogen, GnRH, FSH

Summarise this cycle by drawing your own diagram of development of an ovarian follicle, using figure 2.3.9 on page 67 of the main textbook to help you.

The uterine (or menstrual / endometrial) cycle

Name the three phases of the uterine cycle:

1_____

2_____

3_____

What happens in the first phase? Which stage(s) of the ovarian cycle overlaps with this phase?

What happens in the second phase? Which stage(s) of the ovarian cycle overlaps with this phase?

What happens in the third phase? Which stage(s) of the ovarian cycle overlaps with this phase?

Understanding the hormonal control of the reproductive cycle is fundamentally important. Use the space below to ensure you have fully understood the relationship between the **hormones**, the **ovarian cycle** and the **uterine cycle**. This may be a diagram (such as figure 2.3.10 on page 69 of the main textbook), written notes, links to online sources - whichever way will work best for you to ensure you understand the relationship between all of these

W2.4: Reproduction and embryology

Use pages 73-83 of the main textbook to help you with this section.

Fertilisation

Fill in the blanks about fertilisation, below, using pages 74-75 of the main textbook to help you:

Every individual human develops from just a single cell – a f_____

e_____ (the f_____ of a male and female g_____).

For successful fertilisation, a sperm must reach a secondary oocyte within _____-

_____ hours of ovulation.

Once released into the pelvic cavity, the o_____ is captured by the

f_____ of the uterine tube. It then travels down the uterine tube via

f_____ c_____ and p_____.

Sperm introduced into the vagina around this time ascend into the uterus.

P_____ released by sperm cause u_____

c_____ which aid their movement. Ejaculate contains

m_____ of sperm, but less than _____% reach the uterine tube and

the o_____. Many are destroyed by the a_____

environment, others cannot pass through the cervical m_____.

Sperm may reach the oocyte within minutes, but are unable to fertilise it before

undergoing a final series of changes called c_____.

Capacitation

What is thought to be the mechanism that triggers capacitation, and what happens once capacitation has occurred?

Penetration and fusion

What is the acrosome reaction, and what does this reaction enable?

The figure below shows the process of fertilisation. Annotate this diagram with your own notes to help you embed knowledge of the different stages. Pages 74-75 of the main textbook will help you.

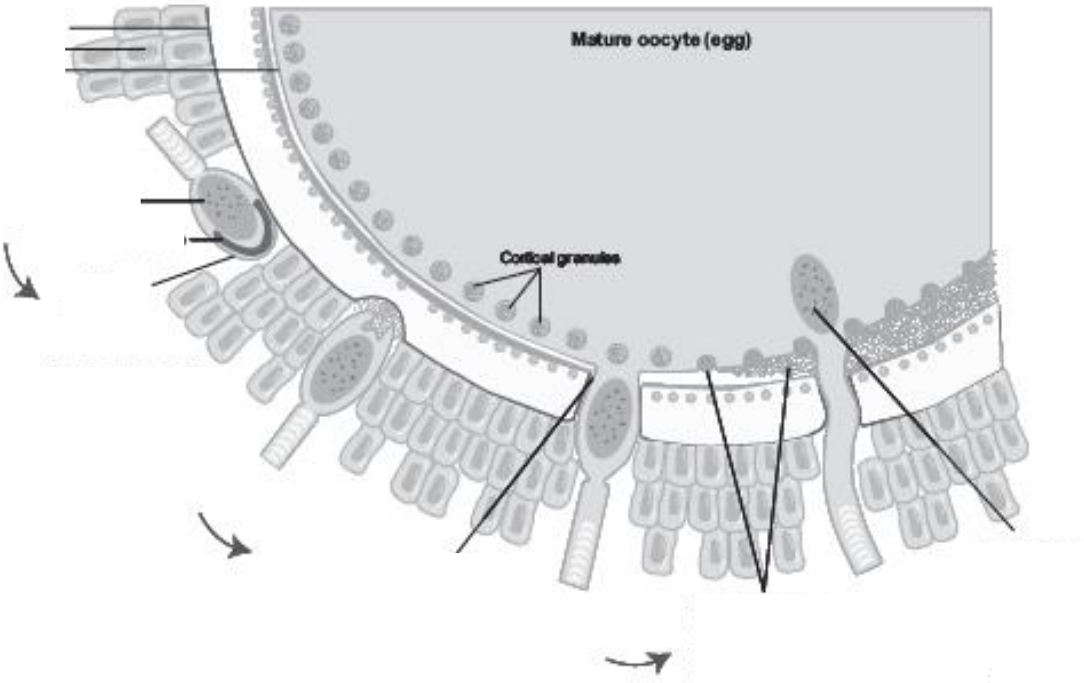


Figure 2.4.2 Stages of fertilisation
Source: Figure 2.4, p.40, Knight (2016)

© Carpenter and Hunter (2025) p75

What is polyspermy?

How is this prevented from happening?

From fertilisation to implantation

Fill in the gaps, using page 75 of the main textbook to help you:

The nuclear material of the ovum reorganises into a female p_____. The nucleus of the sperm cell swells and forms a male p_____, while the rest of the sperm d_____. The male and female pronuclei of the ovum come together and fuse, forming a d_____ n_____ with chromosomes mixed together. The resulting cell, now called a z_____, has the full complement of _____ (_____ pairs) chromosomes. This means both the m_____ and p_____ characteristics are present.

Embryology: Implantation and embryo development

Embryology is the study of the developing **embryo** and covers the time span of 0– 8 weeks after fertilisation. At nine weeks, the embryo has formed all the main systems and organs; it is officially known as a **fetus**.

Development before implantation

Read the text on pages 77-78 on ‘cleavage to blastocyst’. Annotate the figure below with your own notes to fully explain the journey from fertilisation up to the point of implantation.

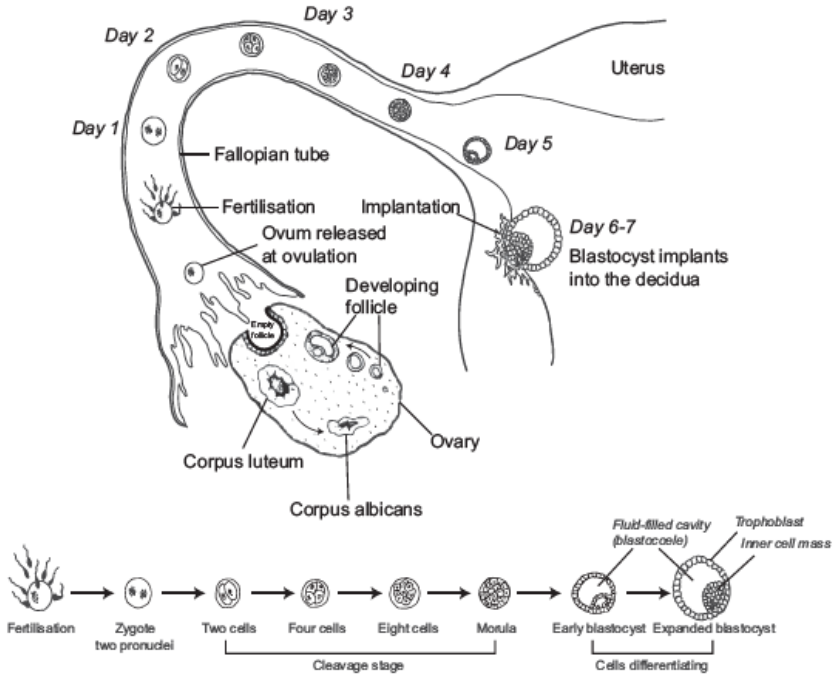


Figure 2.4.3 From fertilisation to implantation showing stages of embryo development
Source: Figure 3.5, p.57, Knight (2016)
© Carpenter and Hunter (2025) p76

Implantation

Add you own notes in the blank column on the processes of implantation:

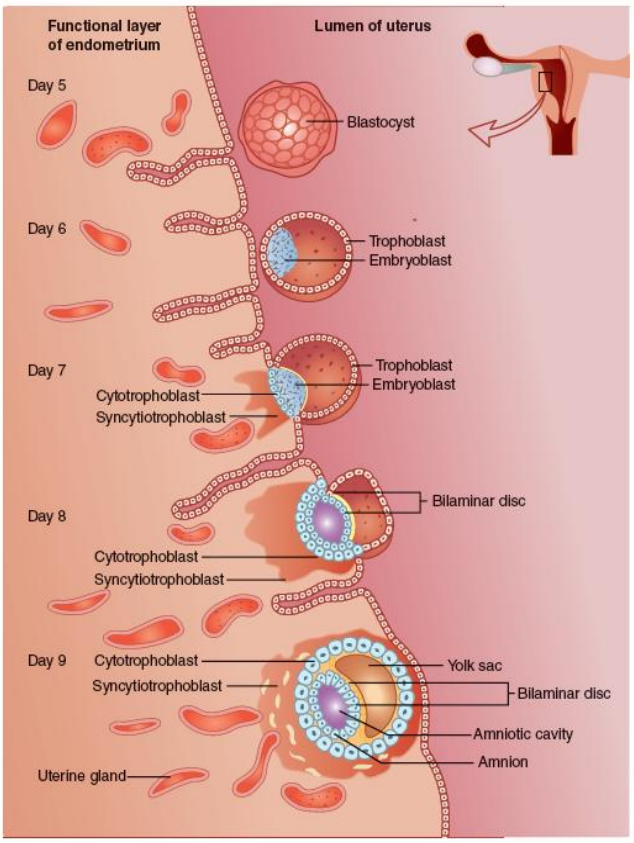


Figure 2.4.5 Stages of embryo implantation (days 5–10). © Carpenter and Hunter (2025) p79

Embryogenesis

Gastrulation

Up to this point, the inner cell mass has developed two key layers, and for this reason is known as the b_____ e_____ d_____. These two layers are known as the outer e_____ and the inner e_____. During gastrulation, the bilaminar embryonic disc undergoes significant changes and becomes the t_____ e_____ d_____. The third layer, the m_____, forms by migration of cells from the ectoderm towards a central 'line' called the p_____ s_____. Cells from the surface migrate between the two existing layers.

The three layers produced are called germ layers. Link the correct explanation to each layer, below:

Ectoderm	Loosely organised migrating cells between the endoderm and ectoderm
Endoderm	Superficial cells which did not migrate to the interior
Mesoderm	Cells facing the yolk sac

This trilaminar embryonic disc which eventually forms the fetus. It first begins to separate from other cells and bulges into the amniotic cavity forming first a head fold and, by four weeks, a tail fold.

Further development, folding and growth, forms an embryo with internal organs. All the tissues and organs of the body develop from the three embryonic germ layers.

Add the correct germ layer to the table below to the corresponding explanation of which tissues and organs develop from it, and then add some examples of the main body structures produced:

Tissues and organs	**Germ layer**	**Main body structures produced**
Forms the epithelial linings of organs such as the gastrointestinal tract and endocrine system		
Forms muscle, bones, gonads and blood		
Forms nerve, hair, eyes and epidermis of skin		

Late embryogenesis

Complete the table below with the key milestones of organogenesis during the embryonic period:

Week	Key milestones
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	

W2.5: The placenta and the developing fetus

Use pages 85-96 of the main textbook to help you with this section.

Pre-lacunar stage

At implantation, nutrients required by the inner cell mass simply diffuse across from surrounding trophoblast cells. However, as the distances between cells and the demands of the embryo increase, this is not sustainable for long.

Lacunar stage

What are the lacunae?

What do the trophoblastic finger-like projections become known as?

Primary, secondary and tertiary villus stages

In your own words, describe the development process from primary, into secondary and then tertiary villi:

Answer true or false to the following questions:

All the chorionic villi are surrounded by (bathed in) maternal blood of the lacunae	
The blood vessels of the fetus and mother are brought very close together, allowing for exchange of nutrients and gases.	
On occasion, the two circulations may meet, meaning mixing of blood can occur	

The mature placenta

Describe the two sides of the placenta:

1.
2.

What is in between the two plates?

Delete the grey sections as appropriate:

Although they are in extremely close proximity, the maternal and fetal circulations DO / DO NOT join together and there IS / IS NOT mixing of blood.

Fill in the blanks about placental circulation, using pages 88-89 of the main textbook to help you:

Maternal blood is pumped into the i_____ s_____ under pressure from the a_____ s_____, and blood drains away into the v_____ s_____. This creates a c_____ g_____, so that o_____ and n_____ in maternal blood diffuse across cell membranes into the f_____ b_____ vessels, and w_____ p_____ and c_____ d_____ in the fetal vessels diffuse across in the opposite direction. The fetal blood vessels connect to the fetus by the u_____ c_____.

In your own words, describe the umbilical cord:

Functions of the placenta

Add a brief description of how the placenta performs its key functions in the table below. Use pages 90-92 of the main textbook to help you:

Function	Description
Oxygenation	
Nutrition	
Endocrine	
Protection and Immunity	
Immunological barrier	

Fetal development

Fill in the blanks in the table below. You can also draw your own images of fetal development. Table 2.5.1 in the main textbook will help you.

Age	Image	Key development points
9-12 weeks		
13-16 weeks		
17-20 weeks		
21-30 weeks		
30-38 weeks		

Fetal skull

Which of the Vault, base and face are non-compressible, and why?

Label the key landmarks and structures of the fetal skull on the figure below:

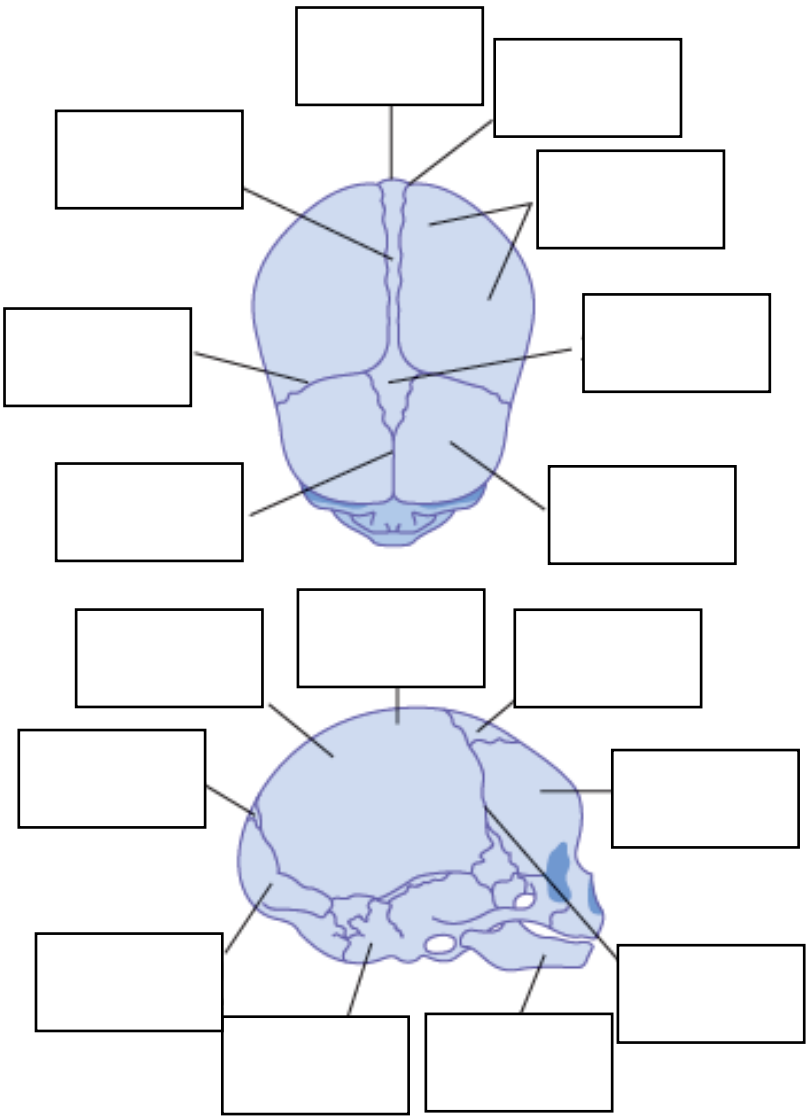


Figure 2.5.5 Landmarks and structures of the fetal skull

© Carpenter and Hunter (2025) p95

Label the approximate fetal skull diameter lengths below as follows:

Label the suboccipito-bregmatic diameter using a red colour, and then draw over the line showing that diameter in red. Add the diameter length here: _____cm

Label the submento-bregmatic diameter using a green colour, and then draw over the line showing that diameter in green. Add the diameter length here: _____cm

Label the occipito-frontal diameter using a blue colour, and then draw over the line showing that diameter in blue. Add the diameter length here: _____cm

Label the suboccipito-frontal diameter using an orange colour, and then draw over the line showing that diameter in orange. Add the diameter length here: _____cm

Label the occipito-mental diameter using a purple colour, and then draw over the line showing that diameter in purple. Add the diameter length here: _____cm

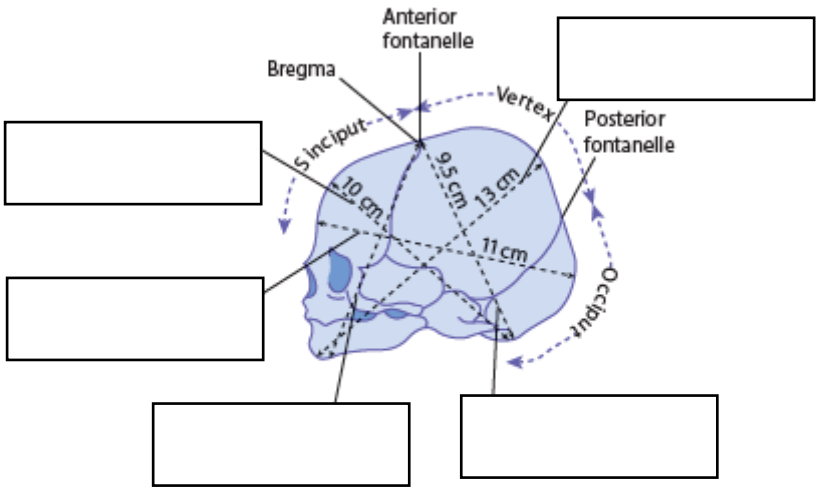


Figure 2.5.6 Approximate diameters of the fetal skull

Describe the two key fontanelles of relevance for midwifery:

SECTION W3:
Maternal changes and adaptations to pregnancy

W3.1: The blood and cardiovascular system

Use pages 99-120 of the main textbook to help you with this section.

Overview of Blood

The core constituents of blood are p_____, r_____ b_____ c_____, w_____ b_____ c_____ and p_____.

Label the following figure, which shows the components of blood having been through a centrifuge.

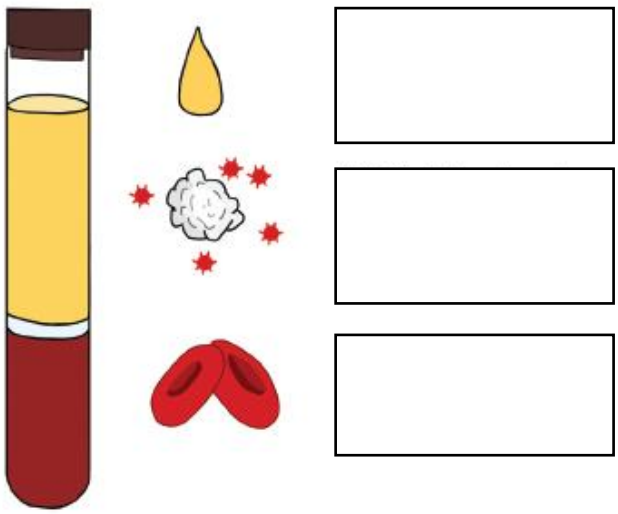


Figure 3.1.1 Blood composition

© Carpenter and Hunter (2025) p100

Plasma consists of _____% water, _____% proteins and the remaining _____% is made of fats, carbohydrates, electrolytes, gases and chemical messengers.

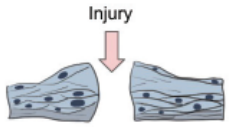
Red blood cells, or **erythrocytes**, contain h_____, which binds to oxygen. This is made up of four h_____ units and four g_____ chains. Each haem unit contains an atom of i_____ that can attach to an o_____ molecule, meaning each haemoglobin molecule can carry up to _____ oxygen molecules.

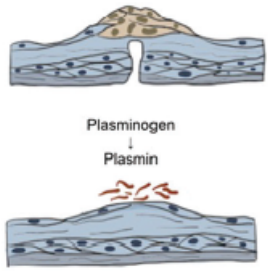
White blood cells or **leukocytes** account for less than ____% of blood volume although they are l_____ than erythrocytes. White blood cells are essential to ensure optimal functioning of the i_____ s_____.

Platelets contain granules in their cytoplasm that promote h_____ by blood c_____.

Haemostasis

Use the table below, showing Figure 3.1.6 (p104) from the main textbook, to make your own notes on the process of haemostasis.

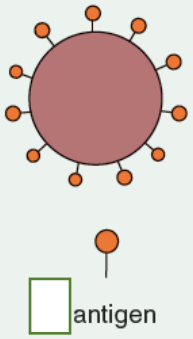
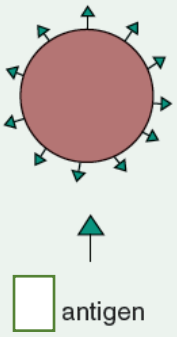
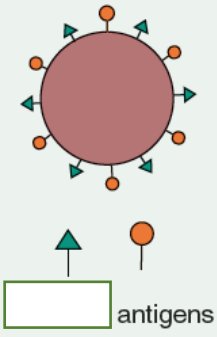
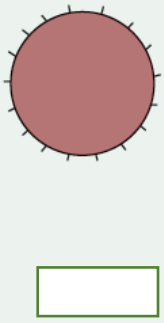
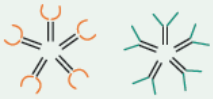
Process of haemostasis	Your Description
1. Vasoconstriction 	
2. Platelet phase	
3. Coagulation phase	

Process of haemostasis	Your Description
4. Clot retraction and destruction  Figure 3.1.6 Haemostasis © Carpenter and Hunter (2025) p104	

Blood Groups

Fill in the gaps in the table 3.1.2 below (page 106 of the main textbook) which explains the ABO blood group system. Then answer the questions at the bottom of the table. Then, answer the two questions below the table. Pages 105 and 106 of the main textbook will help you.

Table 3.1.2 ABO blood group system

Blood Group	A	B	AB	O
Red blood cell type Antigen	 	 	 	
Antibodies	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Who can they donate blood to?				
Who can they receive blood from?				

Which group is the Universal Donor (orange box) _____?

Which group is the Universal Recipient (blue box) _____?

Overview of the Cardiovascular System

The cardiovascular system is composed of the h_____, the b_____ v_____ and the b_____.

The heart

The function of the heart is to:

Label the figure of the heart below (page 107 of the main textbook will help you):

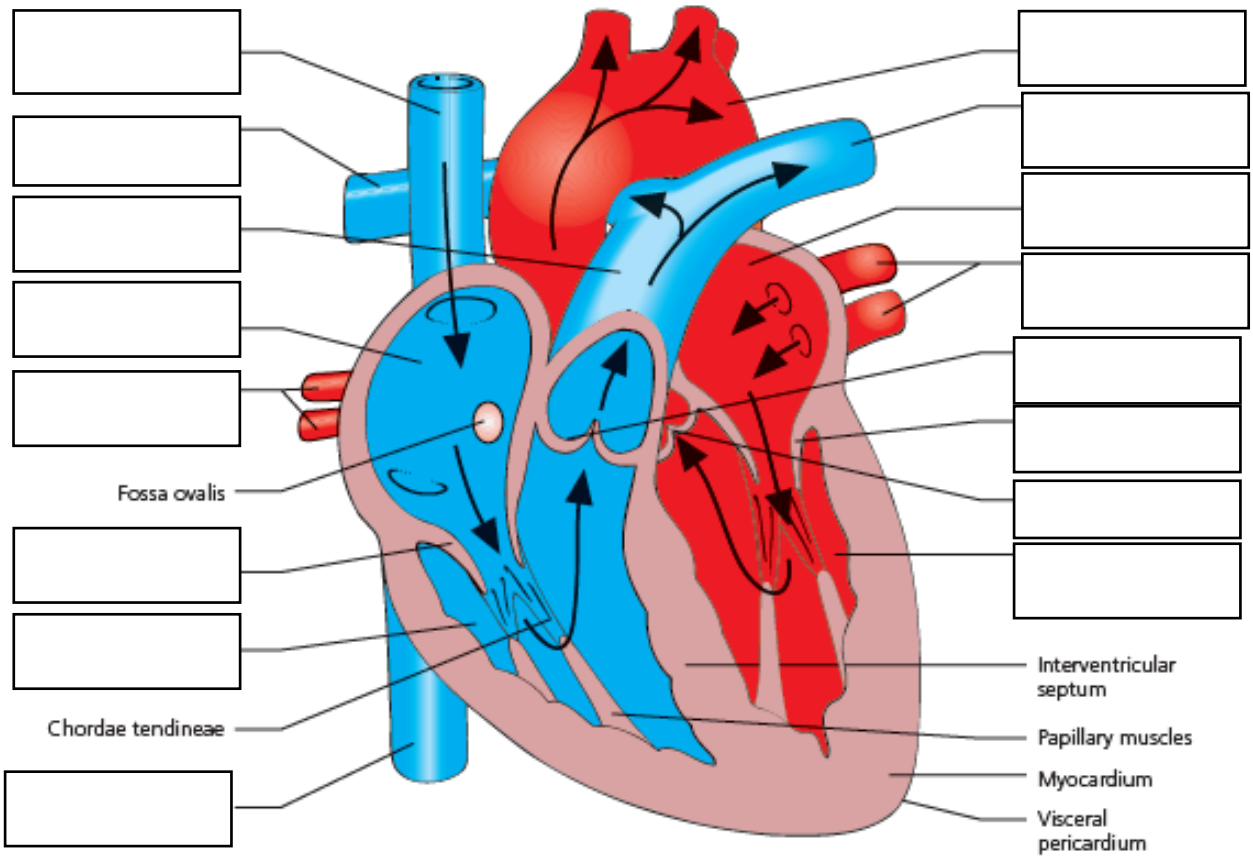
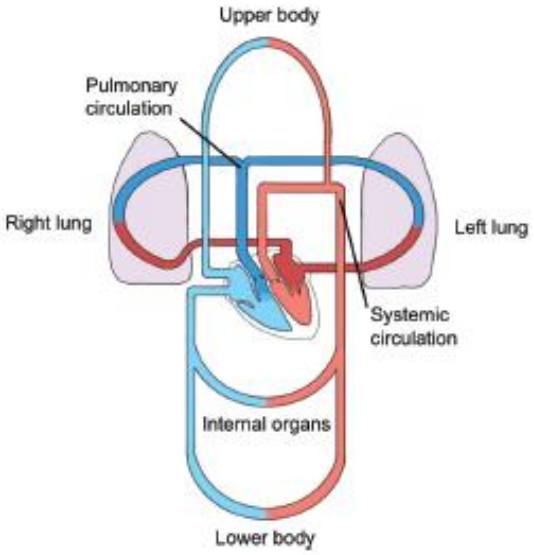


Figure 3.1.7 Frontal section of the heart
Source: Figure 12.4, p.308, Clancy and McVicar (2009)

© Carpenter and Hunter (2025) p107

Use the figure below and pages 107-108 of the main textbook to help you complete the excerpt to the right.  Figure 3.1.8 Pulmonary and systemic circulation © Carpenter and Hunter (2025) p108	Blood from the RIGHT/LEFT side of the heart travels to the l_____ to allow g_____ e_____. This is called the p_____ c_____. This o_____ blood returns to the RIGHT/LEFT side of the heart. Oxygenated blood is then pumped from the RIGHT/LEFT side of the heart around the body, and then back to the RIGHT/LEFT side of the heart. This is known as the s_____ circulation.

Blood vessels: arteries, veins, capillaries

Use the space below to add your own notes on the key differences between arteries, veins and capillaries. Make sure to consider direction of blood flow, presence of valves, pressure in the vessel, as well as key structural features. Pages 108-111 of the main textbook will help you.

Fill in the gaps in the diagram below to show transfer of gases and nutrients in the capillary

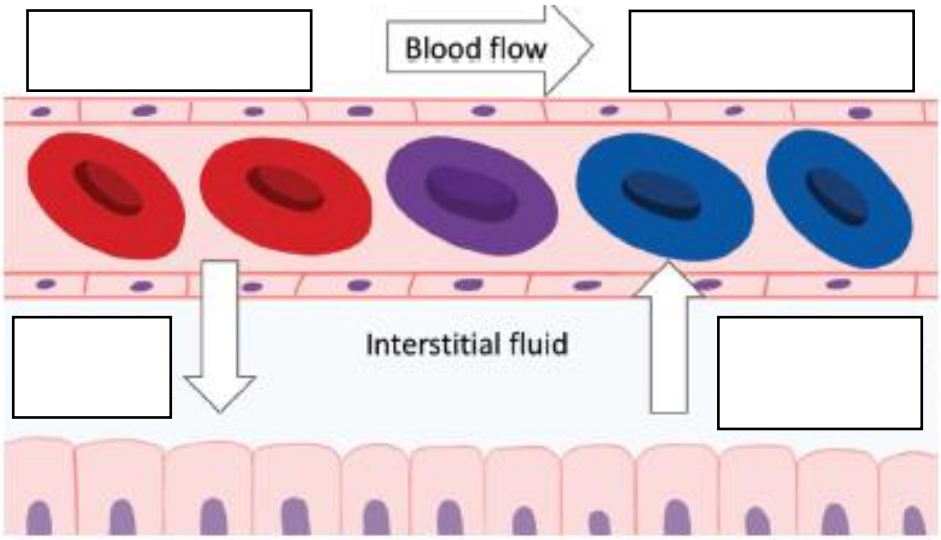


Figure 3.1.13 Gas and nutrient exchange at capillary level

© Carpenter and Hunter (2025) p107

Cardiac output and blood pressure

Use pages 114-116 of the main textbook to help you answer the following:

Define the terms:

Stroke Volume   Heart rate   Cardiac Output

What is Blood Pressure?

What is the systolic blood pressure?

What is the diastolic blood pressure?

What is meant by peripheral resistance?

Long term control of peripheral resistance is mostly influenced by the renal system and is considered later.

Short term control of peripheral resistance is mostly influenced by the **nervous system** via b_____ and c_____.

Baroreceptors work by:

Chemoreceptors work by:

Changes and adaptations to the blood cardiovascular system during pregnancy

Haematological changes during pregnancy

What is physiological anaemia of pregnancy, and what causes this to occur?

What are some of the advantages of the increased blood volume in pregnancy?

In the table below, describe whether each element of a Full Blood Count (FBC) test result will be higher, lower, or stable during pregnancy:

Element of FBC	Change
Red Blood Cell count	
Haemoglobin (Hb) level	
Mean cell volume (MCV)	
Platelet level	
White cell count (WCC)	
Coagulability	

Haemoglobinopathies

The term haemoglobinopathies describes a range of **inherited** disorders that affect the quantity or the structure of haemoglobin, resulting in a reduction of the RBCs' ability to carry oxygen.

The two main haemoglobinopathies encountered in midwifery are:

1. _____ 2. _____

Both of these conditions are inherited via recessive genes.

Use the space below to describe in which people sickle cell disease is most prevalent, describe the condition and draw an example of a sickle cell, and explain the signs and symptoms of the disease:

Use the space below to describe in which people thalassemia is most prevalent, describe the condition, and explain the signs and symptoms of the disease:

Cardiovascular changes during pregnancy

Complete the following sentences summarising changes to the cardiovascular system in pregnancy:

- Cardiac output_____ by _____ to _____% from early pregnancy to accommodate _____ blood volume circulating
- The heart _____ by 12% and moves _____ and rotates _____
- The left ventricular wall _____ in thickness to sustain the increased blood volume.
- Due to the relaxing effect of p_____ on vascular tone, blood pressure in pregnancy tends to be slightly _____.
- _____ in heart rate by 10-20%, although remaining within normal range
- _____ in blood flow to _____, skin, _____ and kidneys
- Peripheral resistance _____ by 35-40%. This, along with reduced venous return due to gravity, can cause lower limb oedema (swelling).
- _____ in stroke volume by 10%

W3.2: The respiratory system

Use pages 121--132 of the main textbook to help you with this section.

Overview of the respiratory system

Key structures

Label the following figure showing key structures of the respiratory system:

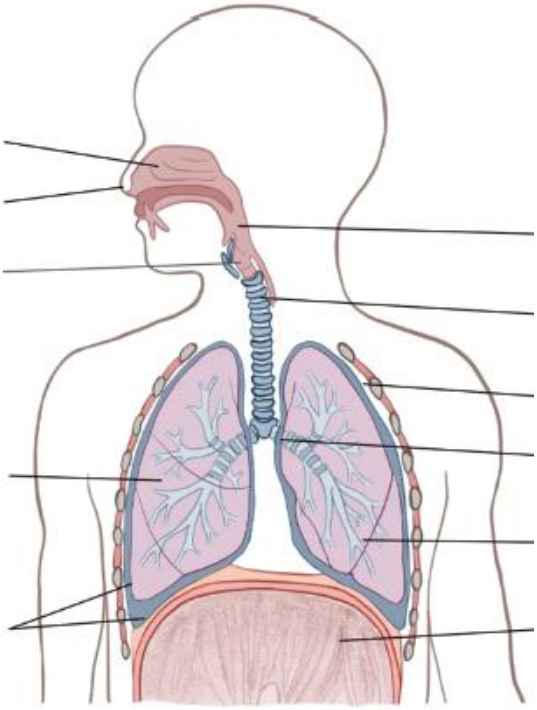


Figure 3.2.1 Anatomy of the respiratory tract © Carpenter and Hunter (2025) p122

Use the space below to make any notes on the key structures above. Use pages 121-124 of the main textbook.

Physiology of respiration

There are four phases of respiration. These are listed in the table below. Add a description of each of these phases to the table.

Phase	Description
Pulmonary ventilation	
External respiration	
Respiratory gas transport	
Internal respiration	

Add your own description to the image below (page 125 of main textbook) showing inspiration and expiration:

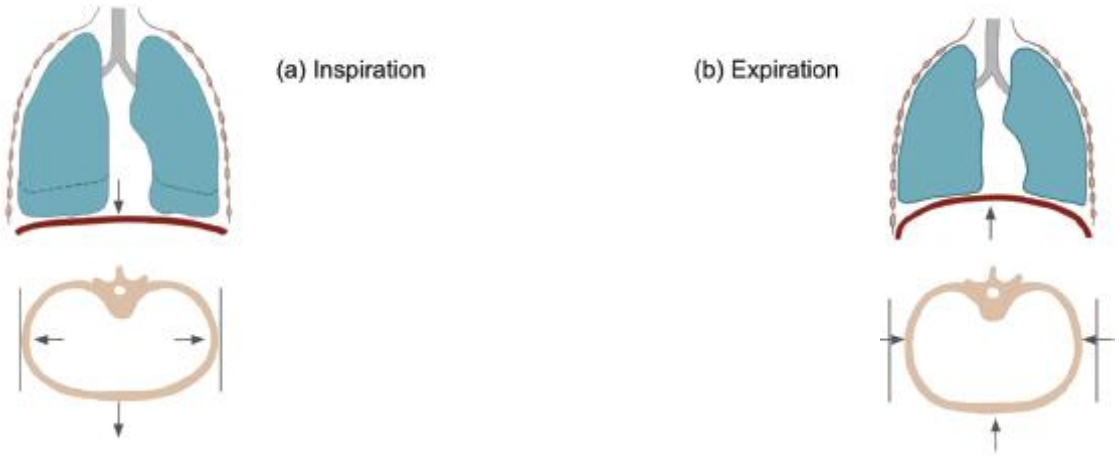


Figure 3.2.4 Inspiration and expiration shown from the front and across the thoracic cavity

© Carpenter and Hunter (2025) p125

Explain in your own words how gas exchange occurs in the alveoli of the lungs:

Explain in your own words how internal respiration occurs:

Cellular respiration

Now that oxygen has been brought into the tissues via the processes described above, this oxygen can be used at the cellular level to produce energy, via **cellular respiration**. Aerobic respiration (in the presence of oxygen) can be summarised as:

Glucose + **O_____** = **Carbon Dioxide** + **Water** + **_____**

Overview of changes and adaptations of the respiratory system during pregnancy

Anatomical changes to the respiratory system

What changes occur to the mucosa in the nasal cavity? What can this lead to?

What anatomical changes does the growing uterus cause?

Physiological changes to the respiratory system

Use table 3.2.1 on page 131 of the main textbook. Enter the parameters which reduce, increase or remain stable into the spaces below and fill in the information:

Parameter	Description	Normal value for a healthy female	Change in pregnancy
Parameters which **reduce** in pregnancy			
Parameters which **increase** in pregnancy			
Parameters which **remain stable** in pregnancy			

W3.3: The nervous system

Use pages 133-158 of the main textbook to help you with this section.

Nervous system overview

Organisation and functions of the nervous system

The nervous system can be thought of as the master command and communication system of the human body. It is often split into two separate parts for ease of learning: the **central nervous system (CNS)**, and **peripheral nervous system (PNS)**.

Figure 3.3.1 (page 134) in the main textbook gives an overview of the central and peripheral nervous systems. Use the space below to draw and annotate your own summary figure:

Neurons and neuroglia

Complete the gaps below (page 134 of the main textbook will help you).

The nervous system performs its function through the function of highly specialised cells called n_____, supported by specialise support cells – n_____.

N_____ carry nerve impulses from one part of the body to another – this is how messages are communicated. Due to their specialisation, neurons DO / DO NOT usually undergo further m_____ d_____. However, they are built to last, and can last a l_____.

The specific structure of neurons differs slightly depending on their function. Link the descriptions below to the correct neuron type:

Efferent / motor neuron	Extend from the CNS to tissues elsewhere in the body
Afferent / sensory neuron	Form connections between the motor and sensory neurons in the CNS
Interneuron	Carry impulses from sensory receptors in the tissues back to the CNS

Use tables 3.3.1 and 3.3.2, along with Figure 3.3.2, on page 135 of the main textbook to complete the table below. First, draw and annotate a sensory and a motor neuron, then add in a description of each.

Neuron type	Annotated drawing	Description
Motor neuron		
Sensory neuron		

Structures common to motor and sensory neurons

Complete the table below to describe some of the key structures which are common to both motor and sensory neurons. Sketch an image if this is helpful. Use page 135 of the main textbook to help you.

Structure	Explanation
Myelin	
Schwann cells	
Nodes of Ranvier	
Synapse	
Presynaptic cell	
Postsynaptic cell	

Communication between neurons t the Action Potential

Neurons are 'excitable' cells. This means they can conduct an electrical signal along the axon, known as the **action potential**. In your own words, below, briefly outline the process of communication among neurons:

Refer to the action potential and the synapse, using page 136 of the main textbook to help you. Images have been placed to aid your description.

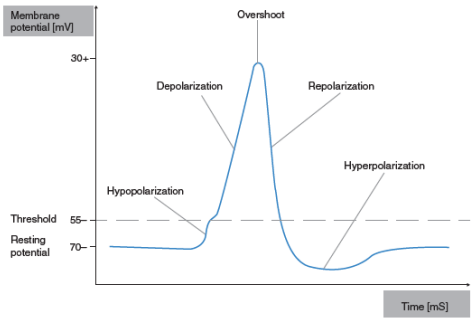
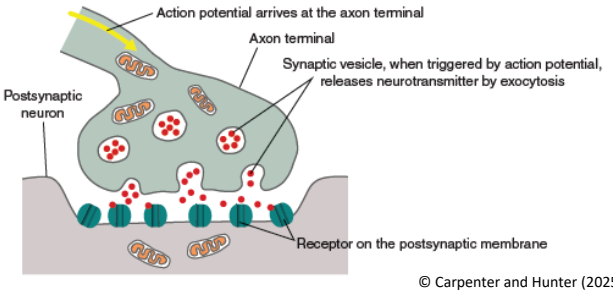


Figure 3.3.3 The action potential © Carpenter and Hunter (2025) p137



© Carpenter and Hunter (2025) p137

Figure 3.3.4 Close up of an axon terminal where it meets the dendrite of another neuron

Central Nervous System t the Brain

Annotate the cross-section of the brain below, from page 139 of the main textbook. Add in key details to each structure by drawing an arrow to the label and adding your own detail. An example has been given for you with 'Diencephalon'.

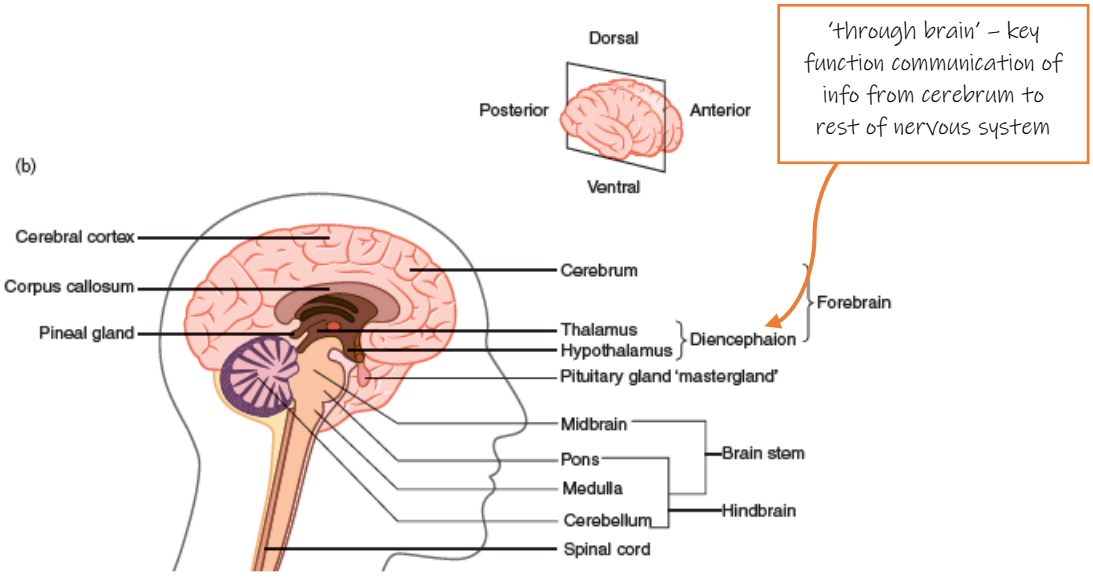


Figure 3.3.5 a) Side view of the brain, b) cross section through the centre of the brain
© Carpenter and Hunter (2025) p139

Central Nervous System t the Spinal Cord

Answer the questions below, using pages 140-142 of the main textbook to help you:

Through which part of the vertebrae does the spinal cord travel?

What is the function of the spinal cord?

What is the dorsal root? What is the dorsal root ganglion comprised of?

What is the ventral root?

Where are cell bodies of motor neurons located?

What is the cauda equina?

Name the three membranes which surround the brain and spinal cord:

What is the blood brain barrier?

Peripheral Nervous System t somatic nervous system

The key function of the somatic nervous system is to control voluntary actions. Often (but not always) these actions are under **conscious** control. Correctly link the boxes below to describe the somatic senses and the motor component of the somatic nervous system:

Somatic senses	Responsible for voluntary movement
Motor component	Eg mechanoreception, thermoreception. Mechanism for gaining sensory information from the body

Reflex activity

Describe the five key stages to a simple reflex arc:

1	
2	
3	
4	
5	

Gate control theory of pain

Describe, in your own words, the gate control theory of pain:

Peripheral Nervous System t Autonomic nervous system

The function of the autonomic nervous system is to mediate changes in tissue function which are under **involuntary** control, thereby maintaining **homeostasis**.

This is achieved by the **sympathetic** and **parasympathetic** divisions working to either increase or decrease activity of target cells.

Sympathetic is often associated with 'fight or flight'.

Parasympathetic often referred to as 'rest and digest'.

Using table 3.3.3 on page 145 of the main workbook, complete the table below to show the effect of the two divisions on body structures:

Structure	Sympathetic Division	Parasympathetic division
Eye	Dilates pupil; allows for distance vision	
Salivary glands	Concentrated secretion stimulated	Watery secretion stimulated
Sweat glands	Increased secretion	Not innervated
CARDIOVASCULAR SYSTEM		
Blood vessels		Not innervated, except penis and clitoris: dilation
To skin		
To skeletal muscles		
To digestive viscera		
Heart, rate and force of contraction	Increases	
Blood pressure		Decreases (indirect)
RESPIRATORY SYSTEM		
Diameter of airways		
Respiratory Rate		
DIGESTIVE SYSTEM		
Sphincter muscles	Contract	

Structure	Sympathetic Division	Parasympathetic division
General level of activity		Increases
Secretory glands		Stimulated
URINARY SYSTEM		
Kidney		Not innervated
Bladder	Relaxes muscle of bladder, contracts internal sphincter	

Changes and adaptions to the nervous system during pregnancy

Make your own notes below on changes to the nervous system. Use page 146 of the main textbook and your own research to help you:

Grey matter of the brain shrinks	
Cognitive ability	
Sleep patterns	
Changes to sensory organs	

W3.4: The endocrine system

Use pages 147-160 of the main textbook to help you with this section.

Endocrine system overview

What are the four 'key functional headlines' of the endocrine system?

1.

2.

3.

4.

Hormones

What are hormones?

Link the hormone type below with the correct example(s) and definition:

Peptides	Adrenaline	Derived from fatty acid, lipid soluble. Cannot be stored, must be produced as required
Catecholamines	Insulin, glucagon	Derived from cholesterol, highly lipid soluble. Cannot be stored, must be produced as required
Steroid hormones	Prostaglandin	Derived from tyrosine, slightly lipid soluble. Can be stored in cell and released quickly
Eicosanoids	Oestrogen, Cortisol	Water soluble, poorly soluble in lipids. Can be stored in cell and released quickly

Regulation of hormones

Hormones are regulated by positive and negative feedback loops. Describe in your own words how blood glucose levels are regulated by hormones acting via negative feedback loops. You may choose to draw a diagram such as Figure 3.4.1 on page 149 of the main textbook:

Now, describe in your own words how a positive feedback loop works, such as via the action of prolactin and oxytocin to cause milk production and ejection from the breast:

Key endocrine glands in depth

Hypothalamus and pituitary gland

The endocrine and nervous systems are key in maintaining homeostasis. The hypothalamus and pituitary gland are often considered to be the **command centre** for the whole of the rest of the endocrine system. Together they control and regulate most of the other endocrine glands. The hypothalamus also has an important role in the nervous system, further demonstrating the close link between them.

Use the figures 3.4.3 and 3.4.4, as well as the relevant text (pages 150-155), to understand the role of these important structured. Make your own notes below to help you embed this knowledge – you can make a diagram, write notes, whatever will help you!

Adrenal glands

Answer the following questions using pages 153-155 to help you:

Where are the adrenal glands located?

The adrenal cortex secretes steroid hormones, usually separated into which three groups:

Give a brief explanation of the actions of these three groups:

1.

2.

3.

Which hormone(s) does the adrenal medulla secrete?

What triggers the secretion of the hormone(s) from the medulla?

The HPA Axis

Which three glands are involved in this axis?

Give a brief explanation of the HPA axis:

Thyroid gland

Which two hormones does the Thyroid gland produce and release?

What is Hypothyroidism? What can cause this?

What is Hyperthyroidism? What can cause this?

What are some symptoms of hypothyroidism, and hyperthyroidism?

Hypothyroidism:

Hyperthyroidism:

Pancreas

What percentage of the pancreas is dedicated to hormone production?

What are the clusters of hormone-producing cells known as?

Alpha and Beta cells are considered above in regulation of hormones (p76). Give a brief description of the role of delta cells and pancreatic polypeptide (PP) cells:

Changes and adaptations to the endocrine system during pregnancy

Hormones to maintain the pregnancy

Enter the correct text into the gaps in the table below. Pages 157-158 of the main textbook will help you.

Hormone	Effect in pregnancy
	Only made during pregnancy, almost exclusively by the placenta. hCG levels peak during the first trimester, as it stimulates the corpus luteum to produce progesterone to maintain the pregnancy. hCG has often been linked to nausea and vomiting in pregnancy as both peak at a similar time. No causal pathway has been found.
Human placental lactogen (hPL)	
Oestrogen(s)	
	A key pregnancy hormone, produced by the ovaries and placenta during pregnancy. It stimulates the thickening of the uterine lining for implantation of a fertilised egg. It comes from the Latin pro- , meaning 'for' and gest- , referring to pregnancy (gestation). Progesterone levels remain high throughout pregnancy due to its role in maintaining the uterus in a quiescent state, stopping the uterus from contracting and entering labour. This effect of 'relaxing' the smooth muscle, although aimed at the uterus, has far reaching consequences across many of the other body systems

Provides nutrition to the fetus. It also stimulates milk glands in the breasts for breastfeeding.

Actually a group of hormones, is made by the placenta during pregnancy to help maintain a healthy pregnancy.

Progesterone

Human chorionic gonadotropin hormone (hCG)

Changes to the HPA Axis

Write you own brief notes below on how elements of the HPA axis change in pregnancy:

Hypothalamus Pituitary Adrenal glands

Thyroid gland

Fill in the blanks below:

Changes to the thyroid gland during pregnancy tend to mimic h_____.

Overall, though, thyroid function remains within n_____ levels. The thyroid tends to slightly e_____ during pregnancy, but this is usually not detectable via a physical examination.

Thyroid hormones are essential for f_____ development of the brain and nervous system. The embryo is entirely r_____ on m_____ thyroid hormones via the p_____ for development until 18-20 weeks gestation.

Pancreas and gestational diabetes

Explain what is meant by insulin resistance:

If production of insulin cannot overcome this resistance, what condition will develop?

W3.5: The musculoskeletal system

Use pages 161-171 of the main textbook to help you with this section.

Overview of the musculoskeletal system

Skeletal system

The skeletal system is made up of bones, ligaments, joints and cartilage.

Bones

State the functions of bone below:

1.
2.
3.
4.

Figure 3.5.5 (page 163 of main textbook) has been reproduced below with the labels changed to numbers. Write in the correct label for each number in the space provided.

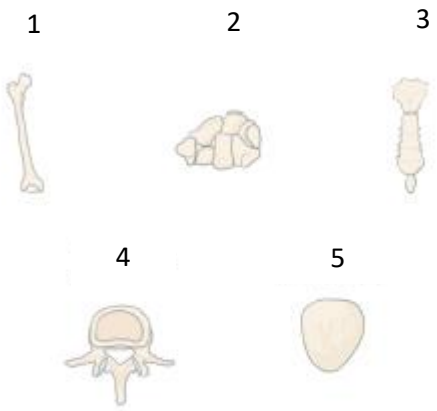


Figure 3.5.3 Five types of bones according to their shape © Carpenter and Hunter (2025) p163

1_____

2_____

3_____

4_____

5_____

What is **haematopoiesis**, and where does it occur in adults?

Muscular system and tendons

Skeletal muscle was introduced at the start of this workbook. What is its function?

What is the name of the specialised junction between the motor neuron and muscle fibre which brings about muscle contraction?

Label and then further annotate Figure 3.5.5 (page 164 of the main textbook) to explain the key features of skeletal muscle and how these relate the its function. Add in your own image of relaxed and contracted fibres as shown in Figure 3.5.6 (page 165) of the main textbook.

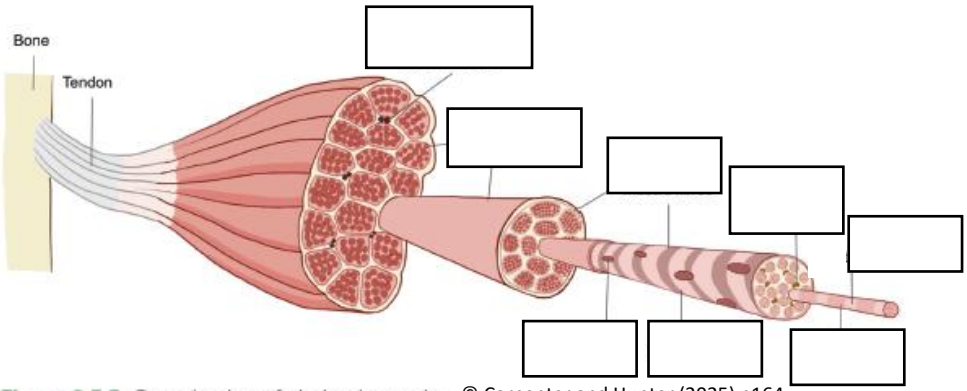


Figure 3.5.5 Organisation of skeletal muscle © Carpenter and Hunter (2025) p164

Joints and ligaments

A joint is:

Most joints are f_____, allowing the body to move.

In some cases, bones are so strongly held together that movement is

i_____.

Link the statements below to the correct joint type:

Fibrous joints	Do not allow for movement, with some exceptions eg symphysis pubis in pregnancy.
Cartilaginous joints	Most moveable. Main functions: reduce friction, prevent wear due to bone-to-bone contact, distribute weight.
Synovial joints	Immoveable. Do not allow for movement between the presenting bones. Functionally, bones have fused together.

Describe ligaments and explain their function. Use page 167-168 of the main textbook to help you.

Changes and adaptations to the musculoskeletal system in pregnancy

Physical changes

What is Lumbar lordosis, and what effects can it have?

How is bone composition challenged by pregnancy?

Which hormones impact the cartilage and connective tissue present in joints? What effect do these hormones have?

What causes Pelvic Girdle Pain, what symptoms might women experience with this condition, and how might they be supported to manage these symptoms?

Fill in the blanks in Figure 3.5.11 (page 170 of the main textbook) to understand how varicosities occur in pregnancy:

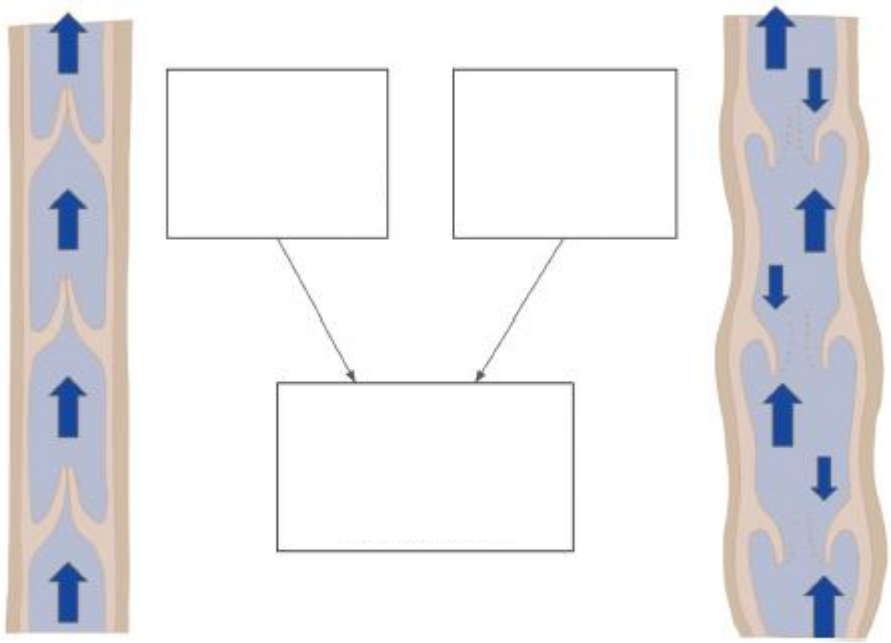


Figure 3.5.11 Varicose veins in pregnancy © Carpenter and Hunter (2025) p170

Describe carpel tunnel syndrome and explain why this can occur during pregnancy:

The image below shows diastasis recti. Describe in your own words what this is, and why it occurs in pregnancy:

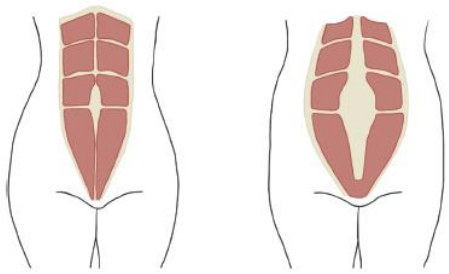


Figure 3.5.12 Diastasis recti © Carpenter and Hunter (2025) p170

W3.6: The renal system

Use pages 173-182 of the main textbook to help you with this section.

Renal System overview

Structure and function of the renal system

Label the diagram below with the main elements of the renal system:

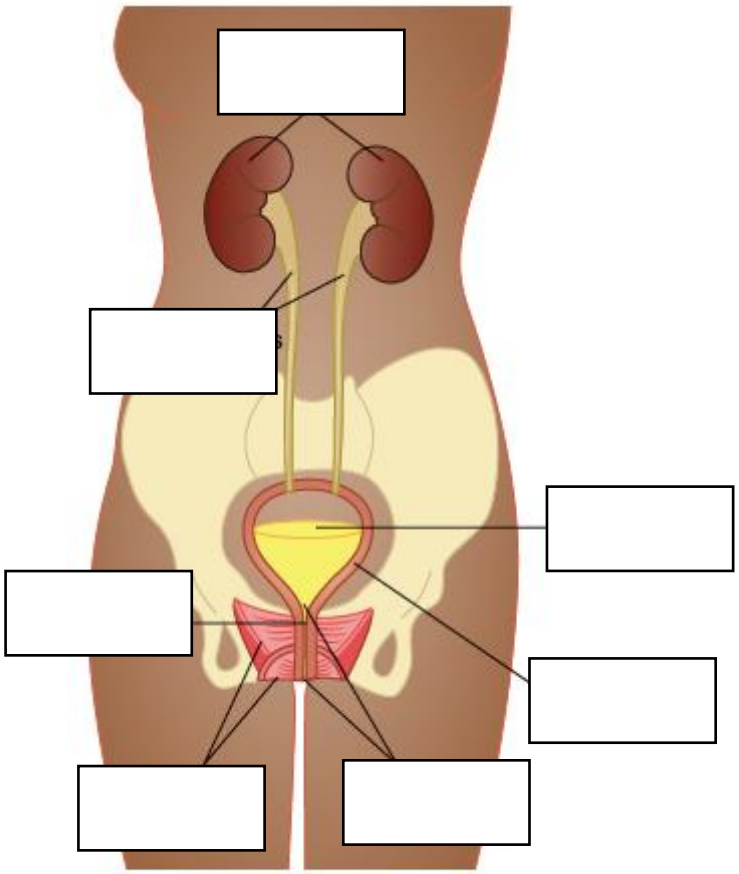


Figure 3.6.1 The renal system
© Carpenter and Hunter (2025) p173

What is the key function of the renal system?

The Kidneys

What are the functions of the Kidney:

Label the kidney below with key anatomy. Use the space to the side to add further notes on key structures. Then label the figure of the nephron below.

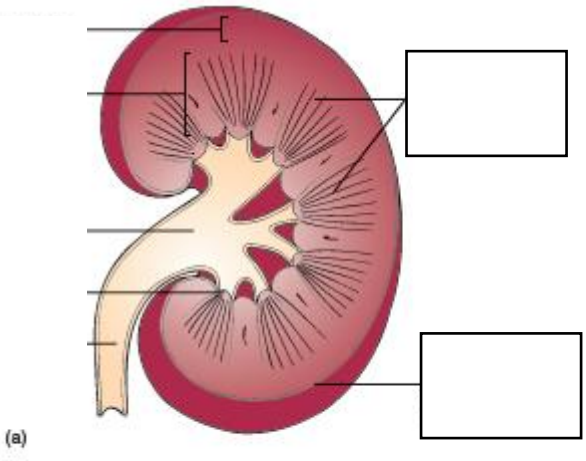


Figure 3.6.2 a) Anatomy of the kidney;
Source: Figure 15.3(a) and (b), p.424, Clancy and McVicar (2009)
© Carpenter and Hunter (2025) p174

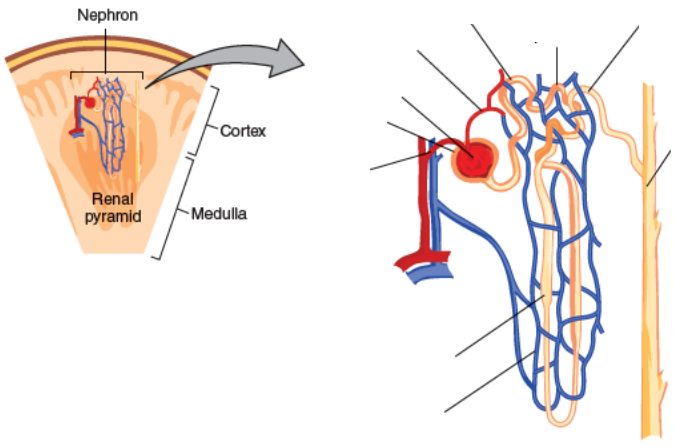


Figure 3.6.3 Process of filtration and urine formation in the kidney
© Carpenter and Hunter (2025) p175

Use the space below to write key notes on the function of the kidney **in fluid homeostasis and excretion of waste**. Pages 175-177 of the main textbook will help.

Step 1: The G_____

Step 2: The P_____ C_____ T_____

Step 3: The L_____ of the N_____

Step 4: The D_____ C_____ T_____

Step 5: The C_____ D_____

Step 6: P_____ C_____ N_____

The kidneys function to **regulate blood pressure** occurs via the Renin- Angiotensin-Aldosterone System (RAAS). Use the space below to create your own flow diagram of this system, using pages 177-178 of the main textbook to help you.

What are the other key functions of the kidney (see page 178 of the main textbook)?

After the kidneys

Write you own notes on key stages of the journey which urine takes from the ureter onwards.

What is urine comprised of?

Urine can be a variety of colours – some more concerning than others. Expand on this below:

Urine can also have a variety of smells! Expand on this below:

Is it normal to have proteinuria (protein in the urine)? What might proteinurea be a sign of?

Changes and adaptations to the renal system during pregnancy

Use page 181-182 of the main textbook to help you answer what influence the following may have on the renal system in pregnancy:

The growing uterus	
Rising oestrogen levels	
Increased hCG levels	
Increased fluid retention	
Rise in GFR	
Glucosuria	
Rising progesterone levels	

A number of factors may make women more prone to urinary tract infections (UTIs) during pregnancy. What are these?

W3.7: The gastrointestinal system

Use pages 183-196 of the main textbook to help you with this section.

Overview of the gastrointestinal system

The gastrointestinal tract (GIT) runs right the way through the body, starting from

the m_____ and ending at the a_____.

Its principal function is _____.

Give a **very brief** explanation of the function of each of the following in the GI system:

Mouth	
Pharynx	
Oesophagus	
Stomach	

Small intestine	
Duodenum	
Jejunum	
Ileum	
Large intestine	
Caecum	
Colon	
Rectum	
Anal canal	

Accessory organs	
Liver	
Gallbladder	
Pancreas	

Changes to the gastrointestinal system during pregnancy

Increasing hormone levels cause various changes to the GIT during pregnancy. In the table below, enter the hormone(s) which are thought to bring about the given effect:

Change to the GIT	**Hormone(s) responsible**
Increased sensitivity to smell, food cravings and aversions, and possibly to nausea and vomiting in pregnancy.	
Reduced tone in the gallbladder, resulting in incomplete emptying, which increases the risk of gallstones.	
Increased fluid intake	
Ptyalism	
Changes in the gut microbiome promote increased energy storage and a rise in proinflammatory mechanisms which protect against invading pathogens	

Change to the GIT	Hormone(s) responsible
Reduced peristalsis, leading to poor gut motility. This sluggish behaviour, together with increased water absorption in the colon, often results in constipation.	
Gastric emptying is delayed, meaning chyme stays in the stomach for longer, increasing the potential for heartburn.	
Gums become swollen and bleed easily, predisposing pregnant people to gingivitis and periodontal disease	

As discussed previously, insulin resistance increases during pregnancy. Leptin resistance also develops. What is this, and what does it lead to?

Finally, what effect does the enlarging uterus have on the gastrointestinal system?

Nutrition in pregnancy

Macronutrients

Complete the table below using pages 192-193 to help you. The first row has been completed for you as an example.

Type	Requirements in pregnancy	Source
Protein	Increase in pregnancy, as protein is key for tissue growth and repair.	Beans, pulses, meat, fish and dairy products
Carbohydrates		
Fats		
Fibre		

Micronutrients

Complete the table below using pages 193-194 to help you.

Type	Requirements in pregnancy	Source
Vitamin D		

Type	Requirements in pregnancy	Source
Folates / Folic Acid		
Other B vitamins		
Vitamin C		
Vitamin A		
Iron		
Calcium		

What advice would you give a woman who has been prescribed iron supplementation during pregnancy to maximise its effect?

Consider the application to practice box on page 196 of the main textbook, and make some notes below on your thoughts

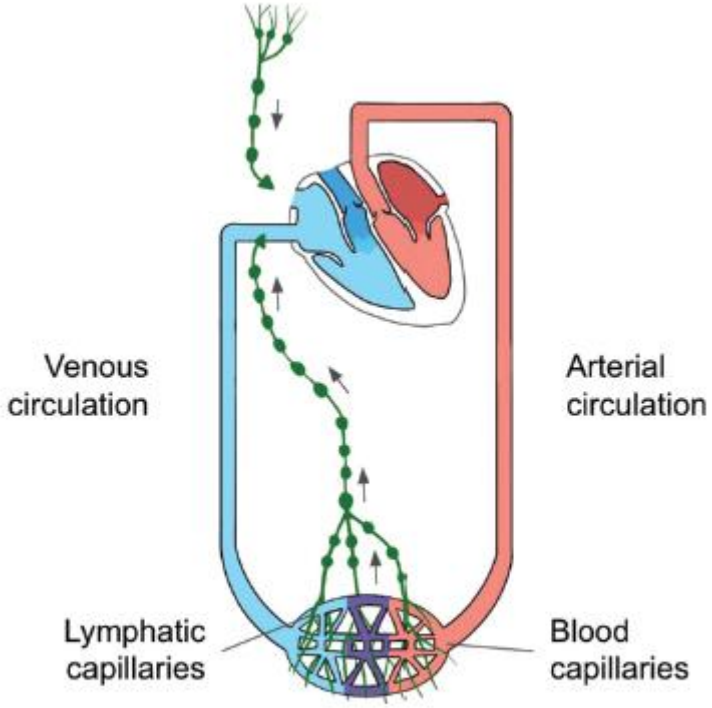
W3.8: The immune system

Use pages 197-214 of the main textbook to help you with this section.

Immune system overview

Lymphatic system

Annotate the diagram below to explain, in your own words, the function of the lymphatic system:



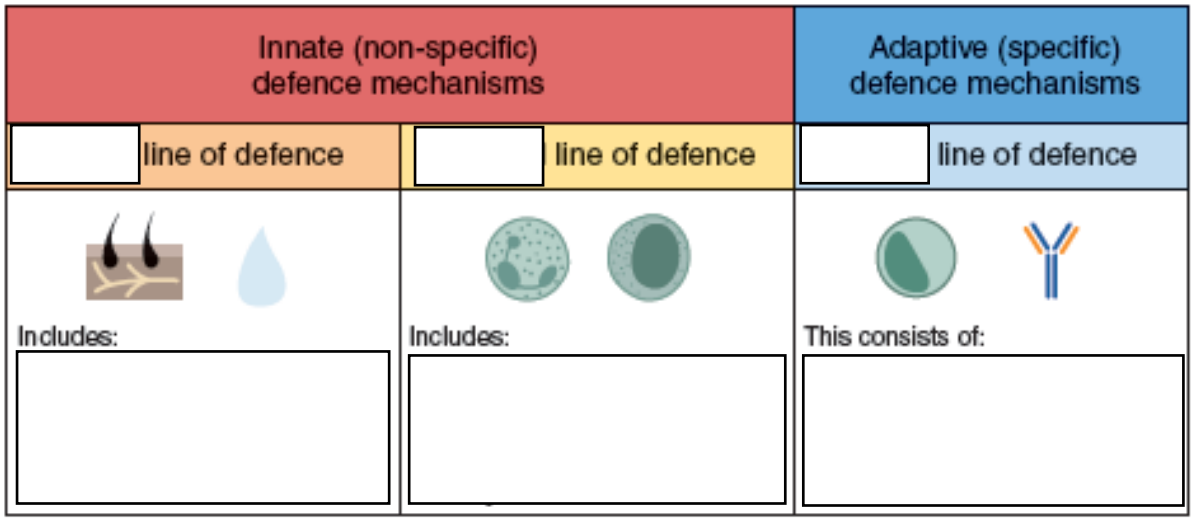
© Carpenter and Hunter (2025) p198

Figure 3.8.1 Lymphatic system overview

Innate and Adaptive Defence mechanisms

What is the main function of the immune system?

Fill in the gaps in figure 3.8.4 (p200 of the main textbook) to explain the innate and adaptive defence mechanisms. And the first, second and third lines of defence:



© Carpenter and Hunter (2025) p200

Figure 3.8.4 Overview of innate and adaptive defence mechanisms

Innate mechanisms

Inflammatory response

An innate response which occurs any time the body tissue is injured, with four common visible signs (page 202 of main textbook):

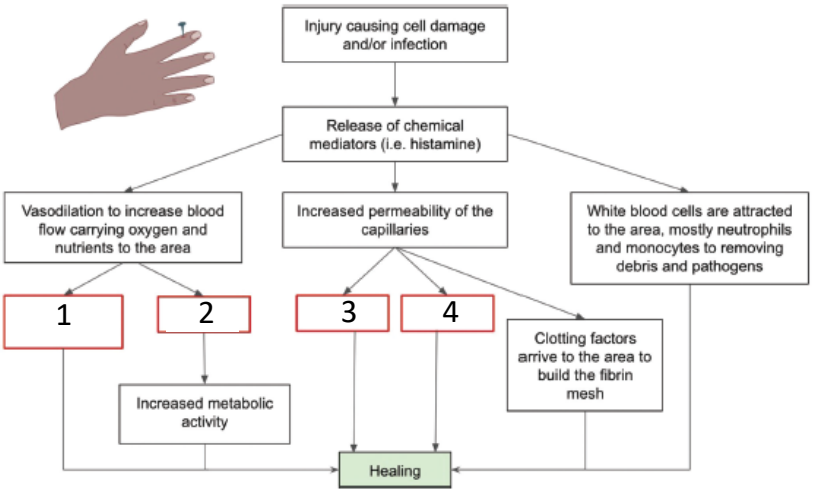


Figure 3.8.6 The inflammatory response © Carpenter and Hunter (2025) p200

1.

2.

3.

4.

Natural killer (NK) cells

What type of cells are NK cells, where are they based and how do they work?

Pyrexia

What is pyrexia, how can it help to fight harmful microorganisms?

What can occur with excessively severe pyrexia?

How does fetal body temperature differ from maternal temperature?

Adaptive mechanism

Complete the blanks on the adaptive mechanism using page 204 of the main textbook to help you:

- Also known as the s_____ defence mechanism
- It recognises and acts against a specific p_____ that have bypassed the i_____ defences
- The response generated is s_____ - rather than l_____ to the injury site
- It has m_____ - it remembers invaders and mounts a g_____ and q_____ attack when encountered again
- Divided into h_____ (antibody-mediated) immunity and c_____ (cell-mediated) immunity

Antigens and lymphocytes

What is an antigen? What is meant by the terms 'self' and 'non-self' in this context?

What are the two main types of lymphocytes (apart from NK cells)? What is meant by the term immunocompetence?

Humoral immunity

The figure below, from page 206 of the main textbook, shows the process of humoral immunity. Use the text on page 205 of the textbook to annotate this figure to aid your understanding of the process.

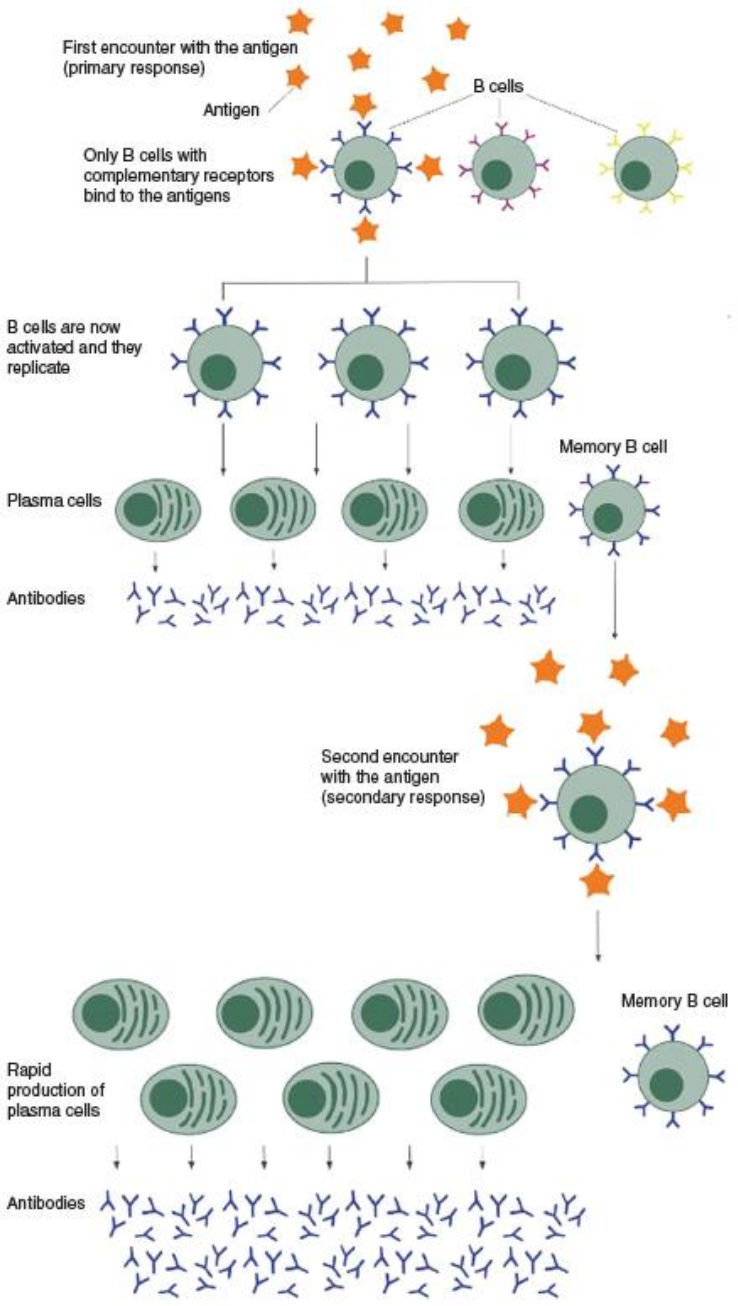


Figure 3.8.9 Antibody production during primary and secondary response

© Carpenter and Hunter (2025) p206

What are antibodies? What are they also known as, and what are the five classes?

Three of the five classes of IG are particularly relevant to midwifery. Link the Add in the correct class of IG to the statements below:

The first antibodies released by the plasma cells during the first infection (primary response)	
Make up approximately 80% of all antibodies and are present during primary and secondary responses. These can cross the placenta and provide immunity to the fetus	
These are passed through breastmilk and other bodily fluids	

Cellular immunity

What are the different types of T cells, and how do they act?

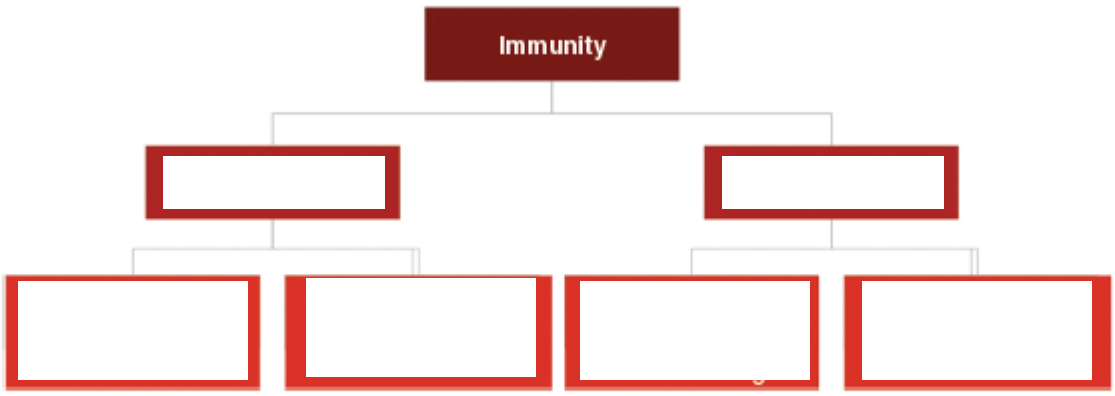
Hypersensitivity and anaphylaxis

Explain the following:

Immediate hypersensitivity	
Anaphylactic shock	
Delayed hypersensitivity	

Acquired immunity and vaccinations

Fill in the gaps in the figure (page 210 of the main textbook) to explain the four types of immunity.



© Carpenter and Hunter (2025) p210

Figure 3.8.13 Four types of immunity

Describe the key types of vaccination:

Changes and adaptations to the immune system during pregnancy

Acceptance of the fetus

It is now understood that pregnancy is defined as a state of **immunomodulation**, not immunosuppression. In your own words, explain what this means:

Passive immunity to the fetus and neonate

Describe how the fetus and neonate can receive immunity passively from the mother. How is this affected if the baby is born pre-term?

Rh factor and incompatibility

Add your own explanations to the figure below (page 213 of the main textbook).

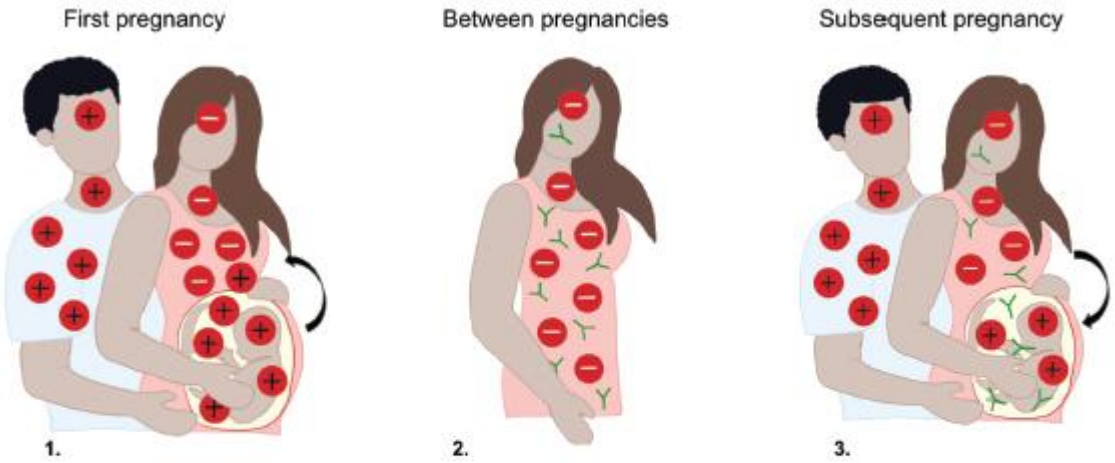


Figure 3.8.14 RhD incompatibility

© Carpenter and Hunter (2025) p213

What are the risks of RhD incompatibility to the fetus?

What does the Anti-D injection consist of, and how does it work?

SECTION W4:
Labour and birth

W4.1: The maternal pelvis

Use pages 217-226 of the main textbook to help you with this section.

Structure and functions of the pelvis

Describe the functions of the pelvis:

Label the figure of the main bones of the pelvis, below:

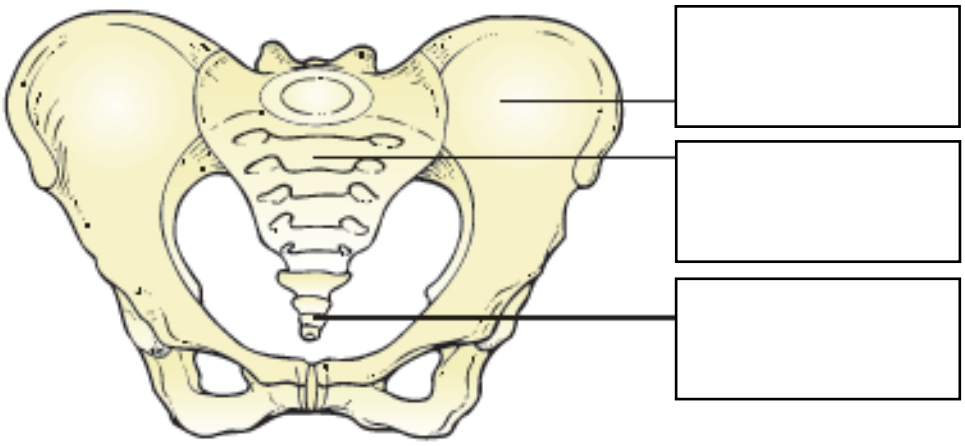
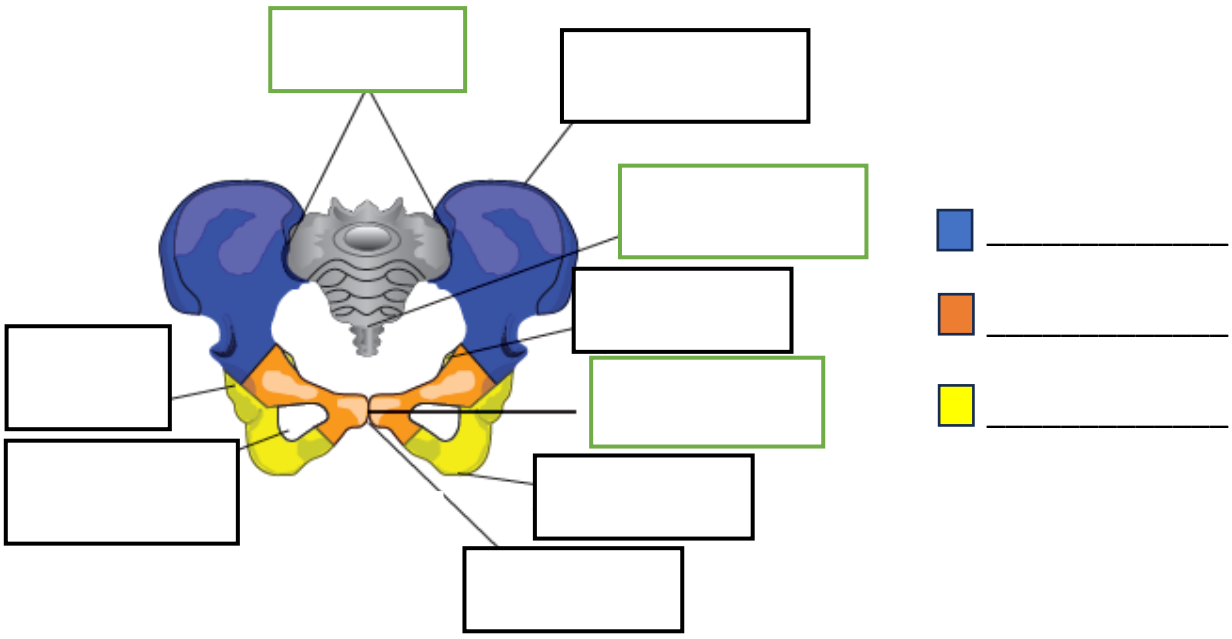


Figure 4.1.4 The pelvic bones © Carpenter and Hunter (2025) p219
Source: Figure 3.18, p.81, Clancy and McVicars (2009)

The innominate bone consists of three fused bones. These are coloured in the figure below. Use the key to the right of the image to label these bones. Some other key landmarks of the pelvis are shown with a black highlight around the box. Label these. The key joints are also shown with a green highlight around the box. Label these.



© Carpenter and Hunter (2025) p220

Figure 4.1.5 The components of the innominate bones and the pelvic joints

Now complete the following statements about the pelvic ligaments:

The s_____ l_____ span the sacroiliac joints.

The s_____ l_____ span the sacrococcygeal joint.

The i_____-p_____ l_____ reinforce the symphysis pubis.

Pelvis variations

Annotate the figure below (page 223 of the main textbook) to highlight the differences in structure between the male and female pelvis:

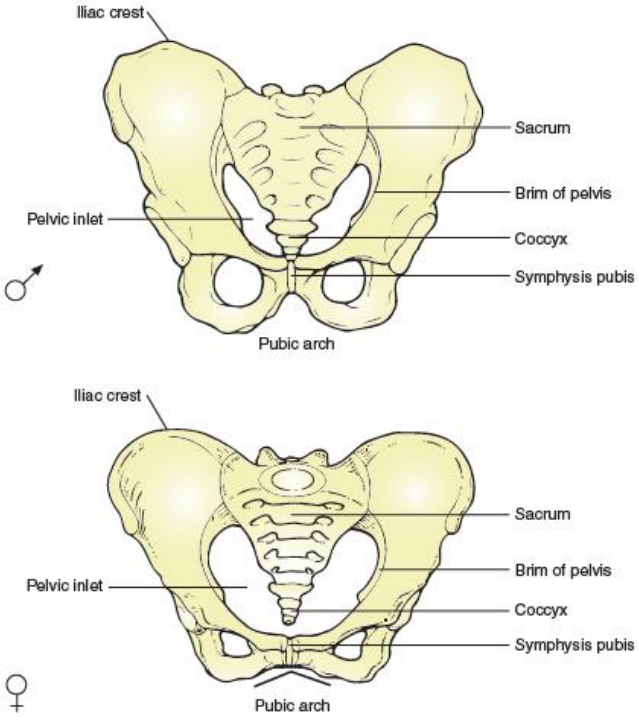


Figure 4.1.8 Female and male pelvises
Source: Figure 3.18b,c, p.81, Clancy and McVicars (2009)
© Carpenter and Hunter (2025) p223

Figure 4.1.9 (page 223 of the main textbook) shows some of the variations which can occur in female pelvic shape. However, is it likely that there are four, distinct pelvis shapes? Use the text on page 222 to help you explain and expand your answer:

Use the table below to add key notes on the different sections of the 'true pelvis' – particularly thinking about this from the perspective of the fetus navigating its way through the space during labour and birth. Use pages 222- 226 of the main textbook to help you:

Section of the true pelvis	**Key notes**
Pelvic brim	
Pelvic cavity	
Pelvic outlet	

W4.2: Physiology of first stage of labour

Use pages 227-238 of the main textbook to help you with this section.

Definition and phases of the first stage of labour

Although labour and birth is one, continuous process, it is often separated into three stages.

What is the definition of the first stage of labour?

The first stage of labour itself may be split into three phases – state these and give a brief explanation:

1. 2. 3.

The onset of labour

During pregnancy, uterine quiescence is maintained by the hormone progesterone. What is the literal meaning of progesterone?

The precise mechanisms directing the onset of labour are unknown. However, it is dependent on h_____ and m_____ factors, and the interplay between m_____, f_____ and p_____.

Labour is generally expected to take place between _____ and _____ weeks gestation.

From quiescence to activity

Delete the incorrect words / statements:

Progesterone levels DO / DO NOT fall towards the end of pregnancy in humans.

Instead, there is a shift from PROGESTERONE / OESTROGEN dominance to PROGESTERONE / OESTROGEN dominance.

Progesterone levels remain LOW / HIGH, but LOSE / GAIN their sensitivity - called functional withdrawal.

What does this change in the oestrogen / progesterone ratio result in?

There are four phases in the onset of labour, link the correct title to the correct phase below:

Phase 0	Stimulation
Phase 1	Involution
Phase 2	Quiescence
Phase 3	Activation

During phase 0, progesterone and other hormones inhibit uterine activity. This is the state in which the myometrium is found for the majority of pregnancy.

The transition from phase 0 to phase 1 is gradual, taking place a few weeks before childbirth. Place or copy the correct descriptor, below the table, into each box of the table to explain the development of the **activation** phase:

Contraction-Associated Proteins (including gap junction proteins)	
Placental Corticotropin-releasing hormone	

Increased myometrial excitability	

Enables the transmission of signals between myometrial cells, oxytocin and prostaglandin receptors, and calcium channels. This might be coordinated by a fetal inflammatory response that takes place near the end of the pregnancy as a result of the fetus growing and stretching the uterine wall.

The function of this is to stimulate fetal adrenal glands to produce steroids (such as cortisol). Via a positive feedback loop, cortisol then stimulates further placental CRH production. As the fetal hypothalamic-pituitary-adrenal system matures, both fetal and placental CRH increase, which enhances the production of oestrogen. This further alters the oestrogen/progesterone ratio tipping the balance towards oestrogen.

The above changes lead to this, and the response to uterotonics, by stimulating gap junction formation and oxytocin and prostaglandin receptors. In this phase, myometrial contractions occur more often and are more intense.

Once the myometrium has been activated it can then react to the **stimulation** provided by uterotonics. Phase 1 and 2 combined, activation and stimulation, can initiate strong contractions in the myometrium which dilate the cervix and deliver the unborn baby. Use the table below to write your own notes on the key hormones involved at this stage. Table 4.2.1 (page 230) in the main text book will help you.

Oestrogen	

Prostaglandins	
Oxytocin and oxytocin receptors	

The uterus in labour

Of what sort of muscle cells is the uterus principally comprised?

Whereabouts in the uterus is the most dense concentration of these cells (and also oxytocin receptors)?

Whereabouts in the uterus are there fewest of these muscle cells?

Why is this important?

Use the diagram below to label the three layers of smooth muscle cells. Also add on your own labels for the upper and lower uterine segments.

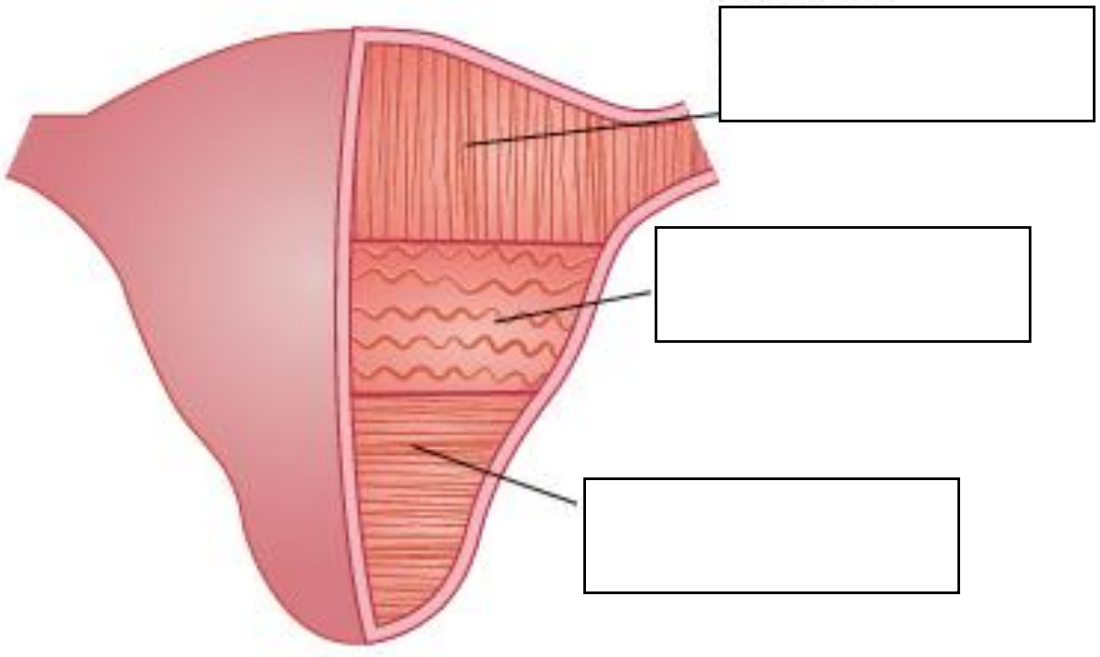


Figure 4.2.2 The uterine muscle layers

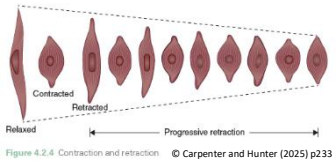
© Carpenter and Hunter (2025) p231

Physiological processes in established labour

Use figure 4.2.3 (page 232 of the main textbook) of the path of a contraction to describe, in your own words, the **coordinated** nature of uterine contractions. Consider where a contraction starts, how it builds, and how it fades. Draw your own version of the diagram and annotate it with the detail if you prefer.

How does the frequency, length and strength of contractions change throughout labour?

The table below explains key physiological processes in the first stage of labour. Insert the missing text found below the table into the correct boxes:

	Between contractions the uterus relaxes, but some of the shortening in the smooth muscle fibres is retained. As labour progresses, the muscle fibres gradually become shorter and thicker.  Figure 4.2.4 Contraction and retraction © Carpenter and Hunter (2025) p233
Fundal Dominance	
Polarity	
	Consists of **effacement** and **dilation**. Effacement is the gradual softening (**ripening**) of the cervix, followed by thinning. The external os is pulled up first, whilst the internal os remains closed until dilation. Dilation is the opening up of the cervix, caused by the retraction of smooth muscle concentrated in the upper segment of the uterus, which pulls the lower segment, and then cervix, up. In women who have not laboured before, effacement happens before dilation. In subsequent labours, effacement and dilation can happen simultaneously.

	A positive feedback loop which begins during the first stage of labour and continues until just beyond the birth of the baby. In the first stage of labour, as the fetus descends, it applies pressure onto and stretches the cervix. This stretch triggers receptors, which sends a message to the posterior pituitary to release oxytocin, causing contractions to increase in length, strength and frequency. This causes the fetus to apply more pressure onto the cervix, which causes more stretch and more triggering of receptors - and so on.
Forewaters	
General Fluid Pressure	While the membranes remain intact, the pressure of uterine contractions is exerted on the amniotic fluid and, as fluid is not compressible, the pressure is equalised over the fetal body and placenta. The same amount of pressure will also be applied onto and across the cervix, due to the pressure within the forewaters equalising, making it dilate evenly. Once the waters have broken, this no longer applies.
	The change from contractions that pull the cervix up and open to contractions that push the baby out of the uterus can precipitate physical and psychological symptoms in labouring individuals, caused by a surge in catecholamines at this stage in the labour process. List some of the symptoms below:

Transition

Retraction

Ferguson's Reflex

Cervical Dilatation

The coordinated activity of the upper and lower uterine segments. Muscle fibres in the upper segment contract and retract, pulling up the tissue in the lower uterine segment, which contains less contractile smooth muscle, and effacing and dilating the cervix.

More smooth muscle cells are found in the fundus and fewer in the lower segment. Therefore the process of retraction physically pulls the lower segment of the uterus up – causing effacement and dilatation of the cervix.

As the membranes are exposed by the dilating cervix, and the fetal head is pushed further down into the pelvic cavity, a small amount of amniotic fluid usually becomes trapped in front of the fetal head. As the pressure of the advancing fetal head increases, the membranes eventually give way and the waters break.

Read the application to Practice box on pages 236-237 of the main textbook. Consider how you might create a care environment which will support the physiology of birth. Make some notes below:

W4.3: Physiology of second stage of labour

Use pages 239-248 of the main textbook to help you with this section.

How would you define the second stage of labour?

What is the 'passive phase' of second stage labour? Why might a passive phase occur?

Other than a vaginal examination, what signs would tell you that a woman's cervix was fully dilated and ready to birth her baby?

Second stage events

Once the cervix is fully dilated, the fetus can descend through the birth canal and be born. In an unimpeded birth, descent happens with each contraction. The fetus will recede after the contraction ends, and then advance a little further with the next contraction.

What does this allow for?

Fetal axis pressure

Use the diagram below to explain, in your own words, fetal axis pressure. Why is this important?

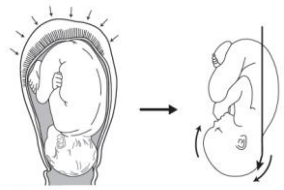


Figure 4.3.2 Fetal axis pressure
© Carpenter and Hunter (2025) p241

Ferguson reflex

Ferguson reflex was introduced in the previous section, but continues in second stage. How does it change during the second stage, and what does this cause?

Use the space below to draw a diagram of the Ferguson reflex as a positive feedback loop:

Displacement of soft tissues

As the fetus descends through the pelvis, soft tissues are stretched and displaced. Complete the following statements to explain this process correctly by inserting the missing words from the list provided:

rectum perineum down anus up bladder

The pelvic floor is displaced. Anteriorly, it is pushed _____, and the b_____ is pushed upwards into the abdomen.

Posteriorly, the pelvic floor is pushed _____, and the _____ becomes flattened.

The _____ will be stretched and appear flattened

The _____ is bulges, stretches and becomes paper thin

The passage of the fetus

As the fetus journeys through the maternal pelvis, the widest part of the fetus needs to be aligned to the widest part of the pelvis. Pelvic shape varies from woman to woman; so this journey through the pelvis will be different for different women, depending on their pelvic diameters.

Consider the two pelvic shapes described in the table blow. Answer the questions in the first column based on these pelvic shapes. It may help to have a doll and (ideally soft) pelvis available. You may need to (re)visit fetal positions before completion.

	A pelvis with an inlet and outlet that are widest in the antero-posterior diameter	A pelvis where the inlet is widest along the transverse or oblique diameter, and the outlet is widest along the antero-posterior diameter
Usual position of fetal head as it passes through the pelvic brim into the pelvic cavity		
Will the fetus need to rotate in the pelvic cavity?		
What will happen to a fetal head in the OA position as it passes under the pubic arch?		
What will happen to a fetal head in the OP position as it passes under the public arch?		
Which part of the fetal head will be born first if the fetus is in an OA position?		
Which part of the fetal head will be born first if the fetus is in an OP position?		
Will the fetal head rotate after it has passed through the pelvic outlet in order to align the shoulders for birth?		

As per the interrupter on page 245 of the main textbook, it will be useful if you can get hands on with a doll and pelvis to help you visualise and embed knowledge of the journey of the fetus during labour ad birth. An old teddy might do the trick – with some imagination! Use this to consider the fetal had positions outlined in Figure 4.3.5 (page 245) of the main textbook. Use the space below to make any notes you wish:

How do you think a midwife can help ensure that the fetus descends with as little impediment and discomfort as possible?

W4.4: The fetus during labour

Use pages 249-257 of the main textbook to help you with this section.

Fetal lie, presentation and position

Add your own explanations in the table below to explore the fetal lie, presentation and position, if you are able to, get hands on with a doll and pelvis to help embed this knowledge

Element	Description
Fetal lie	
Fetal presentation	
Fetal position	

Label the figure below with the correct fetal position in each instance:

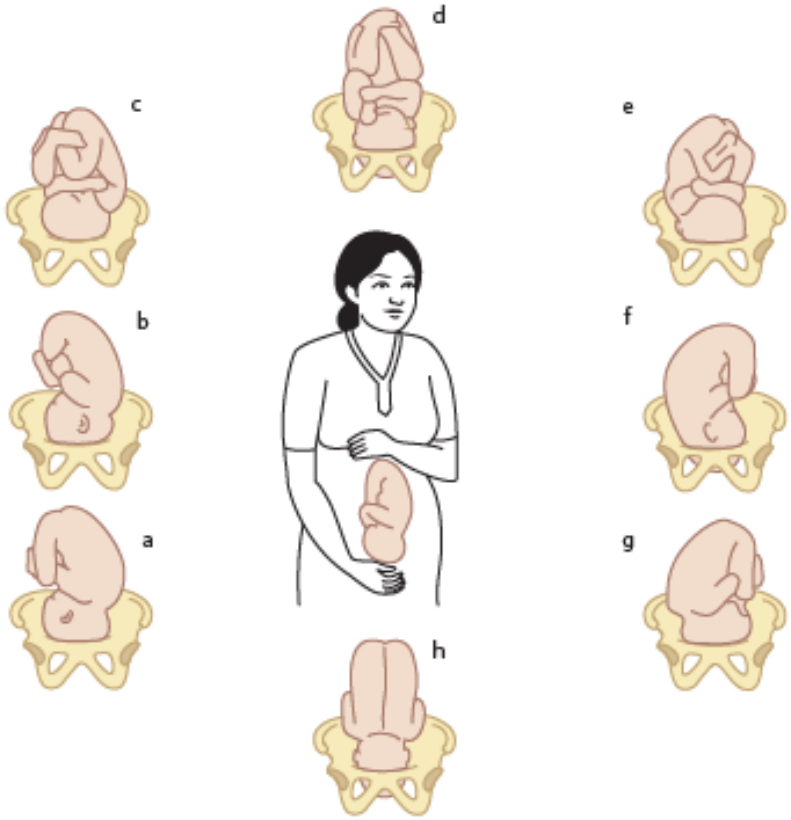


Figure 4.4.3 Describing fetal position:

© Carpenter and Hunter (2025) p252

Fetal heart rate during labour

Labour is physically demanding, and requires **active participation** from the fetus. For a physiological birth with a healthy, term fetus this is unlikely to cause any problem. However, where things deviate from normal physiology, or where the fetus is preterm or unwell, the fetus may be less able to cope with the demands of labour over time.

Currently, monitoring of fetal health relies largely on observation of the fetal heart, alongside thorough consideration of the wider clinical picture.

The two key ways in which fetal heart can be monitored are:

1.	2.

Sympathetic vs parasympathetic control of fetal heart rate

The function of the fetal heart is regulated by both the s_____ and a_____ components of the nervous system.

Complete the table below to provide a definition of each component of the fetal heart rate. Table 4.4.1 (page 254) in the main textbook will help you.

Component	Definition
Baseline rate	
Baseline variability	
Acceleration	
Deceleration	

Briefly explain how baroreceptors and chemoreceptors work, as part of parasympathetic control, to influence fetal heart rate:

Briefly explain how sympathetic control of the fetal heart occurs:

Complete the boxes below with key details about the four types of fetal hypoxia.

Acute Hypoxia	Subacute hypoxia
Gradually evolving hypoxia	Chronic hypoxia

This has given a brief introduction to some of the key considerations of monitoring the fetal heart during labour. More detailed examination is outside the scope of the textbook, and hence this workbook.

W4.5: Third stage of labour

Use pages 259-268 of the main textbook to help you with this section.

Define the third stage of labour:

Birth of the placenta and membranes

Link the correct definition to each of the three phases of the birth of placenta and membranes:

Latent phase	This includes the separation and detachment of the placenta and membranes from the uterine wall.
Detachment phase	This is the period from complete separation of the placenta to the birth of the placenta and membranes.
Expulsion phase	This is the time from the birth of the baby until the placenta starts to separate. A short phase.

Clinical signs of placental detachment

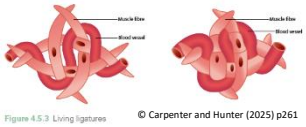
What are the signs of placental detachment?

Control of uterine bleeding

Answer the questions in the table below:

At term, what is the approximate blood flow through the uterine arteries?	
As this is maternal arterial supply, is it under high or low pressure?	
If, after the separation of the placenta, the maternal placental blood supply is not quickly controlled, what will ensue?	

There are a number of mechanisms which ensure haemostasis is achieved. Fill in the gaps in the table below using the text provided below it.

Mechanism	Explanation
Apposition of uterine walls	
	The maternal spiral arteries, which 'spiral' their way through the smooth muscle fibres, are occluded (blocked) by the ongoing retraction of those muscles via this mechanism, which constrict the torn vessels.  Figure 4.5.3 Living ligatures © Carpenter and Hunter (2025) p261
Hypercoagulable state of pregnancy	
	This further stimulates maternal oxytocin production, which is further enhanced when neonates start to breastfeed, encouraging ongoing uterine contractions. A baby in this state who starts to crawl towards the breast will also kick down on its mother's belly, further strengthening her contractions.

Living ligatures

Skin-to-skin contact

Once the placenta has been birthed, the retraction of smooth muscle continues under the influence of contractions. This mechanism therefore occurs, effectively applying pressure to the placental site. Until it has left the uterus, the placenta's bulk will prevent these contractions from being fully effective and the risk of bleeding remains high.

Women have an increased capacity for clotting during pregnancy, and there is a further transient rise during labour in preparation for birthing the placenta. Usual clotting processes commence, and the placental site is quickly covered in a fibrin mesh.

Management of the third stage of labour

Describe the process of expectant management of the third stage:

What are the core elements of active management of the third stage:

Confirmation of completion of the third stage

This includes examination of the placenta, membranes and cord; and monitoring of blood loss.

Why is it important to monitor blood loss?

Use the space below to outline your own systematic examination of the placenta, membranes and cord.

Why is it important to undertake this as part of third stage care?

W4.6: Pelvic floor and perineum

Use pages 269-279 of the main textbook to help you with this section.

Pelvic floor function and structure

Label the diagrams of the deep (a) and superficial (b) pelvic floor muscles below:

a

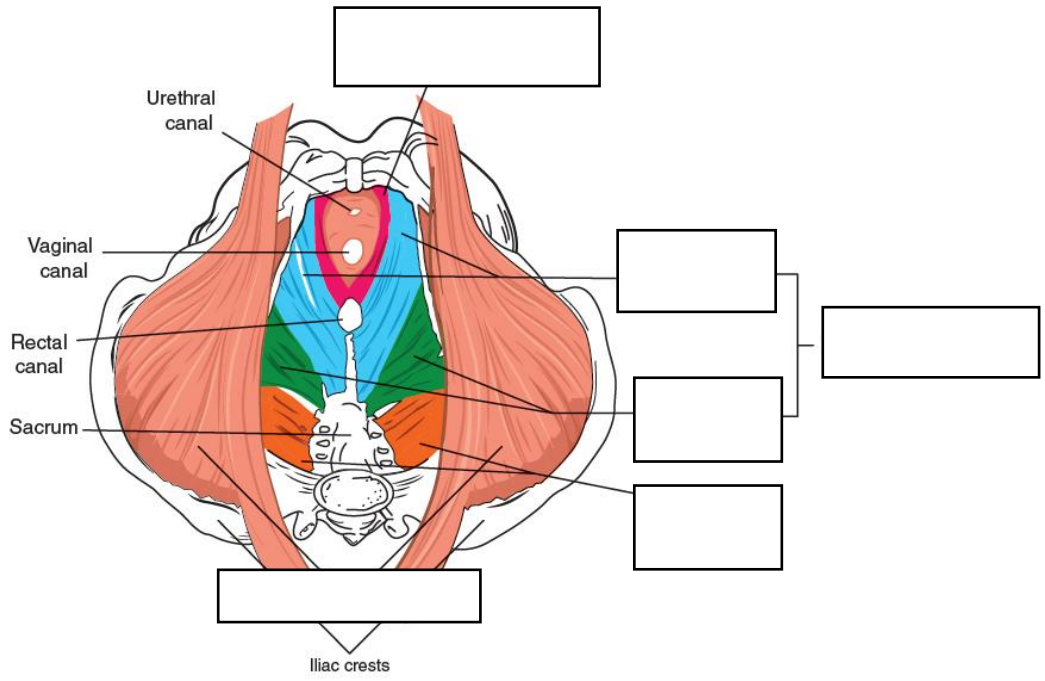


Figure 4.6.3 Deep pelvic floor muscles © Carpenter and Hunter (2025) p273

b

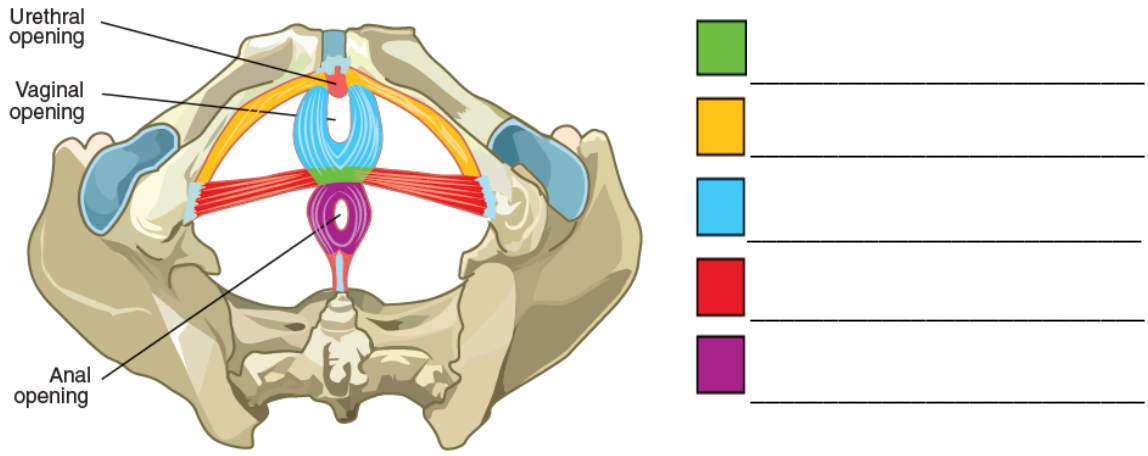


Figure 4.6.4 Superficial pelvic floor muscles
© Carpenter and Hunter (2025) p2274

What are the four key functions of the pelvic floor?

1.

2.

3.

4.

Explain why pelvic floor exercises are important during pregnancy and postnatally; and give a brief outline of how to perform these:

The perineum in childbirth

Damage to the perineum, vaginal wall, labia and other areas is not unusual during the birth of a baby. Below, describe the key types of perineal trauma.

Trauma	Description
Superficial	
First degree	
Second degree	
Third degree (please explain 3a, b and c)	
Fourth degree	

Repair to the perineum aims to achieve both haemostasis and alignment. Explain these terms in this context:

Haemostasis: Alignment:

W4.7: Changes to body systems during labour and birth

Use pages 281-287 of the main textbook to help you with this section.

In Section W3 we considered the changes which happen during pregnancy across the body systems. Further change and adaptation occurs during labour; and this is what will be explored here. Use the table below to add your own notes on these changes.

Body system	Relevant changes during labour
Cardiovascular system – blood parameters	
Cardiovascular system	
Respiratory system – maternal alkalosis	
Respiratory system – maternal acidosis	

Body system	**Relevant changes during labour**
Gastrointestinal system and nutrition	
Renal system	
Nervous system	

SECTION W5:
The puerperium

W5.1: Maternal postnatal physiology

Use pages 291-308 of the main textbook to help you with this section.

Changes to body systems in the puerperium

The puerperium is the period of time after birth of the baby and placenta, up until _____ weeks, or _____ days later. It is a time of p_____ and p_____ adjustment.

Using pages 292-293 of the textbook to help you, make your own notes on changes to body systems during the puerperium.

System/ component	Physiological influences and outcome
Cardiac	
Haematological (including coagulation)	

System/ component	Physiological influences and outcome
Renal system	
Respiratory	
Gastro-intestinal	
Endocrine (including Thyroid gland)	

System/ component	Physiological influences and outcome
Uterus	
Breasts	
Vagina	
Other	

Postnatal physiology and care

Uterine involution is:

This is brought about by "a_____" and assisted by the action of o_____

Lochia

Link the statements below together correctly:

Day c.10+	**Lochia rubra**	Dark red/pink/brown. Watery. Contains leucocytes, mucus, vaginal epithelial cells, necrotic decidua, non-pathological bacteria.
Day 1-4	**Lochia serosa**	Yellow-white discharge. Mostly serous fluid and leucocytes, plus some cervical mucus and microorganisms
Day 5-c.10	**Lochia alba**	Red. Thick mucoid consistency. Decidual tissue which is initially sterile until colonisation occurs from vaginal flora.

Define primary and secondary postpartum haemorrhage:

Primary postpartum haemorrhage…

Secondary postpartum haemorrhage…

Use pages 294-297 of the textbook to help you answer the following two case studies.

1. Anushka: Anushka is two days postnatal after a vaginal birth with normal blood loss at birth, and no perineal tear. She tells you that she is getting cramps on and off – and they are worse when breastfeeding. Would you be concerned? What might you do / ask Anushka to help your decision making?

2. Deepa: You go to visit Deepa at home who had her baby 10 days ago. You can still clearly palpate her uterus.

Would this concern you? Why?

What might you do / ask Deepa to help you with your decision making? Would you be happy to discharge Deepa from midwifery care at this point?

Perineal healing

Wounds that are not sutured will heal by S_____ I_____.

Use page 298 of the textbook to fill in the empty boxes with the remaining stags of healing. Use the space around to make notes on key details for each stage.

1. Haemostasis

2.

3.

4.

What are some of the signs of compromised healing?

Bladder and bowel function

Both the bladder and bowel are affected by hormonal changes in pregnancy and can undergo stress and sustain damage during labour. Use the spaces below to note the ways in each can be affected during labour, and potential postnatal complications:

Bladder:

Bowel:

Thrombosis and thromboembolic disorders

Postnatal hypercoagulability, particularly in the first 48 hours following birth, increases the risk of thrombosis and thromboembolic disorders (VTE).

DVT = d_____ v_____ t_____

PE = p_____ e_____

A DVT is:

What is a PE? Where else can clots travel, causing what to occur?

What has MBRRACE-UK (2023) found to be the leading direct cause of maternal morbidity up to 6 weeks postnatally in the UK?

There are a number of additional risk factors, in addition to being postnatal, which can further increase chance of developing a DVT. List these below:

In the table below, write 'DVT' or 'PE' in the spaces provided to indicate which condition this is a symptom of. (Note that the symptoms listed can be indicative of other conditions. Here we are focusing only on these two.)

Symptom	**Condition**
Swelling in one leg (rarely, it can be both)	
Shortness of breath or difficulty breathing	
Collapse	
Throbbing or cramping pain in one leg (usually in the calf)	
Localised itchiness	
Sudden change in mental state	
Numbness or weakness on one side of the body	
Irregular or rapid heart rate	
Painful area feels warm and surrounding skin may appear darkened	
Swollen veins that are hard and/ or sore	
Pain (particularly chest pain)	

What are some of the key ways to reduce the risk of developing DVT:

Mental health in the postnatal period

Transient or ongoing mental health issues are a common feature postnatally. In the UK, depression and anxiety affect 15– 20% of women in the first year following childbirth (NICE, 2020). Annotate around the image below to add in details of the different mental health conditions which can occur in the postnatal period (use table 5.1.7, page 304 of the main textbook to help you).

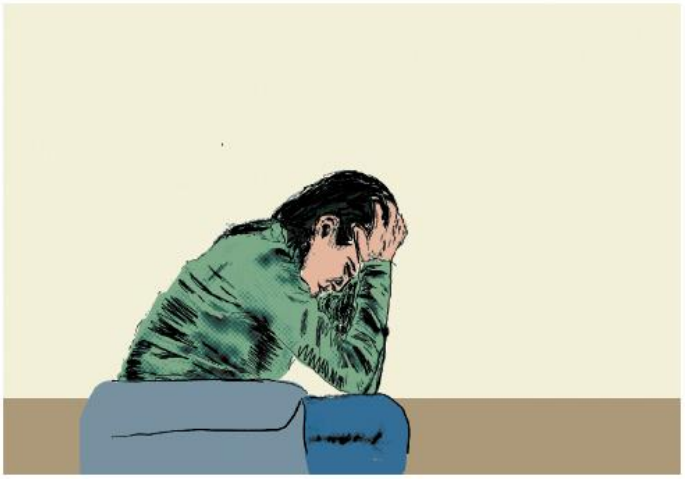


Figure 5.1.4 Postnatal blues
Source: Image from Claire Smith

© Carpenter and Hunter (2025) p305

W5.2: The transition from fetal to neonatal life

Use pages 309-334 of the main textbook to help you with this section.

Fetal circulation

Fill in the blanks below to describe the unique features of fetal circulation (use page 310 of the main textbook to help you):

Oxygenated blood travels from the placenta to the baby via the u_____ v_____**.** Half of this blood then travels to the baby's heart via the l_____, and half travels directly to the heard via the d_____ v_____. Once in the heart, most of the blood travels from the r_____ a_____ to the l_____ a_____ via the f_____ o_____. From the left atrium, the blood passes into the l_____ v_____ then via the ascending aorta to the rest of the body. The small amount of blood which was left in the right atrium moves into the r_____ v_____**.** A very small amount of blood travels from there to the lungs, however most of the blood bypasses the lungs by passing through the d_____ a_____. Deoxygenated blood then returns to the placenta via the u_____ a_____**.**

Label the five key features of fetal circulation shown below in red boxes (there are six boxes as one of the five features is split into its two component parts):

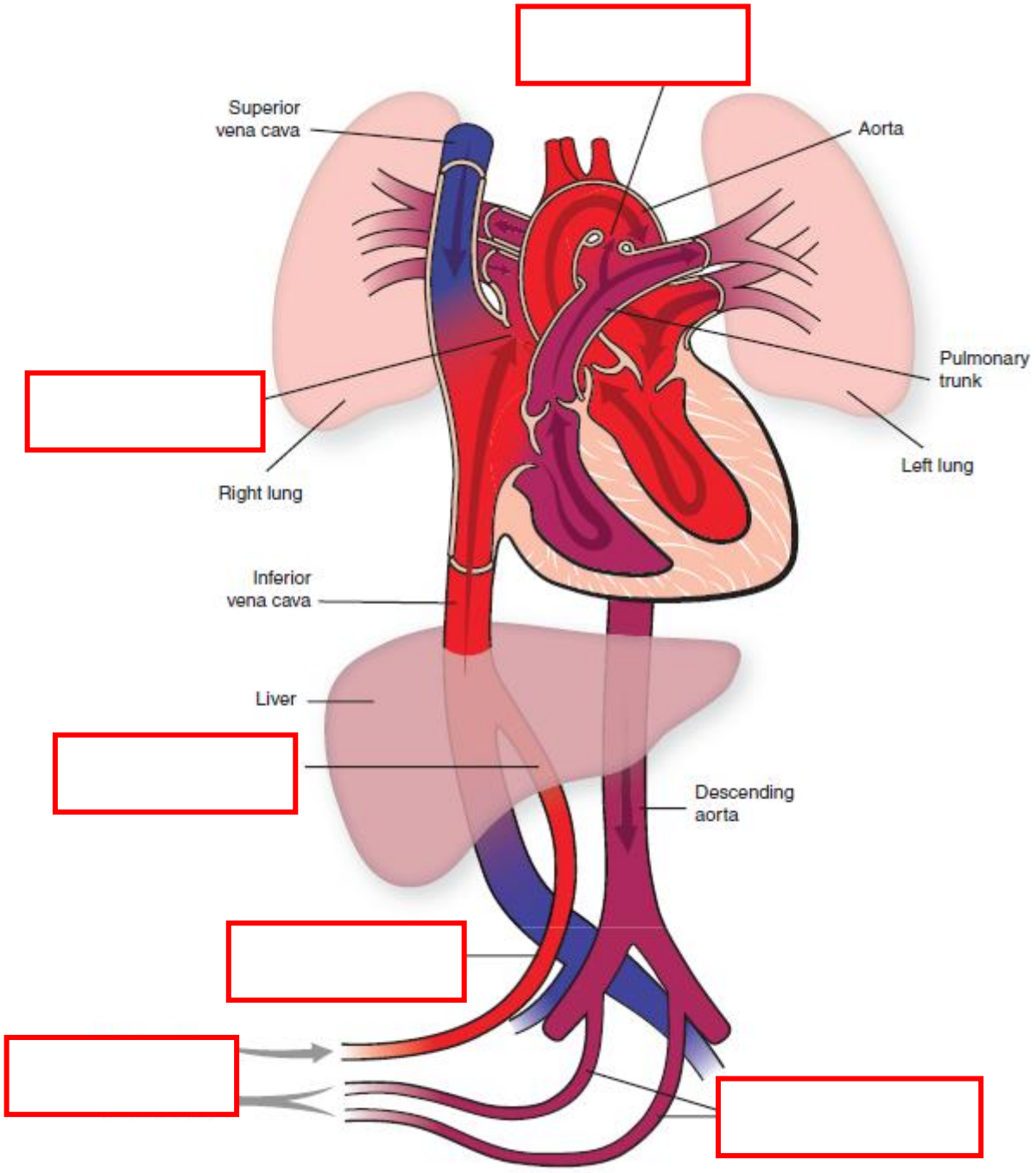


Figure 5.2.1 Fetal circulation

© Carpenter and Hunter (2025) p311

From fetal to neonatal circulation

Two relatively immediate changes initiate other changes within the newborn's body. Use the boxes below to provide the explanation for these changes.

	Description	Explanation
Change 1	Termination of blood supply from the placenta	
Change 2	Sensory stimulation	

Now fill in the blanks below to describe the other changes which support the transition from fetal to neonatal circulation initiated by the two changes above:

Blood flow in the **u**_____ **v**_____ stops, the **d**_____ **v**_____ gradually closes and blood flow is redirected for hepatic circulation.

The presence of **o**_____ stimulates the **d**_____ of the blood vessels in the lungs (previously been subjected to hypoxic vasoconstriction). The lungs then change from being an area of **h**_____ resistance to being an area of **l**_____ resistance, encouraging blood flow to, rather than away, from them.

The **d**_____ resistance within the lungs has the effect of reducing the pressure within the **r**_____ **a**_____ of the heart. This, together with the increased pressure in the **l**_____ **a**_____, causes the **f**_____ **o**_____ to close (remember, the foramen ovale only opens from right to left). The decreased resistance within the lungs also has the effect of reducing the flow of blood through the **d**_____ **a**_____ which gradually closes.

Maintaining glucose levels (metabolism)

Following birth, the initial nutritional need is for c_____ in the form of g_____. A newborn blood glucose level is approximately _____ to _____% of their mothers at first, but this f_____ quickly within the first hour of life.

What is meant by the phrase counter-regulation?

Complete the table below to show the different ways the newborn can achieve this:

Method	Explanation
Insulin suppression	
	Catecholamines stimulate enzymes in the liver to promote the conversion of stored glycogen to glucose
Glucogenolysis	
	processed from fat stores, are utilised to protect the brain until more glucose is available

Which babies may be less able to maintain their glucose levels?

Temperature stabilisation (thermoregulation)

Label the diagram below to show the key ways in which heat can be lost:

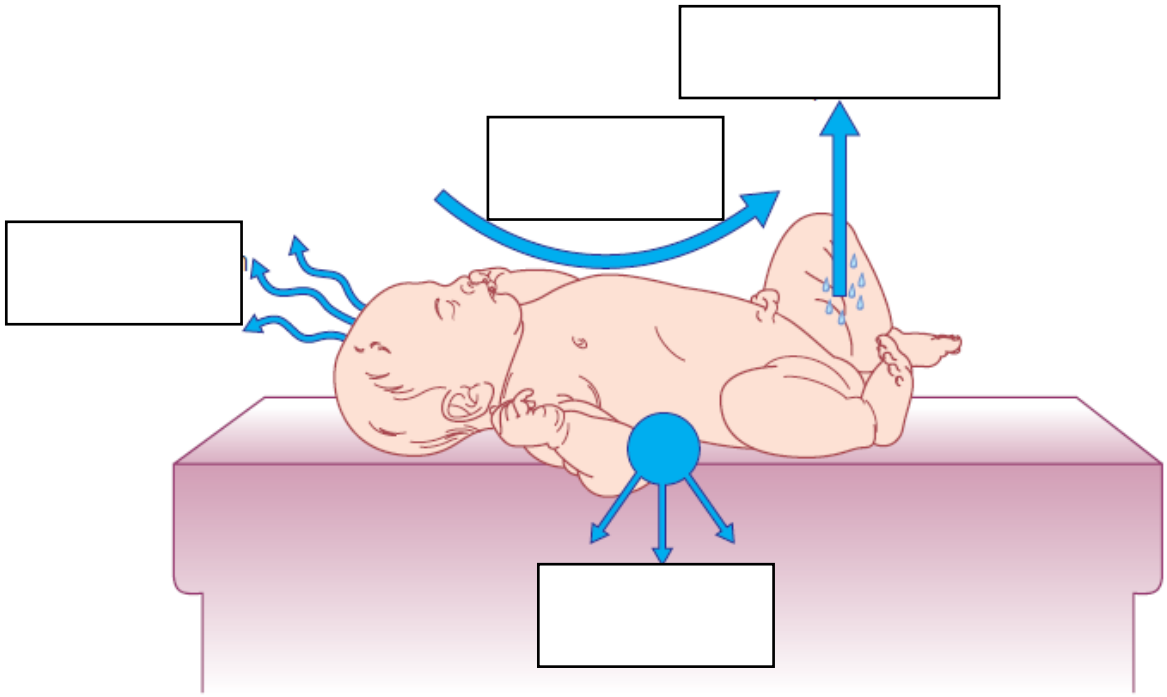


Figure 5.2.3 Heat loss mechanisms

© Carpenter and Hunter (2025) p316

Now complete the table below:

Method of heat loss	**Definition and examples of how this can occur**	**How to prevent**
Radiation		
Convection		
Conduction		
Evaporation		

What is meant by the term ‘non-shivering thermogenesis?

Which babies may be less able to maintain their body temperature levels?

The relationship between hypoglycaemia, hypoxia and hypothermia

Hypoglycaemia, hypoxia and hypothermia are interlinked, as illustrated in the ‘energy triangle’. Fully annotate the figure given below, using the text on pages 317-318 and the figure on page 318 to help you.

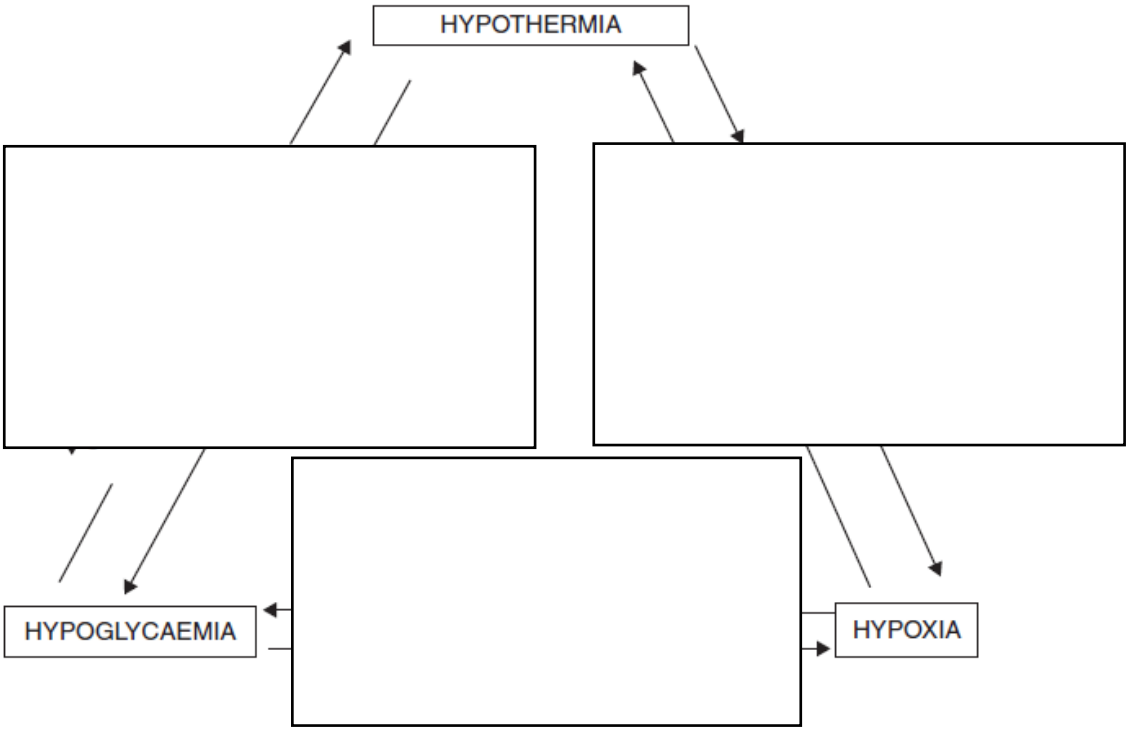


Figure 5.2.5 The energy triangle

© Carpenter and Hunter (2025) p318

Protection from infection

What is the micribiome, and what processes during birth lay the foundations for microbiome development in the fetus?

Supporting the physiological transition to life

Complete the table below to explain how these factors support the transition to extrauterine life:

Factor	Explanation
Vaginal birth	
Optimal cord clamping Or Delayed cord clamping	
Skin-to-skin contact	

Red blood cell changes and neonatal jaundice

Complete the following by deleting the incorrect word, or filling in the gaps:

Fetal red blood cells have a HIGHER / LOWER affinity for oxygen than maternal red blood cells.

After birth fetal red blood cells are broken down and replaced with neonatal red blood cells which are LARGER / SMALLER, MORE / LESS numerous and have a HIGHER / LOWER haemoglobin content.

Haemoglobin from the fetal cells is broken down into h_____ and g_____. Globin is further broken down into a_____ a_____ which are recycled. Haem is converted first to b_____, and then further to b_____ by enzymes in the liver, spleen and lymph nodes. Bilirubin is a w_____ p_____ that needs to be excreted from the body.

Use your own method (an image, a story, text notes – whatever makes sense to you!) to describe the process of bilirubin metabolism. Make sure you include all of the key stages and words in the process. Figure 5.2.6 (page 320) along with text on pages 320-321 will help you.

If you were caring for a mother and newborn, and the newborn developed jaundice at 18 hours old, would this concern you? Why?

Why would you encourage a woman with a newborn with physiological jaundice to feed her baby frequently?

What is kernicterus?

Which babies may struggle more with the effects of physiological jaundice?

How is newborn jaundice assessed and managed?

Give 3 reasons why the neonate of a mother who had induction of labour and then a Caesarean section for fetal distress may develop jaundice after 24 hours of age?

Newborn physical checks and examinations

Systematic examination of the newborn (SEN)

Undertaking a top-to-toe approach to check the newborn within the first hours can check that the baby is transitioning effectively to extrauterine life, and that no anomalies or symptoms of underlying conditions are missed.

A second physical examination within 72 hours of birth provides a further opportunity to check for certain abnormalities and confirm that the newborn is adapting effectively to extrauterine life. In England, this forms the first part of the **Newborn and Infant Physical Examination (NIPE),** other countries have similar versions of this check.

The SEN (NIPE) aims to reduce infant morbidity and mortality by identifying detectable congenital abnormalities in:

1._____ 3._____

2._____ 4._____

The NIPE screening programme handbook is freely available to access from this webpage https://www.gov.uk/government/publications/newborn-and-infant-physical-examination-programme-handbook. Other similar checks in other countries will have their own handbooks. Use the correct handbook / guidance for your area, along with the textbook to answer the following. (If where you are does not have such guidance, or you are not sure, use the link above, along with the main textbook.)

Babies may be at increased risk of having problems with their **eyes** if:

The main purpose of the examination of the **eye** is:

The aim of the examination of the **heart** is early detection of

c_____ h_____ d_____.

Which newborns are at increased risk of CHD?

During a newborn examination, an extra **heart** sound is heard on auscultation and the baby's respiratory rate is 70 per minute. It is also evident that the baby's lips are slightly cyanosed. What might be the problem? What action(s) would you take?

The main purpose of the examination of the **hips** is:

Neonates at increased risk of this are:

The two manoeuvres associated with the examination of the **hips** are the

B_____ and O_____ manoeuvres.

The absence of one (unilateral) or both (bilateral) of the **testes** in the scrotum is

known as c_____.

Neonates at increased risk of this are:

How should a unilateral undescended **teste**, palpable in the inguinal canal, be treated?

How should bilateral undescended and impalpable **testes** be treated? Why?

SECTION W6:
Lactation

W6.1: Constituents of breastmilk

Use pages 337-342 of the main textbook to help you with this section.

An evolving, changing fluid

Colostrum is a highly viscous, concentrated milk produced in the breasts from around 16 weeks of pregnancy and available to the baby immediately after birth. How does colostrum protect babies?

1
2
3
4

A crucial immune defence and immune system trigger

Antibodies found in breastmilk provide passive immunity while the neonate's immune system develops. Match the correct antibody to its function:

IgA	These antibodies can make pathogenic bacteria more susceptible to phagocytosis
IgG	These antibodies function as an antigen receptor on activated B cells
IgM	These antibodies coat the newborn gut, preventing the entry of bacteria and viruses
IgD	These antibodies are made as an initial response to infection

Several important constituents of breastmilk are multi-functional. Summarise the different roles of the compounds in the table below.

Compound	Functions
Lactoferrin	Passive immunity
	Anti-inflammatory mechanism
	Immune defence
Oligosaccharides	Passive immunity
	Immune defence
Cytokines	Anti-inflammatory mechanism
	Immune defence
Vitamin A	Anti-inflammatory mechanism
	Immune defence

How would you explain breastmilk's role in immune protection to parents? Use the space below to detail this. Try to include all of the key functions above, and some examples of how each works.

A complete source of nutrition

Fill in the blanks below. Use page 341 of the textbook to help you.

The constituents of breast milk _____ as a baby develops, providing a _____ _____ of nutrition until six months of age. Until this point, an infant is unlikely to have the _____ and _____ skills needed to cope with solid foods. After this point, the World Health Organisation recommend that breastmilk remains a principal source of nutrition until around _____, and an important supplementary food source until _____ and _____. It can provide half or more of a child's energy needs between the ages of 6 and 12 months, and one third of energy needs between 12 and 24 months.

Use the table below to make your own key notes on the nutritional components of breastmilk:

Component	**Key Notes**
Water	
Carbohydrate	

Component	**Key Notes**
Fats	
Protein	
Vitamins	
Minerals	
Trace elements	

W6.2: Anatomy of the breast and physiology of lactation

Use pages 343-352 of the main textbook to help you with this section.

The anatomy of the female breast

Label the diagrams below from page 347 of the main workbook:

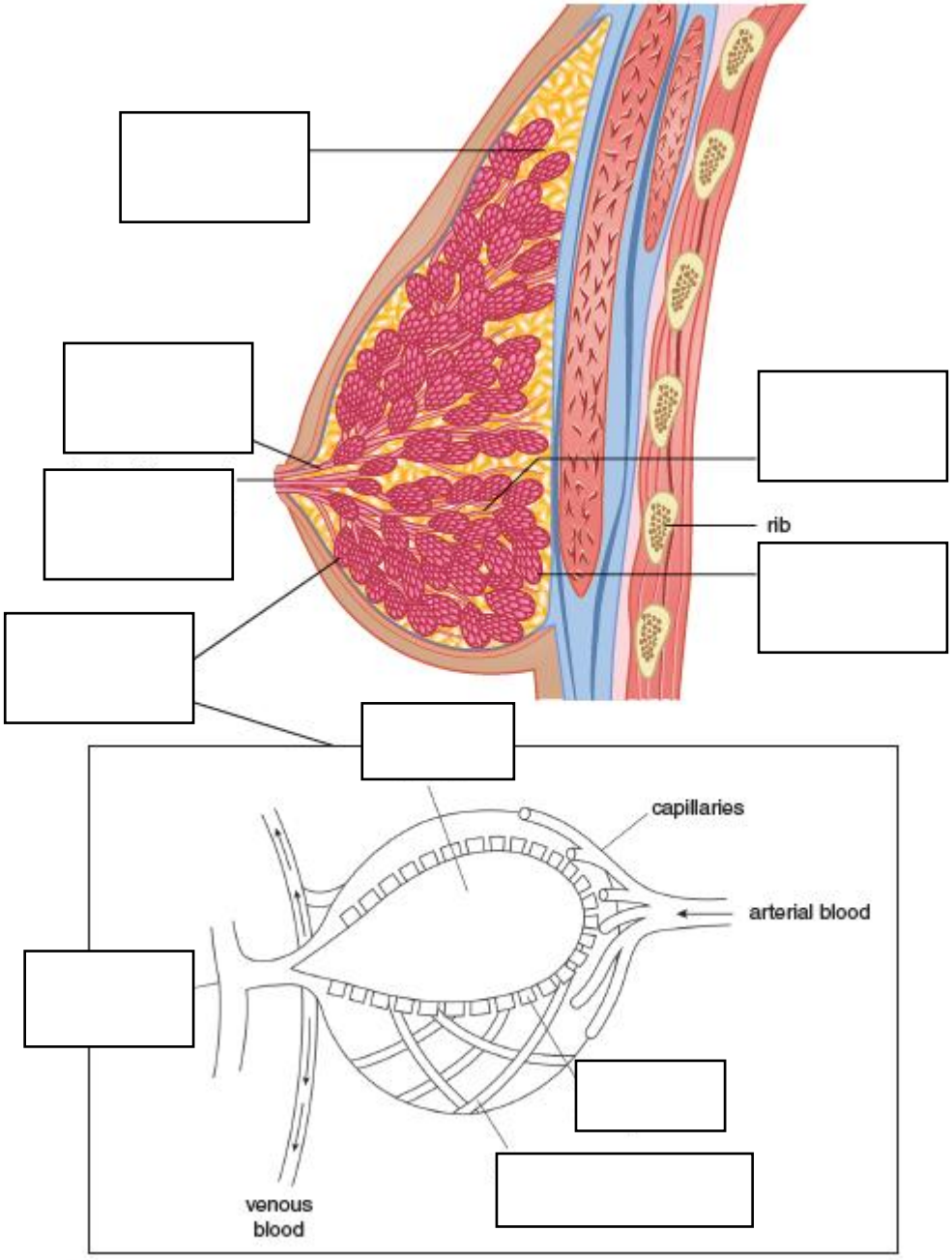


Figure 6.2.3 Internal anatomy of the breast, with magnified cross section of an alveolus

© Carpenter and Hunter (2025) p347

Fill in the blanks using the words in the box below:

The breasts are _____ _____ positioned on the anterior chest wall. Their primary function is to produce milk to protect and nourish the infant. External features of the breast are the nipple, which contains between 4 and 18 (usually 5- 9) openings for milk excretion. Around this is a pigmented area called the _____ which contains a number of sebaceous glands called _____ _____. These glands secrete an oily fluid to keep the skin healthy. This fluid has a particular scent (not unlike amniotic fluid) that is thought to draw the baby towards the nipple to feed.

If we were to travel in through a nipple, we would be met with between 4 and 18 _____, which soon divide into _____. Each ductule terminates in a cluster of _____ known as a _____.

Milk synthesis occurs in the _____. Each alveolus has a rich _____ _____ (why?) and is lined with a single layer of milk-producing cells called _____. Myoepithelial cells surround the alveoli and, when they contract, force milk out into the lactiferous ducts from where it flows to the nipple.

alveoli	**glandular structures**		**vascular supply**
D } v š P } u Œ Ç [• š µ Œ o	**lactocytes**		**ductules**
lactiferous ducts	**areola**	**lobule**	**alveoli**

Breast changes in puberty, pregnancy, and beyond

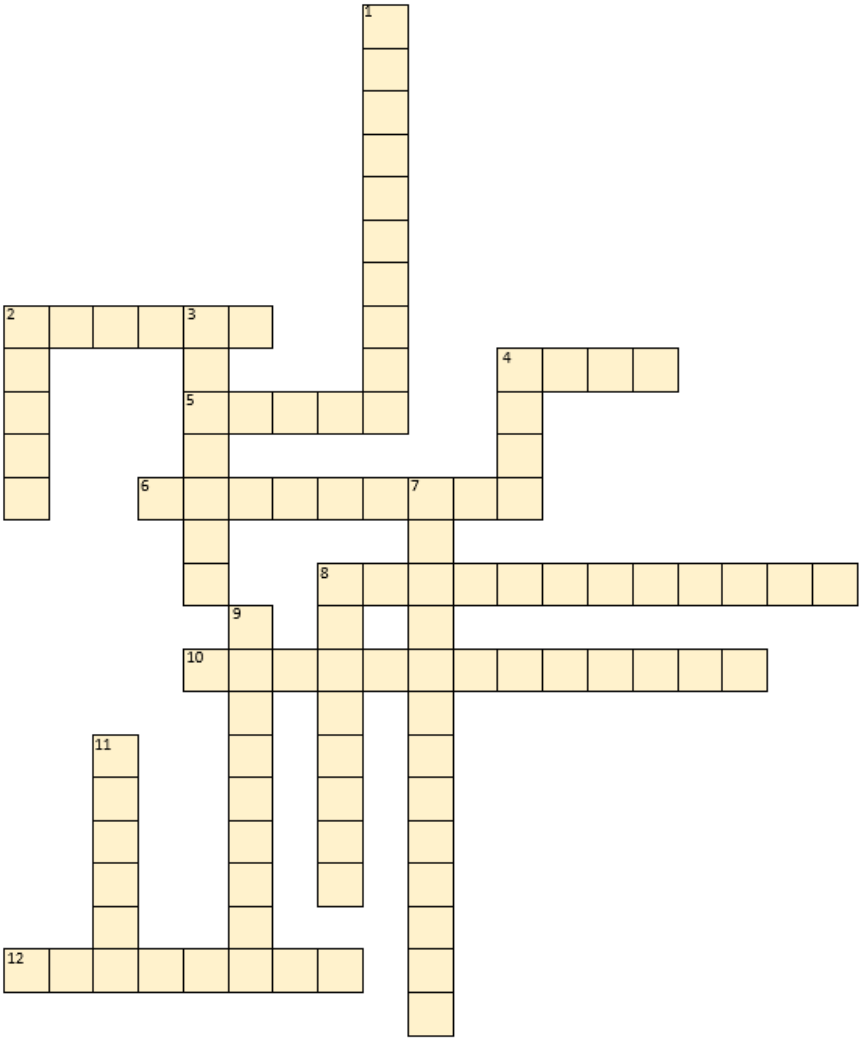
Use pages 346-348 of the textbook to help you complete the cross word below:

Across

2. The areola can do this in pregnancy
4. Varies from person to person, and does not affect production
5. There will be many more of these in the breast in pregnancy
6. Stimulates breast development in pregnancy
8. Levels fall after placenta removed
10. One of the first signs of adolescence in girls (6,7)
12. Progesterone, oestrogen are a type of these

Down

1. Alveolar cells differentiate to become these
2. A consequence of the menopause for breasts
3. Action of tubercles on oily contents
4. This can become more shiny on the breast in pregnancy
7. Stimulates development of ductal system
8. The birth of this is a game changer for lactation
9. Supports oestrogen to stimulate growth of lactiferous ducts
11. Pregnancy protects against a form of this



The physiology of lactation

Lactogenesis and milk transfer

What are the key differences between Lactogenesis I and II, and Lactogenesis III?

Define and briefly explain the following:

Lactogenesis stage 1	
Lactogenesis stage 2 (include details on prolactin receptors)	
Lactogenesis stage 3 (include the two ways which prevent over production of milk)	

Prolactin and Oxytocin

Link the two hormones to the two processes to show which hormone is involved in the regulation of which process:

Prolactin

Oxytocin

Milk ejection

Milk production

In the table below, use the right-hand column to add Prolactin, Oxytocin, or Both to answer the statement given:

Statement	**PROLACTIN, OXYTOCIN, OR BOTH?**
Released in pulsatile bursts from the posterior pituitary gland every 5-15 minutes during a feed	
Produced and secreted by the anterior pituitary gland	
Travels through the bloodstream to receptor sites on the lactocytes	
Induces feelings of love and protection	
Causes myoepithelial cells around the alveoli to contract, pushing milk into the milk ducts and towards the nipple	
Instructs lactocytes to make milk	
Responsible for the 'let down reflex'	
Increases blood circulation to the breast	
Causes smooth muscle around the uterus to contract	
Levels increase in response to stimulation of breast, areola and nipple	
Levels peak around 30-45 minutes after baby starts to feed	
Reduces cortisol levels	
Plasma concentrations of this hormone highest during REM sleep	
Inhibited by stress	

Feedback Inhibitor of Lactation

Human milk contains a protein called FIL (the F_____ I_____ of L_____). This alerts milk producing cells to stop making milk once the breasts become full. Then, when the baby feeds, levels of milk and therefore levels of FIL fall and production recommences.

To summarise:

(Insert the following words into the gaps below: **early**, **more**, **effective**, **production**, **frequent**, **made**)

Milk removal generates _____.

The more milk that is removed, the _____that is _____.

_____, _____ and _____ feeding is essential to maximise milk production.

Use the space below to make notes on how you could summarise the physiology of lactation in a way that will make sense to parents. Consider using the analogy of the Chef (prolactin) and Waiter (oxytocin)

The mechanism of suckling

Number the following statements in the order in which they occur as the baby latches and starts a feed:

No.	Statement
	The tongue, lips and jaw form a seal around the breast tissue.
	Milk flows from the high-pressure environment in the lactiferous ducts to the lower pressure environment in the baby's mouth
	The baby's soft palate rises and seals off the nasal cavity, and the epiglottis seals off the baby's airway
	Baby uses their tongue to bring breast tissue into their mouth, shaping it into a teat with the nipple at the far end
	The baby's tongue moves back up, equalising the pressure in the mouth and breast and milk flow stops
	The milk in the baby's mouth is channelled in a bolus towards the throat, triggering swallowing
	The baby's tongue and lower jaw move down, expanding the space in the oral cavity and reducing the pressure

W6.3: Supporting and maintaining breastfeeding

Use pages 353-368 of the main textbook to help you with this section.

Positioning and Attachment

Enter Positioning or Attachment into the right-hand column of the table below as appropriate:

Definition	Positioning or Attachment?
The way a baby is held or supported in order to feed	
The way a baby latches onto the breast to feed, or the way a mother brings her baby to the breast	

Positioning

Complete the Table below to explain the positioning acronym 'CHINS'

Letter	Principle of positioning
C	
H	
I	
N	
S	

Attachment

Describe what is happening in each of the pictures below, which show different stages of a baby latching onto the breast.

Image	Your description of principles of attachment shown

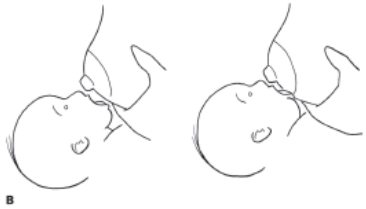



Figure 6.3.2 Latching. Source: © UNICEF UK Baby Friendly Initiative © Carpenter and Hunter (2025) p356	

Effective milk transfer

Khadija has a healthy, 5-day old baby who was born at term. Use the space below to list some signs that might reassure her that her baby is feeding well and taking in sufficient milk:

What might the implications of infrequent feeding in the first couple of days be for Kahdija, and for her baby?

Supporting innate and relational feeding behaviours

Responsive feeding and brain development

How can secure attachment be fostered in a newborn?

List some of the consequences of secure attachment and insecure attachment for the baby's health and emotional wellbeing below

Secure attachment	Insecure attachment

Potential challenges to the physiological mechanisms of lactation

Match the conditions/actions listed in the box below to their effect (some may occur more than once)

SIX things that may adversely impact prolactin levels	FIVE things that may adversely affect oxytocin release	ONE thing that may decrease the fat content of breast milk	ONE thing that may inflate baby's birth weight and reduce desire to feed

Hypothyroidism	**Alcohol**	**Diabetes insipidus**	**Smoking**
Polycystic ovary syndrome		**Type I Diabetes**	**Pain**
Some oral contraceptives		**Intravenous fluids in labour**	**Obesity**
Stress	**Morphine**	**Caesarean birth**	

List the feeding challenges that a baby born at 35 weeks may experience

Match each condition to its most appropriate management plan:

Thrush	Correct positioning and attachment. Expressing breastmilk onto the affected area may relieve
Sore nipples	Hand express a little milk prior to offering feed
Mastitis	Swab mother's nipples and baby's mouth to confirm. Observe a feed to rule out problems with latch. If diagnosis confirmed, treat condition.
Breast fullness	Continue to feed/express according to baby's needs. Warm flannel to encourage milk flow, cold compress after feed to reduce inflammation. Check positioning and attachment. Secure a course of antibiotics, offer analgesics and anti-inflammatories.

The Physiological implications of not breastfeeding

Which of these possible outcomes of not breastfeeding are a risk for the mother, and which for the baby over the course of their life span? Some may be a risk for both.

Physiological implication	**Mother, Baby, or Both?**
Hypertension	
Necrotising Enterocolitis	
Ovarian Cancer	
Crohn's disease	
Hip problems	
Blood loss after birth	
Chest infections	
Arthritis	
Diabetes	
Cardiovascular disease	
Osteoporosis	

THE END

You made it!

We hope you have found this resource useful to consolidate your learning about the amazing anatomy and physiology of childbearing. Whether a student or qualified midwife, or from another health profession entirely, our hope is that we have helped you just a little bit with your knowledge and understanding of this wonderful, but complex, topic – both via the textbook and this accompanying workbook.

We wish you so much success for whatever your future holds; and thank you for your engagement with our book and accompanying workbook!

Jane Carpenter

Louise Hunter