GYM INSTRUCTOR WORKBOOK / MANUAL 1

LEVEL 2

UNIT 1

# ANATOMY & PHYSIOLOGY FOR EXERCISE



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# UNIT CONTENTS


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# KEY ANATOMY AND PHYSIOLOGY TERMINOLOGY

| | |
|---|---|
| **Abduction** | Away from the midline of the body |
| **Adduction** | Towards the midline of the body |
| **Aerobic** | In the presence of oxygen |
| **Afferent** | An incoming signal |
| **Agonist** | The main muscle that causes the muscle action |
| **Anaerobic** | Without the presence of oxygen |
| **Antagonist** | The opposing muscle to the agonist that relaxes to allow movement |
| **Anterior** | In front of the midline (Front) |
| **ATP** | The bodies energy currency |
| **Autonomic** | Under no direct control (actions we do not need to think about) |
| **Cardiac Output** | The amount of blood pumped from the heart in one minute<br>= HR x SV |
| **Cardio-respiratory** | The heart and lungs |
| **Cardiovascular** | The heart and the blood vessels |
| **Circumduction** | A circular movement available at ball and socket joint |
| **Concentric** | A muscle generates force whilst shortening |
| **Constriction** | To become smaller in size |
| **Core** | Name given to muscles that stabilise, support and move the spinal column |
| **Depression** | Downward movement of the shoulder girdle |
| **Diastolic** | Pressure exerted on artery walls when the heart relaxes |
| **Diffusion** | The exchange of gases from high to low concentration |
| **Dilation** | To become larger in size |
| **Distal** | Further away from the midline of the body |
| **Eccentric** | A muscle resists a force whilst lengthening |
| **Efferent** | An outgoing signal |
| **Elevation** | Upward movement of the shoulder girdle |
| **Eversion** | Sole of the foot faces away from the midline |
| **Expiration** | Forcing air out of the lungs |
| **Extension** | Increasing the angle around the joint |
| **Fixator** | The muscle the stabilises the joint within the movement |
| **Flexion** | Decreasing the angle around a joint |
| **Heart Rate** | Number of times the heart contracts in one minute |
| **Transverse Extension** | Arm away from the midline in the horizontal plane |
| **Transverse Flexion** | Arm towards the midline in the horizontal plane |
| **Inferior** | Lower aspect of a structure (Below) |
| **Insertion** | The end attachment of a muscle |
| **Inspiration** | Drawing air into the lungs |
| **Inversion** | Sole of the foot faces the midline |
| **Isometric** | A muscle resist a force whilst maintaining its length (no change) |
| **Lateral** | Further away from the middle of the body |
| **Medial** | Nearer the middle of the body |
| **Origin** | The start attachment of a muscle |
| **Parasympathetic** | Slowing of bodily functions |
| **Pelvic Floor** | Muscles at the base of the abdomen attached to the pelvis |
| **Peristalsis** | Smooth muscle contracts and relaxes causing a wave movement |
| **Posterior** | Behind the midline (back) |
| **Pronation** | Palm of the hand facing downward |
| **Protraction** | Forward movement of the shoulder girdle |
| **Proximal** | Nearer the midline of the body |
| **Retraction** | Backward movement of the shoulder girdle |
| **Rotation** | A bone rotating along its own long axis - this can be medial for lateral |
| **Somatic** | Under direct control (actions we chose to do) |
| **Stroke Volume** | Volume of blood that is pumped from the heart in one contraction |
| **Sub** | Underneath (i.e *sub*marine) |
| **Superior** | Upper aspect of a structure (Above) |
| **Supination** | Palm of the hand facing upwards |
| **Sympathetic** | Speed up of bodily functions |
| **Synergist** | A muscle that assists the agonist in the movement action |
| **Systolic** | Pressure exerted on artery walls when the heart contracts |
| **Venous Return** | The process of returning blood to the heart |

UNIT 1

# SKELETON

**By the end of this section you should be able to…**

Describe the functions of the skeletal system

Identify the major bones that make up the skeletal system and their location

Describe the different types of bone and where they can be found in the body

Explain the structure of a long bone and the stages of growth development

Understand the regions of the spine and postural deviations

Identify the types of connective tissue associated with the skeletal system

Identify the types of joints found in the body and where they can be located

Describe and label the structure of a synovial joint

Name and demonstrate the range of joint movements

**VITAL FACTS**

**SESAMOID**
means
**'SEED LIKE'**

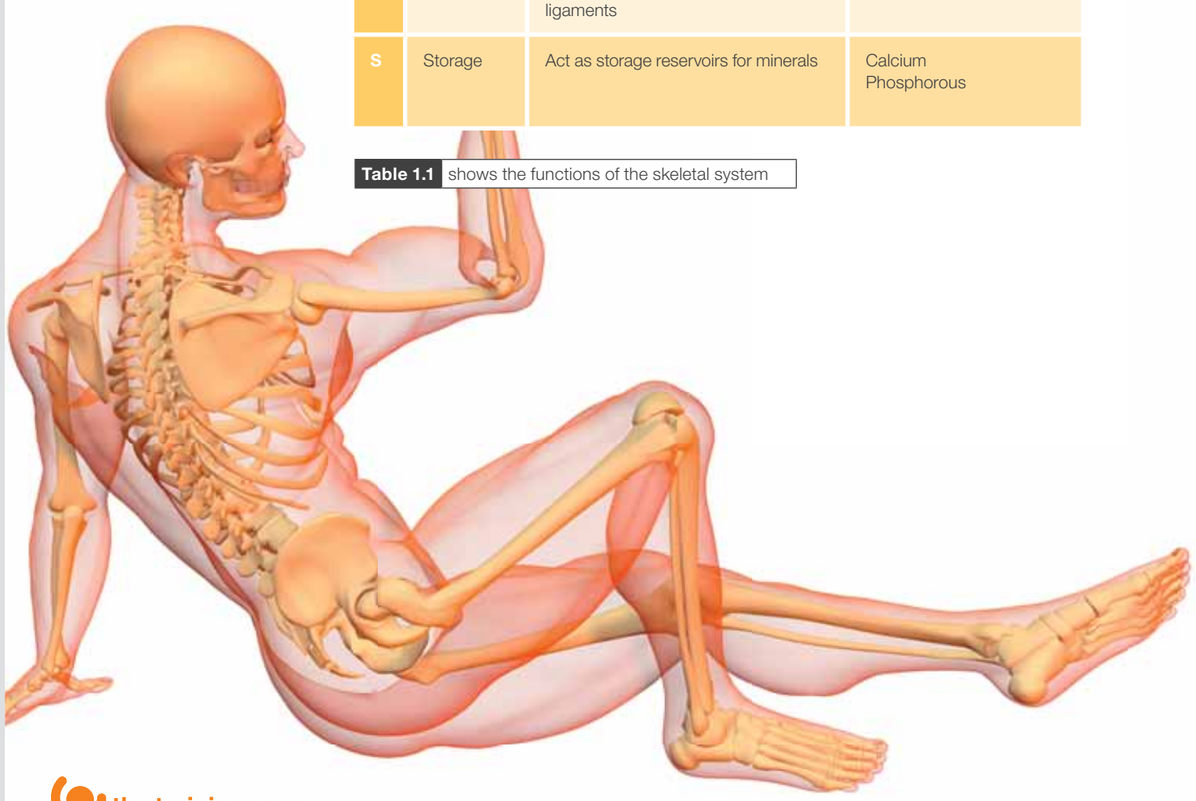
# SKELETAL SYSTEM

The skeletal system is a network of bone, cartilage and ligaments.

## FUNCTIONS OF THE SKELETON

| | Function | Description | Example |
|---|---|---|---|
| P | Protection | Protection of the vital internal organs | Skull protects brain<br>Ribs protect heart/lungs<br>Spine protects spinal cord |
| M | Movement | Our bones provide levers for movement | Radius/ulna- bicep curl |
| S | Shape | Bones provide a supported framework for the body and our shape | Mandible shapes the jaw line |
| P | Production | Within some long bones, red marrow produces white blood cells, red blood cells and platelets | Femur<br>Humerus<br>Tibia |
| M | Muscle attachment | Bones provide surfaces for soft tissue attachment such as muscles and ligaments | Scapula<br>Ilium |
| S | Storage | Act as storage reservoirs for minerals | Calcium<br>Phosphorous |

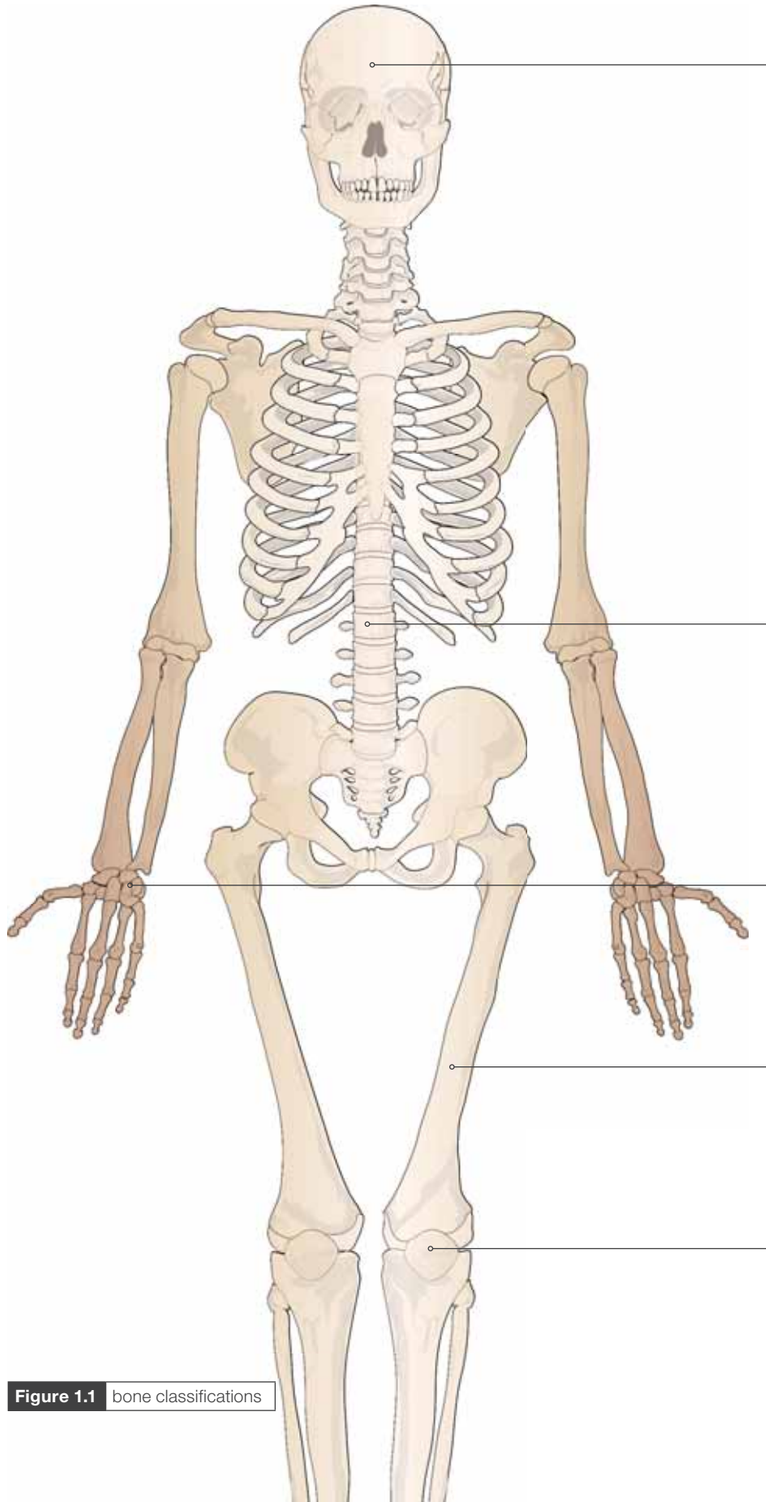
**Table 1.1** shows the functions of the skeletal system



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## BONE CLASSIFICATIONS

Bones are classified by their shape not their size into the following categories:



**Flat bones**
Are flat in appearance and provide protection of vital organs, they also have a large surface area for muscle attachment.
**Skull, Ribs, Sternum and Scapula**

**Irregular bones**
Have no set shape, this is determined by their job within the body.
**Vertebrae**

**Short bones**
Are cuboid in shape, being as wide as they are long. These bones usually occur in groups and give us fine movements.
**Carpals and Tarsals**

**Long bones**
Are longer than they are wide and these bones act as levers to create movement, produce blood cells and store minerals.
**Humerus and Femur**

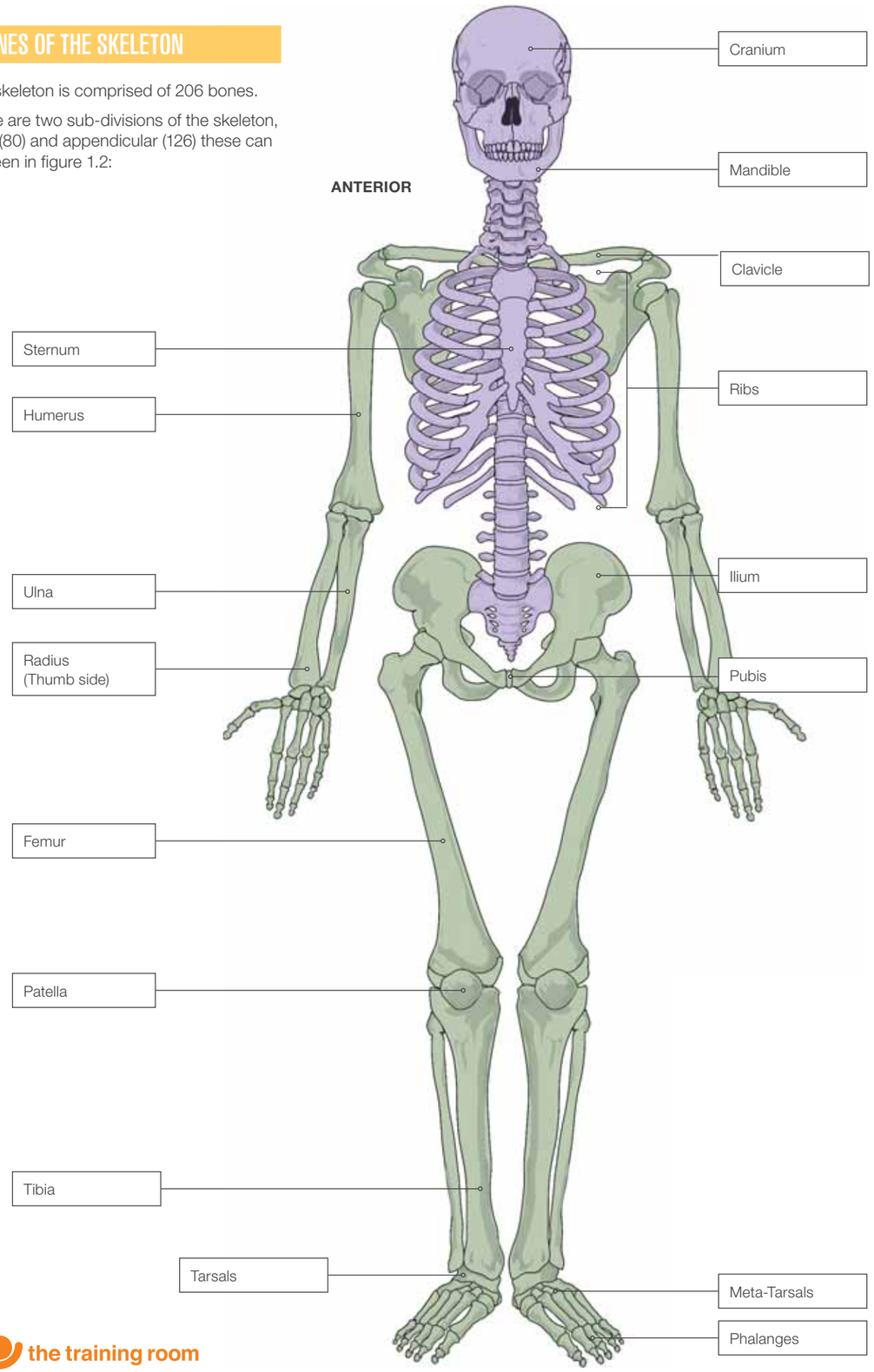
**Sesamoid bones**
These are small bones which develop within tendons to help protect the tendon, along with ligaments.
**Patella**

**Figure 1.1** bone classifications

## BONES OF THE SKELETON

The skeleton is comprised of 206 bones.

There are two sub-divisions of the skeleton, axial (80) and appendicular (126) these can be seen in figure 1.2:



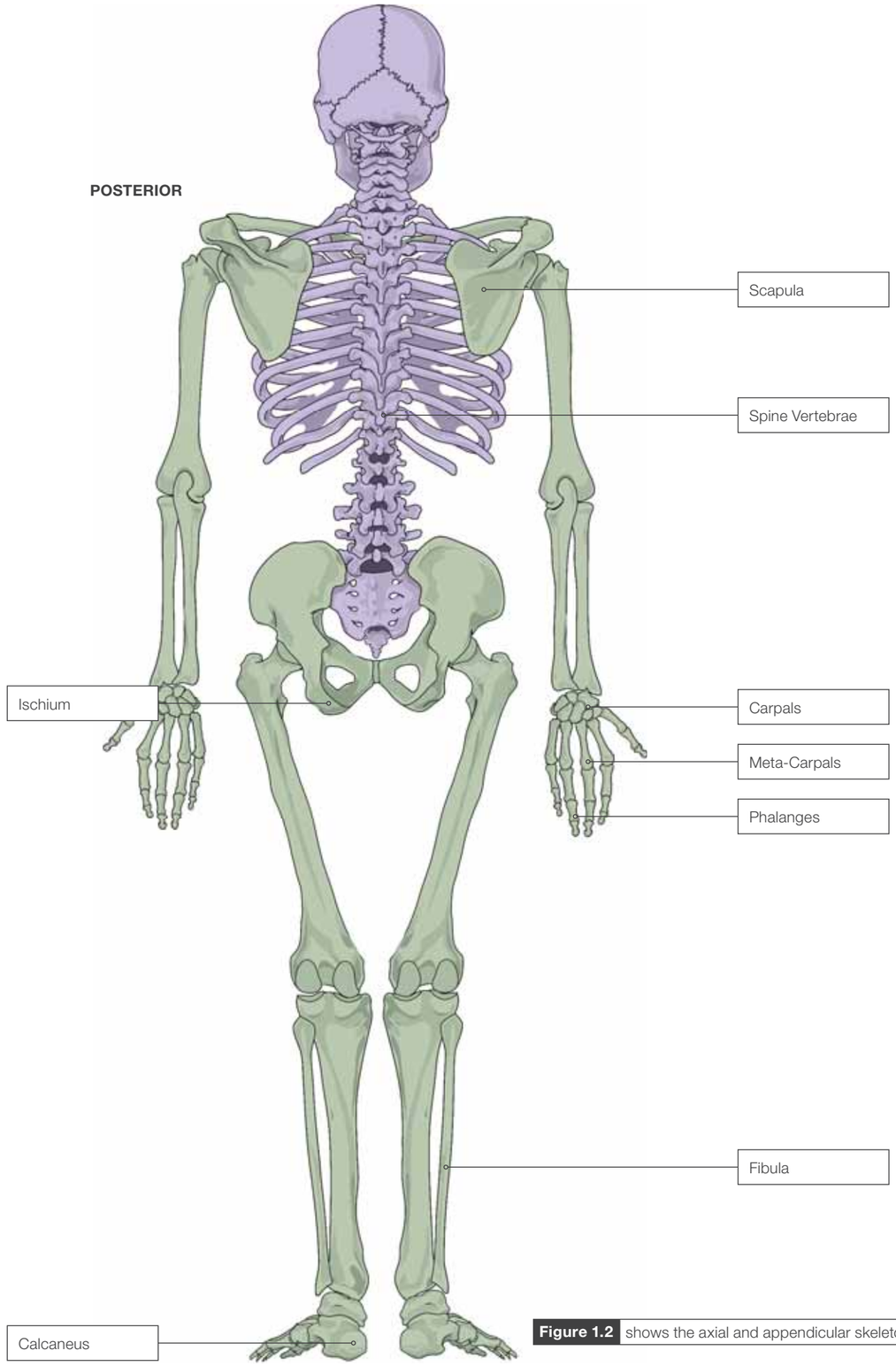




**Figure 1.2** shows the axial and appendicular skeleton

## STRUCTURE OF A LONG BONE

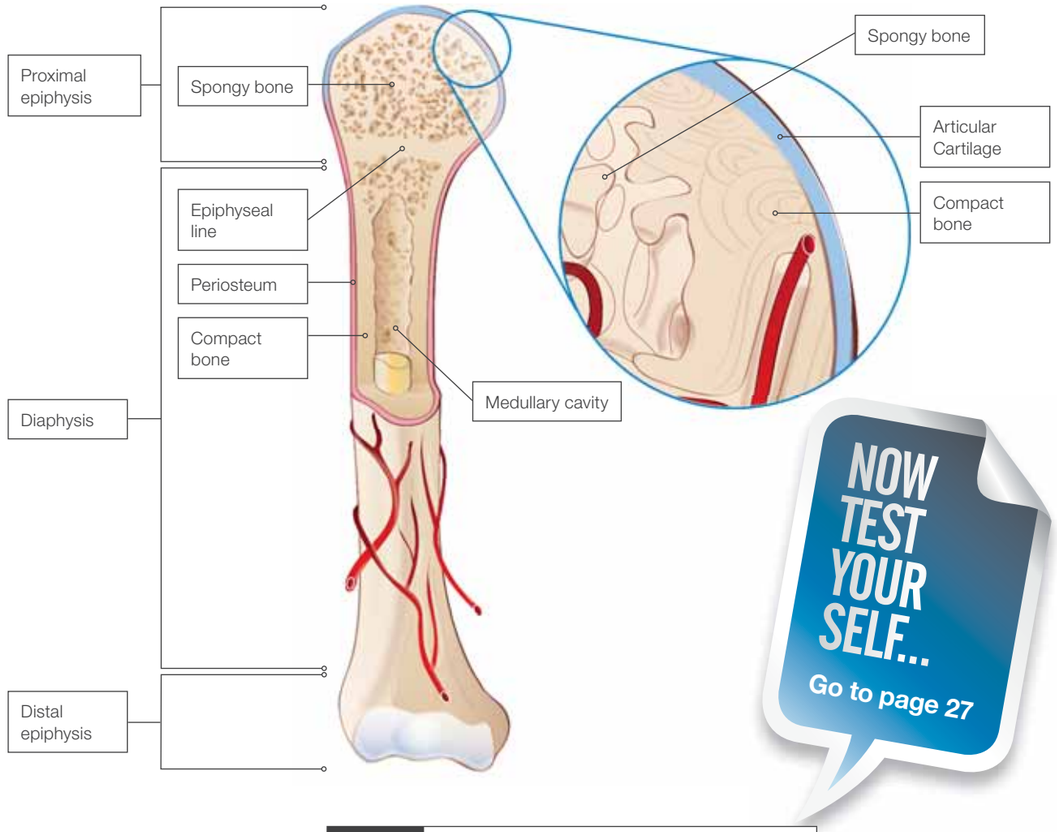



**Figure 1.3** shows the structure and anatomy of a long bone

**VITAL FACTS**

**DID YOU KNOW...**

that growth plate fractures are most common at 14-16 years of age

| Component | Function |
|---|---|
| Articular cartilage | This covers the epiphysis. It helps reduce friction and absorbs shock where two or more bones meet (joint) |
| Epiphysis | This is rounded and located at either end of the bone and is made up of spongy/cancellous bone |
| Epiphyseal growth plate | This is the region in which new bone is created from cartilage. |
| Diaphysis | This is the main shaft of the bone and is made up of compact/ cortical bone |
| Medullary cavity | This is the hollow centre within the diaphysis and contains yellow and red marrow for storing fat and blood cell production |
| Periosteum | This is a fibrous sheath that covers the outside of the bone promoting blood supply and attachment through ligaments and tendons |

**Table 1.2** explains the components of a long bone

## BONE TISSUE TYPES

From table 1.2 you will see there are 2 types of bone tissue within a long bone.

**Compact/Cortical bone** – This is made up of rod like structures which are tightly packed together, making it dense and strong.

**Spongy/Cancellous bone** – This is a honeycomb like structure (looks similar to the inside of a sponge) this makes it lightweight, yet strong. The honeycomb structure allows blood vessels to pass in and out of the bone to import and export nutrients and blood cells.

## THE FORMATION OF BONE

The process of bone formation and growth is known as ossification, there are two cells responsible for this:

**OSTEOBLASTS**

B for blasts means B for build new bone

**OSTEOCLASTS**

C for clast means C for clear old bone deposits

It is the balance of these two cells that control bone growth and formation.

**Foetus: First 2 months**
Cartilage model forms

**Foetus: At 2-3 months**
Compact bone develops starting at the primary ossification site

**Childhood**
Spongy bone develops at secondary ossification sites

**Adolescence**
The growth plates promote longitudinal growth until young adulthood

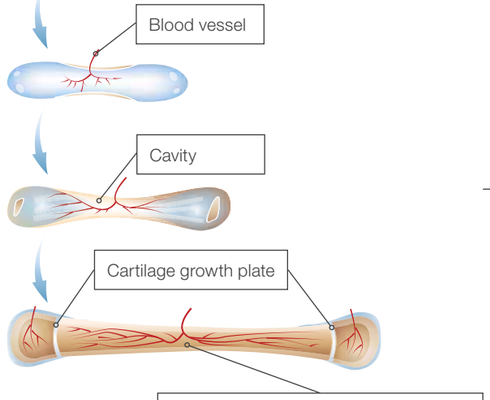



**Figure 1.4** shows the 4 stages of bone growth

## BONE GROWTH

STAGE 1:
A foetus skeleton is formed of cartilage.

STAGE 2:
Around the cartilage periosteum develops. Blood, nutrients and minerals are transported to the middle of the bone.
The primary ossification centre develops, where osteoblast cells start to build the diaphysis structure.

STAGE 3:
The bone continues to develop and the primary ossification centre divides. Growth continues from the secondary ossification sites located at either end of the diaphysis. These are the epiphyseal growth plates where bone growth occurs during childhood and adolescence.

STAGE 4:
At the final stage the growth plates ossify and then become epiphyseal lines (this occurs around the age of 21). After this point the bones will not grow in length, but throughout lifetime bones renew themselves.

## FACTORS AFFECTING BONE GROWTH

The development of bone can be affected by a number of factors.

Nutrition – your diet has direct effect on growth development i.e. lack of mineral intake such as calcium and phosphorus.

Exposure to sunlight – there are cells within your skin that convert UV light into vitamin D, which is a vitamin vital for absorption of calcium in the small intestine.

Hormonal secretions – hormonal balance (Testosterone/Oestrogen) is important in effective bone growth and maintenance. During menopause a reduction in Oestrogen will effect bone growth which can make bones more susceptible to fractures.

Physical activity – bone strength and density develops according to the stresses that it is placed under i.e. weight bearing exercise.

## HELPFUL HINT

Remember the spine by:

Call the Liverpool Soccer Club

712554

## THE SPINE

The spine is an arrangement of irregular bones called vertebrae, which are divided into five sections according to their size.

The five sections are Cervical, Thoracic, Lumbar, and the fused sections the Sacrum and Coccyx (see figure 1.5) These regions give the spine its distinctive 'S' shape. This 'S' shape is important as it absorbs shock and impact with the support of intervertebral discs.

There are 33 vertebrae in total, 9 of these are fused (no movement) and 24 are moveable and separated by intervertebral discs.

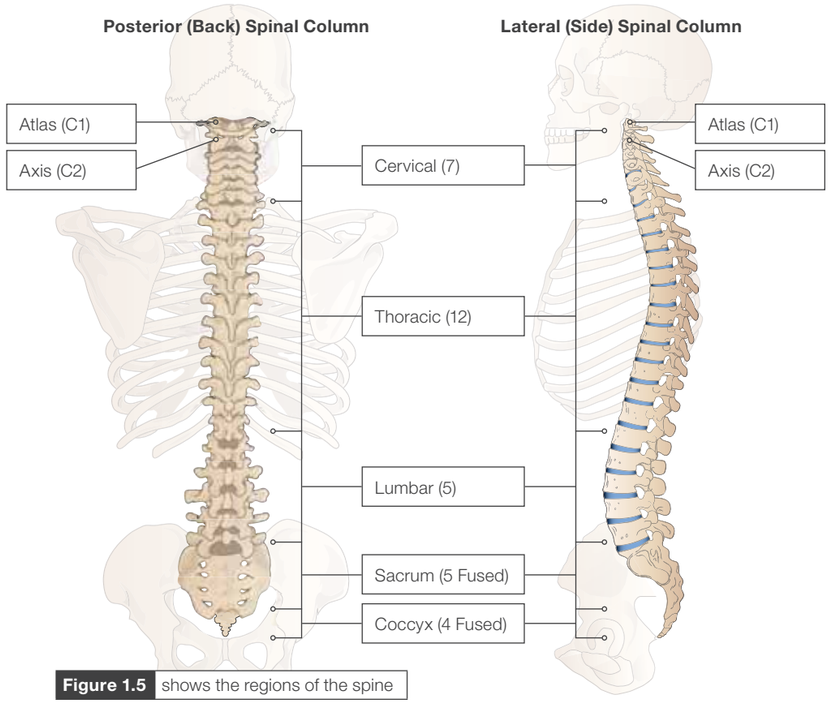



**Figure 1.5** shows the regions of the spine

### Cervical spine

- Consists of 7 vertebrae
- The first and second vertebrae are called the atlas and axis, these support and allow movement of the skull
- Creates a forward curve

### Thoracic spine

- Consists of 12 vertebrae making up the middle spine
- These join with the ribs to create the rib cage (12 pairs of ribs)
- Creates a backward curve

### Lumbar spine

- Consists of 5 vertebrae
- These contain the biggest vertebrae, located in the lower back
- These vertebrae are the largest as they bear the most weight
- Creates a forward curve

### Sacrum and coccyx

- These are the fused sections of the spine which makes them immovable
- The sacrum consists of 5 vertebrae and passes through the pelvis
- The coccyx consist of 4 vertebrae
- Creates a backward curve completing the 'S' shape

## VITAL FACTS

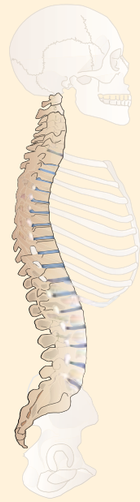
There are 33 vertebrae in total, 9 of these are fused (no movement) and 24 are moveable and separated by intervertebral discs.

## SPINAL ABNORMALITIES

The 'S' shaped spine as shown in figure 1.5 is often referred to as 'normal curvature or neutral spine'. This is when the curvatures of the spine are maintained with minimal muscular effort.

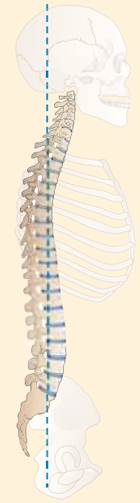
The normal curvature of the spine can become exaggerated or excessive. Genetic and lifestyle factors contribute to this, examples include sports, injuries, fashion, age, pregnancy, obesity, work and disabilities. These can lead to:

### Lordosis



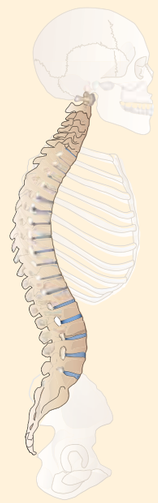
When the lumbar lordotic curve (lower back) is excessive, we refer to this as someone having lordosis. Usually seen with the 'bum out' or 'duck' position, where the pelvis is tilted anteriorly and the person's gluteals protrude posteriorly. Affects ladies during pregnancy as well as people who are overweight/ obese due to the shift in centre of gravity.

### Flat Back



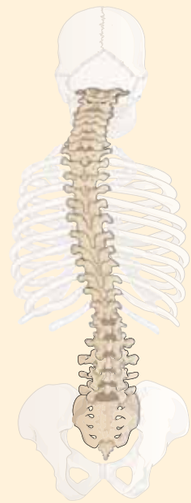
This is a lack of lumbar curvature, so it appears that the thoracic and lumbar spine sections are straight. It is common in those with sedentary lifestyles and leads to tight hamstrings and abdominals, this also commonly affects footballers.

### Kyphosis



When the kyphotic curve (upper back) is excessive, we refer to this as someone having kyphosis. Usually seen with a hunchback, rounded shoulders, forward head, and sunken chest posture. It can affect people who are often sat in a driving position or at a desk, it can also be caused by osteoporosis of the spine and increases the risk of falls in older adults.

### Scoliosis



Is a lateral deviation of the spine, causing the spine to look 'S' shaped from the front or back. Usually seen with one shoulder lower than the other, or one hip higher than the other. Can affect people who play single sided sports i.e. tennis and squash, but more commonly it is caused by genetic factors.

**Figure 1.6** shows the different spinal abnormalities and descriptions

VITAL FACTS

DID YOU KNOW...

We sprain ligaments & strain tendons

# TYPES OF CONNECTIVE TISSUE

Connective tissue is important in the body to connect, surround and stabilise the variety of joints. This tissue is not stimulated by the nervous system and does not have any contractile properties. There are 3 main types of connective tissues found in the body:

## CARTILAGE

## LIGAMENTS

### Hyaline

- Most common type of cartilage found in the body
- Covers the end of bones
- Tough, thin, smooth, bluey-white in colour
- Found in synovial joints and is susceptible to wear and tear
- Synovial fluid reduces friction to assist in joint movement



### Fibro

- Stronger and thicker than both hyaline and elastic cartilage
- Limited locations in the body
- Forms various shapes according to its role
- Within cartilaginous joints it acts as a shock absorber
- Found in intervertebral discs



### Elastic

- Similar to hyaline but has more fibres
- These fibres are made of elastin rather than collagen
- Elastin is responsible for its elastic properties
- Found in the ear
- Used in areas in which maintenance of a set shape is required



**Table 1.3 / figures 1.7** shows the types of cartilage found in the body

## TENDONS

### Ligament Characteristics

- Tough, white, non-elastic fibrous tissue
- They prevent unwanted movement
- They attach bone to bone in all joints to provide stability and withstand tension
- Prolonged tension will permanently damage fibres
- They have a limited blood supply
- Ligaments are often injured during sports, for example anterior cruciate ligament (ACL) in the knee, in football players



**Table 1.4 / figures 1.8** characteristics of ligaments

## INJURY AWARENESS

### Tendon Characteristics

- Tough, white, non-elastic fibrous tissue
- They have limited blood supply
- They attach muscle to bone
- They transmit force produced by muscles



**Table 1.5 / figures 1.9** characteristics of tendon

quickly. This is not as easily achieved with injuries to ligaments and tendons due to their limited blood supply. Cartilage injuries are less likely to heal as they have a very limited nutrient supply. When torn or damaged they may need surgical intervention, for example a prolapsed disc.

HELPFUL HINT

REMEMBER

Tendons tug!

# JOINTS

A joint is an area in which 2 or more bones meet. There are three types of joint found within the body, classified by their degree of movement.

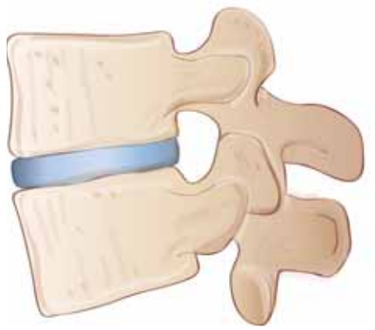
## FIBROUS – FIXED/FUSED

Immovable and interlocking bones, which can be found in the skull.



## CARTILAGINOUS – SLIGHTLY MOVABLE

Slightly moveable, bones are connected together by ligaments, these can be found between the vertebrae and intervertebral discs.



## SYNOVIAL – FREELY MOVABLE

Freely moveable, the most common joint type in the body and also the most unstable. For example the knee.



**Figure 1.10** joints classification

## SYNOVIAL JOINTS

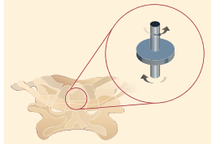
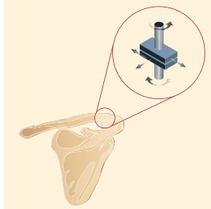
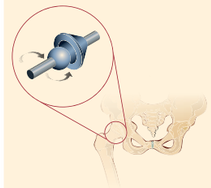
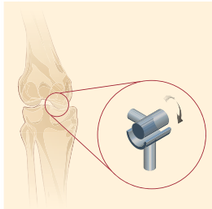
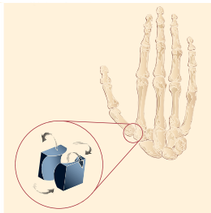
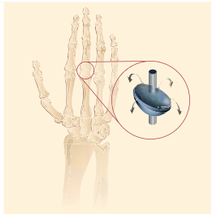
| Joint Type | Joint diagram | Example | Function |
|---|---|---|---|
| Pivot |  | Atlas and Axis | These joints allow a rotational movement around an axis |
| Gliding |  | Acromioclavicular (AC) | These joints allow two bones to slide past each other |
| Ball and Socket |  | Hip/shoulder | These joints allow movement in almost any direction |
| Hinge |  | Knee/elbow | These joints allow flexion and extension |
| Saddle |  | Carpometacarpal (Thumb) | These joints allow a forward and backward movement and an up and down movement, but no rotation |
| Ellipsoid |  | Metacarpophalangeal (Finger) | These joints have a movement similar to a ball and socket joint but to a much lesser degree |

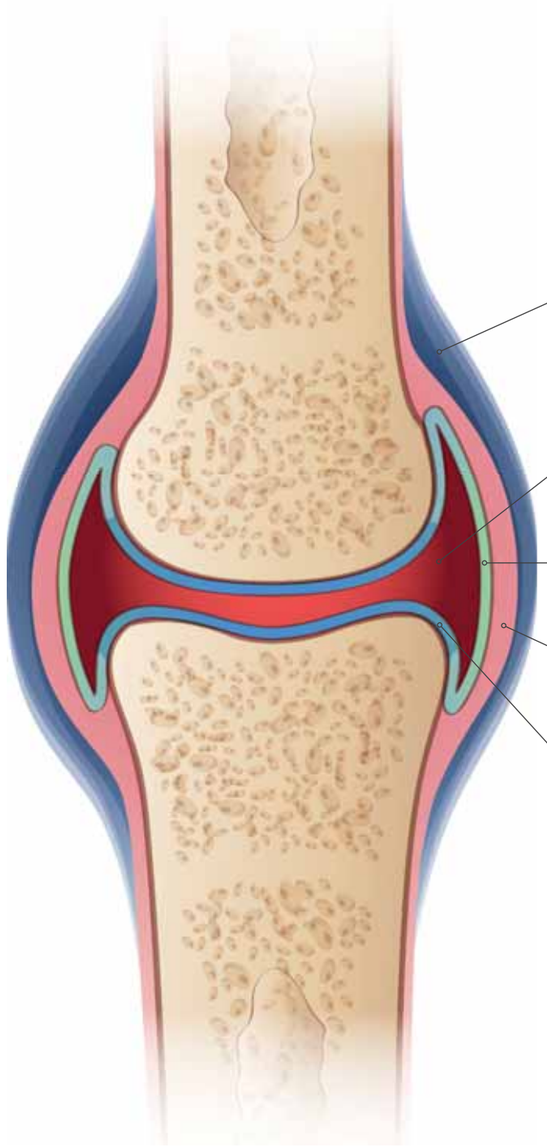
**Table 1.6 / figures 1.11** show the various synovial joint types

### VITAL FACTS

There are 6 types of synovial joint in the body

## STRUCTURE OF A SYNOVIAL JOINT

As we can see from table 1.6 the majority of joints in the body are synovial. The way these joints are structured is key to their function. It allows a larger range of movement whilst maintaining stability and protection from impact and stress. Figure 1.12 shows this unique structure:



**Ligaments**
Attach the bones across the joint providing stability

**Joint cavity (containing Synovial fluid)**
This lubricates the joints and nourishes the cartilage at the end of the bones

**Synovial membrane**
This lines the joint capsule and is responsible for secreting synovial fluid

**Joint capsule**
Surrounds the joint providing structure, strength and flexibility

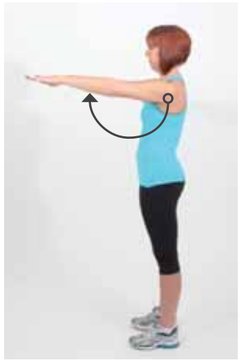
**Articular cartilage**
Also known as hyaline cartilage, covers the epiphysis of the bones within the joint. This reduces friction, provides protection and shock absorption between the bones

**Figure 1.12** shows the structure of a synovial joint

## JOINT MOVEMENTS

Different joints are capable of performing various joint actions. Figure 1.13 shows the movements available at each synovial joint:

### SHOULDER MOVEMENTS



Flexion



Extension



Adduction



Abduction



Medial rotation



Lateral rotation



Horizontal flexion



Horizontal extension



Circumduction

## SHOULDER GIRDLE MOVEMENTS



Elevation



Depression



Protraction



Retraction

## HIP MOVEMENTS



Flexion



Extension



Adduction



Abduction

## SPINAL MOVEMENTS



Flexion



Extension



Lateral flexion



Rotation

## ELBOW MOVEMENTS



Flexion



Extension



Pronation



Supination



Medial rotation



Lateral rotation

## KNEE MOVEMENTS



Flexion



Extension

## ANKLE MOVEMENTS



Dorsiflexion



Plantarflexion



Inversion



Eversion

**Figure 1.13** shows the joint actions and movements

# EFFECTS OF EXERCISE ON THE SKELETAL SYSTEM

When talking about the effects of exercise, we need to think about both the short and long term effects on the body. Short term is whilst the client is exercising and long term changes occur from a sustained period of appropriate training.

A short term effect of exercise on the skeletal system is the increased production of synovial fluid due to the increased movement at synovial joints. The synovial fluid acts as a lubricant to protect the joint from wear and tear.

The long term effects of exercise on the skeleton are adaptations to weight bearing activity. These include ligaments becoming stronger which improves joint stability and an increase in bone density.

# SKELETAL SYSTEM SUMMARY OUTCOMES

## CAN YOU NOW...

- Describe the functions of the skeletal system ☐
- Identify the major bones that make up the skeletal system and their location ☐
- Describe the different types of bone and where they can be found in the body ☐
- Explain the structure of a long bone and the stages of growth development ☐
- Understand the regions of the spine and postural deviations ☐
- Identify the types of connective tissue associated with the skeletal system ☐
- Identify the types of joints found in the body and where they can be located ☐
- Describe and label the structure of a synovial joint ☐
- Name and demonstrate the range of joint movements ☐




## TASK 1.1

List the functions of the skeleton:

1 _____

2 _____

3 _____

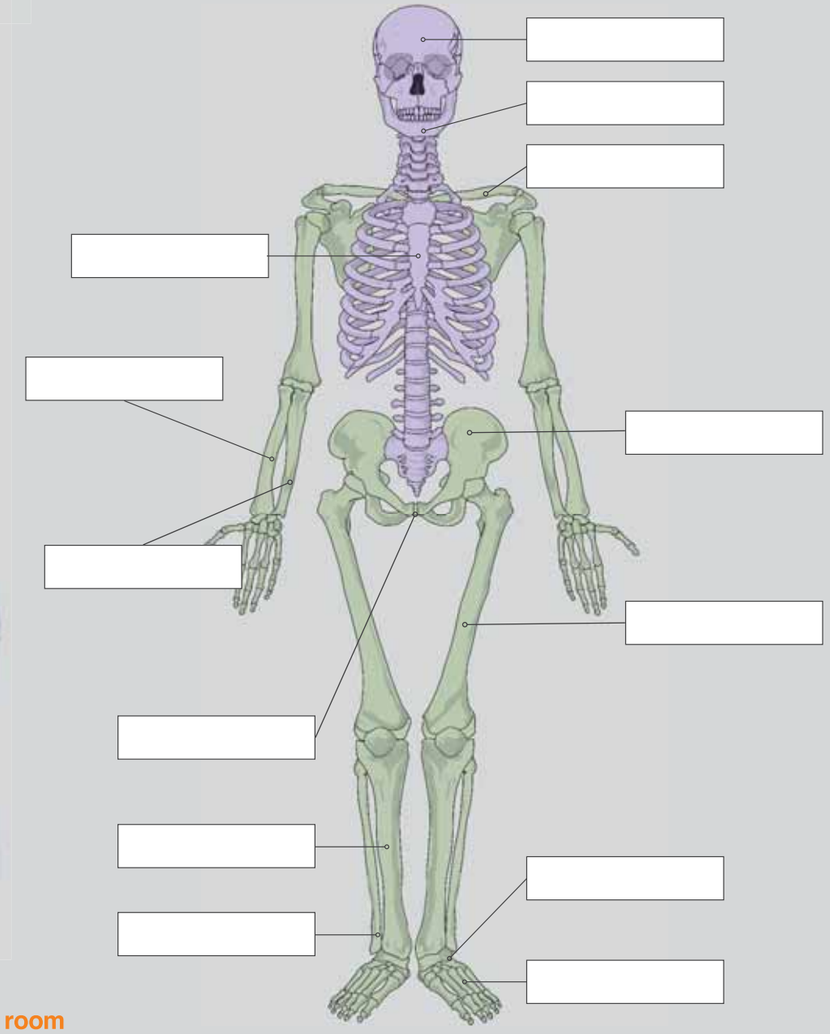
4 _____

5 _____

6 _____

## TASK 1.2

Label the skeleton:



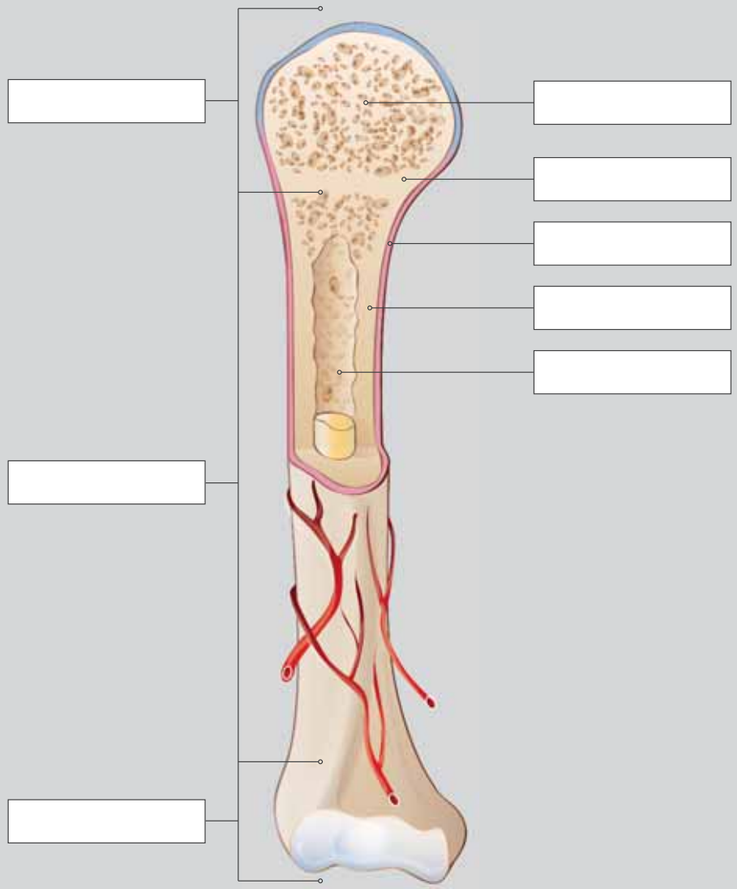
## TASK 1.3

Match the joint names with the examples given:

| | |
|---|---|
| Pivot | Thumb |
| Gliding | Acromio-clavicular joint |
| Ball and Socket | Fingers |
| Saddle | Hip |
| Hinge | Atlas and Axis |
| Ellipsoid | Knee / Elbow |

## TASK 1.4

Label the long bone:





UNIT 1

2

# MUSCULAR SYSTEM

**By the end of this section you should be able to…**

Identify and define the 3 types of muscle tissue in the body

Identify the major muscles within the body, their location and movement actions

Describe and label the structure of skeletal muscle tissue

Explain the principles of muscle contraction and muscle roles within movement

Classify the types of skeletal muscle fibre types

# THE MUSCULAR SYSTEM

There are 3 types of muscle tissue found within the body:

1. Skeletal
2. Cardiac
3. Smooth

Their characteristics are outlined in the table below:



| | Skeletal | Cardiac | Smooth |
|---|---|---|---|
| |  |  |  |
| **Location** | Found throughout the body | The heart | The digestive system and blood vessels |
| **Role** | • Produces locomotion and other body movements<br>• Maintains posture<br>• Generates heat for warmth<br>• Attaches across joints via tendons<br>• Storage and transportation of glycogen | • Contraction of the heart<br>• Rhythm of heart | • Has the greatest diversity throughout the body<br>• Causes Vasoconstriction (narrowing)<br>• Vasodilation (Widening) of blood vessels/ organs |
| **Characteristics** | • Striated/stripy in appearance<br>• Only shortens in one direction<br>• Works both aerobically and anaerobically | • Striated/stripy in appearance but its fibres separate off and connect to each other<br>• Works aerobically only and is reliant on oxygen | • Not striated<br>• Contractible in all directions<br>• Works aerobically |
| **Control** | • Voluntary (under conscious control) e.g. walking<br>• Activated by electrical impulses from a motor unit | • Involuntary (not under conscious control)<br>• Activated by electrical impulses from the (SA) sinoatrial node | • Involuntary (not under conscious control) |

**Table 2.1 and figure 2.1** show the types of muscle tissue found within the body



## SKELETAL MUSCLE

The body is made up of between 656 and 850 muscles, the exact number varies from person to person (Hudson 2006). As a level 2 gym instructor we only need to focus on those responsible for major movements and actions. Figure 2.2 shows their locations and names:

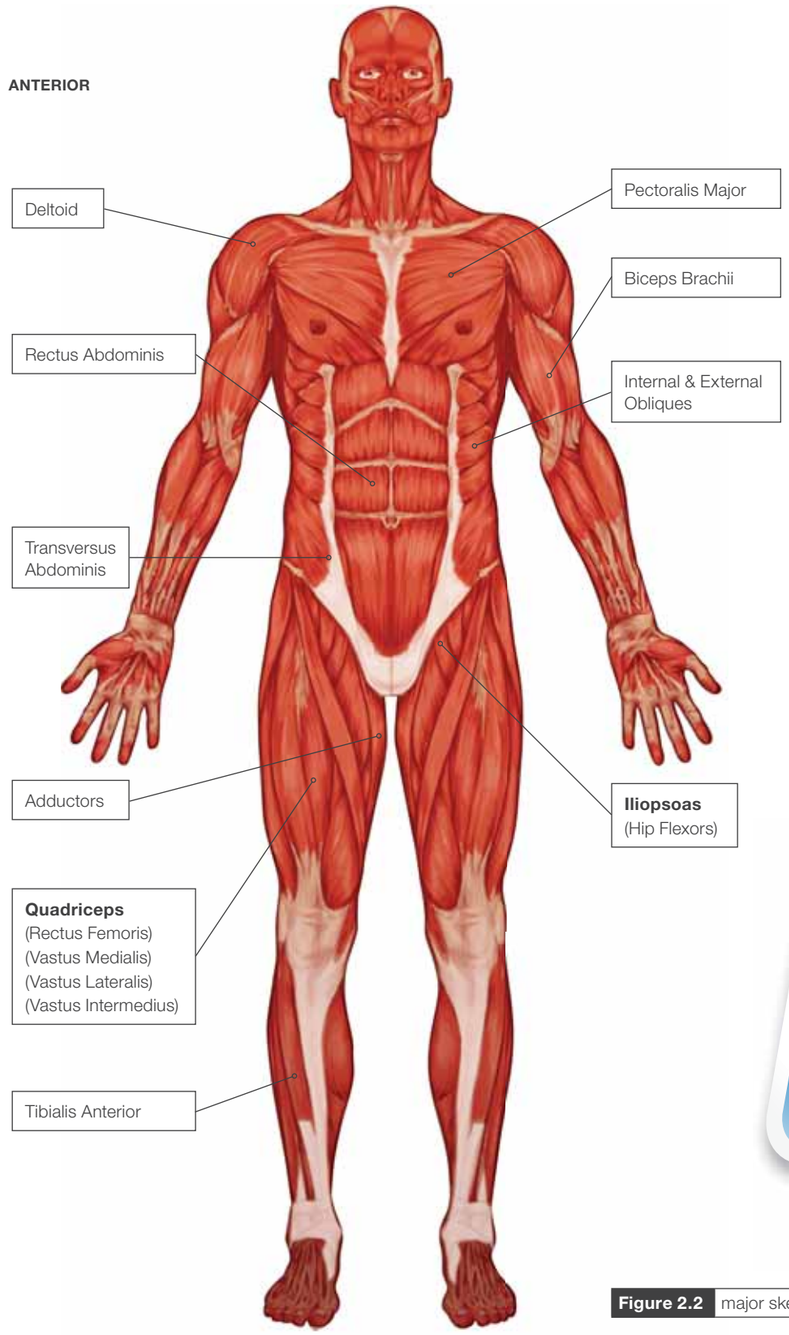



**Figure 2.2** major skeletal muscles of the body

### VITAL FACTS

The names for all the muscles in the body come from latin.

NOW TEST YOURSELF... Go to page 49

**POSTERIOR**

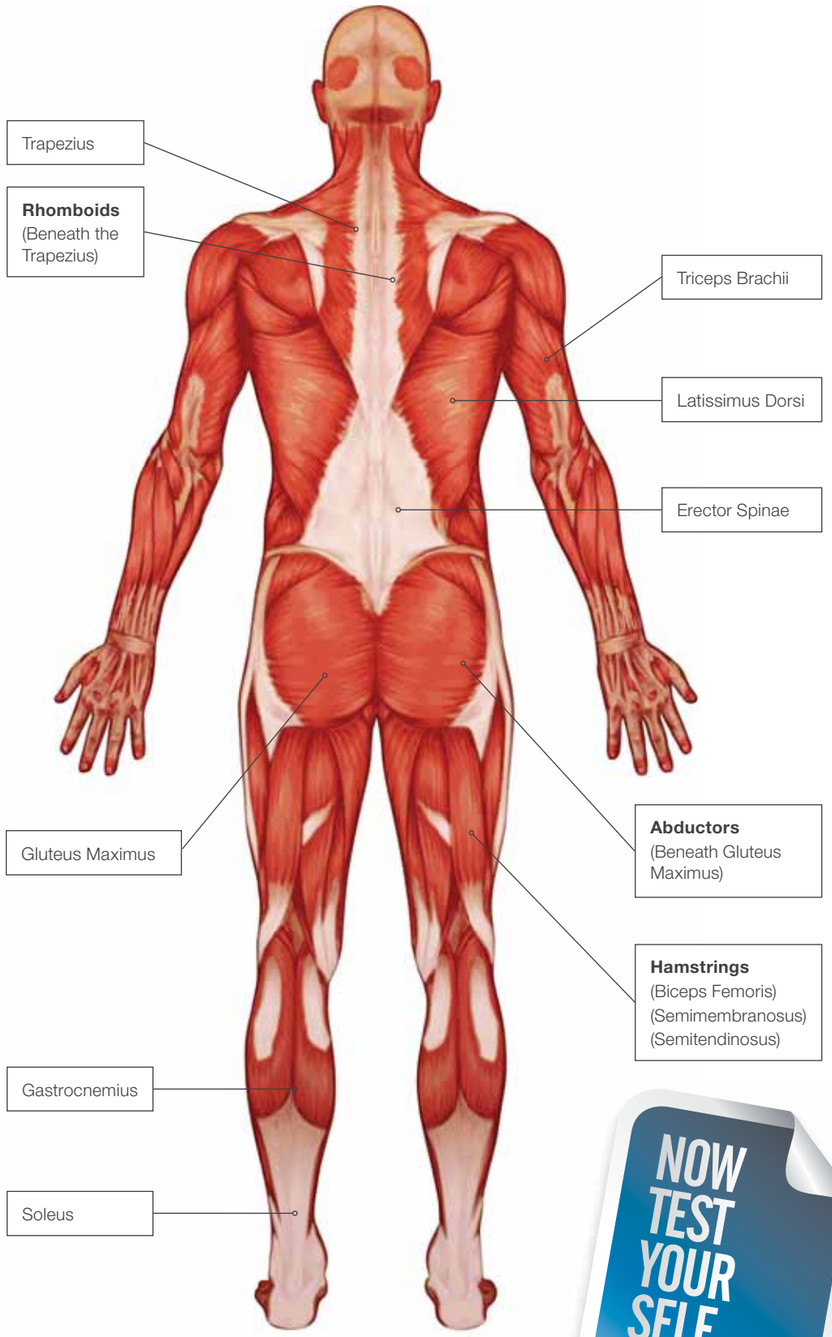



**Figure 2.2** major skeletal muscles of the body

NOW TEST YOUR SELF... Go to page 49

# INSERTIONS AND ORIGINS

Muscles cross a joint and attach to bones via a tendon. Each muscle has a definitive start and end point, this can be on a fixed bone (origin) or on a bone that moves during contraction (insertion).

The origin is usually called the proximal attachment, this is usually nearer the mid-line of the body or closer to the spine. Some muscles have more than one origin, for example the Latissimus Dorsi.

The insertion is described as the distal attachment and is further from the midline of the body. A good example of showing the insertion and origin is a draw bridge as shown below.

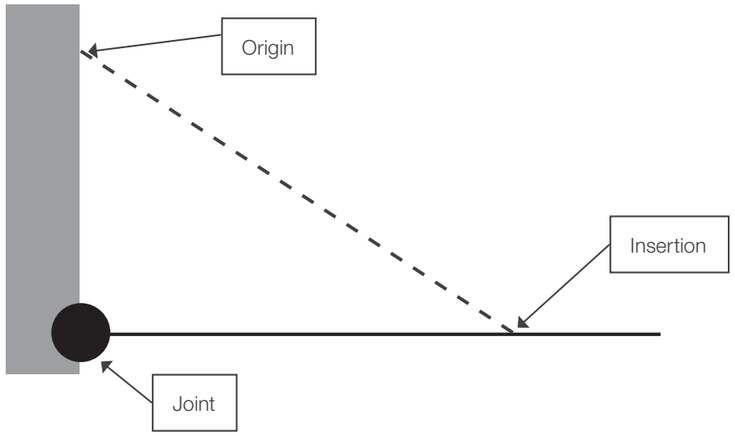



**Figure 2.3** shows the concept of insertions and origins

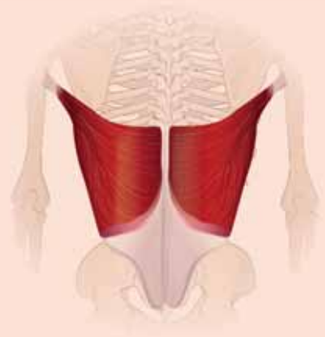
## VITAL FACTS

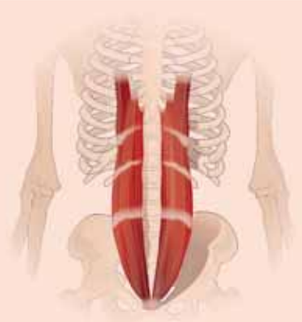
**PROXIMAL**
Closer to the centre midline of the body

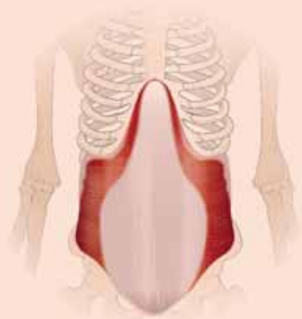
**DISTAL**
Furthest away from midline of the body

# SKELETAL MUSCLE

| Muscle | Location | Origin | Insertion | Movement |
|---|---|---|---|---|
| **Deltoids** |  | Clavicle and Scapula | Humerus | Abduction, flexion and extension of shoulder |
| **Biceps Brachii** |  | Scapula | Radius | Flexion of elbow, supination of forearm, flexion of shoulder |
| **Triceps Brachii** |  | Humerus and Scapula | Ulna | Extension of elbow, extension of shoulder |

| Muscle | Location | Origin | Insertion | Movement |
|---|---|---|---|---|
| **Latissimus Dorsi** |  | Lower Thoracic Vertebrae, Lumbar Vertebrae, Ilium | Humerus | Adduction and extension of shoulder |
| **Trapezius** |  | Base of Skull, Cervical and Thoracic Vertebrae | Clavicle and Scapula | Elevation, retraction and depression of shoulder girdle |
| **Rhomboids** |  | Upper Thoracic Vertebrae | Scapula | Retraction of shoulder girdle |
| **Pectoralis major** |  | Clavicle and Sternum | Humerus | Horizontal flexion, adduction |

| Muscle | Location | Origin | Insertion | Movement |
|---|---|---|---|---|
| **Erector Spinae** |  | Sacrum, Ilium, Ribs, Vertebrae | Ribs, Vertebrae, Occipital bone | Extension and lateral flexion of spine |
| **Rectus Abdominis** |  | Pubis | Sternum | Flexion of spine, lateral flexion of spine |
| **Internal Obliques** |  | Ribs, Ilium | Ilium, Pubis, Ribs, Linea Alba | Rotation and lateral flexion of spine |
| **External Obliques** |  | Ribs | Ilium, Pubis | Rotation and lateral flexion of spine |

| Muscle | Location | Origin | Insertion | Movement |
|---|---|---|---|---|
| **Transversus Abdominis** |  | Iliac crest and Lumbar Fascia | Pubis and Linea Alba | Support of internal organs, forced expiration |
| **Diaphragm** |  | Sternum, Costal cartilages and Lumbar Vertebrae | Central tendon of Diaphragm | Depresses and aids in expiration |
| **Intercostals** |  | Ribs and costal cartilage | Superior border of next rib below | Elevates ribs and aids in expiration |
| **Hip Flexors** |   | Ilium/Lumbar vertebrae | Femur | Flexion of hip |

| Muscle | Location | Origin | Insertion | Movement |
|---|---|---|---|---|
| **Gluteus maximus** |  | Ilium | Femur | Extension and external rotation of the hip |
| **Abductors** |  Gluteus Medius Gluteus Minimus | Ilium | Femur<br>Tibia | Abduction and flexion of hip |
| **Adductors** |  Magnus Longus Brevis | Pubis, Ischium | Femur | Adduction of hip |
| **Quadriceps** |  Rectus Femoris Vastus Lateralis Vastus Intermedius Vastus Medialis | Ilium, Femur | Tibia | Extension of knee and flexion of hip |

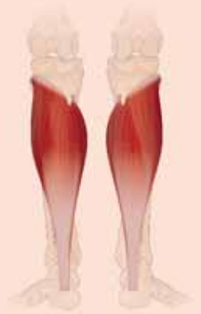
| Muscle | Location | Origin | Insertion | Movement |
|---|---|---|---|---|
| **Hamstrings** |  Biceps Femoris Semimembranosus Semitendinosus | Ischium, Femur | Tibia, Fibula | Extension of hip and flexion of knee |
| **Gastrocnemius** |  | Femur | Calcaneus (heel bone) | Plantar flexion of ankle, flexion of knee |
| **Soleus** |  | Tibia | Calcaneus (heel bone) | Plantar flexion of ankle |
| **Tibialis Anterior** |  | Tibia | Metatarsal and Tarsals | Dorsiflexion and inversion of ankle |

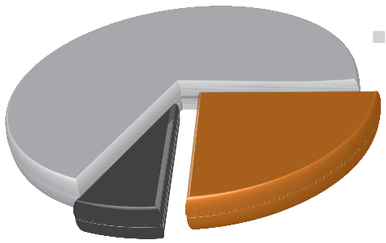
**Table 2.2 and figure 2.4** shows the skeletal muscles with their insertions and origins

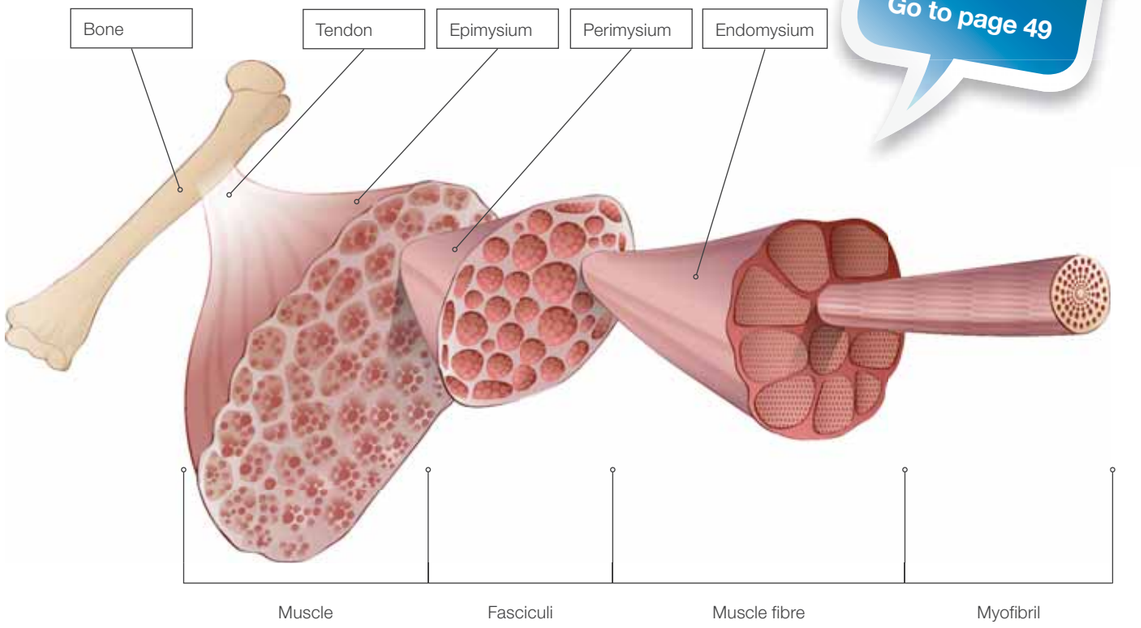
# SKELETAL MUSCLE STRUCTURE

Skeletal muscle is made up of:

- Water 70%
- Protein 23% (Actin and Myosin)
- Minerals 7% (Calcium, potassium phosphorus,) and substrates (glucose/glycogen and fatty acids)

Skeletal muscle is made up of several structures or layers. Each layer is made up of smaller and smaller pieces forming the smallest structures in the centre to the larger structures on the outside. Figure 2.5 shows the organisation of these structures.




NOW TEST YOUR SELF... Go to page 49

**Figure 2.5** shows the structure of skeletal muscle

# MUSCLE STRUCTURE

Below is a flowchart explaining figure 2.4 in words. This shows the structural organisation from the outside of the muscle in.

**TENDON**

Connects the muscle to the bone via periosteum (this is the sheath surrounding the bone)

**FASCICULI**

The whole muscle is made up of bundles of fasciculi and is surrounded and connected by Epimysium (a connective tissue)

Bundles of fasciculi make up the whole muscle

They are made up of muscle fibres surrounded and connected by Perimysium (a connective tissue)

**MUSCLE FIBRES**

Bundles of these make up fasciculi

They are made up of individual myofibrils surrounded and connected by Endomysium (a connective tissue)

**MYOFIBRILS**

Bundles of these make up muscle fibres

They are made up of the protein myofilaments and are arranged in contractile compartments called sarcomeres

**MYOFILAMENTS**

Myofilaments are made up of two contractile proteins, called Actin (thin protein filament) and Myosin (thick protein filament)

**Table 2.3** shows the flow of muscle anatomy

**VITAL FACTS**

**DID YOU KNOW...**

that approx 40% of an adults body weight is muscle and up to 50% in athlete's

NOW TEST YOUR SELF... Go to page 49

## HELPFUL HINT

Think of Sarcomeres like match boxes:

The draw is the Myosin (thick protein filament)



The outside of the box is the Actin (thin protein filament)

When you want to close the box, making it shorter, the draw slides inside the outer box. If you had a chain of these matchboxes (end on end) and this process occurred at the same time then the whole length of the chain would shorten.

In simple terms this is how the actin and myosin work to shorten (contract) your muscles in the sliding filament theory to make your muscles work.

## THE SLIDING FILAMENT THEORY

The sliding filament theory is the method by which muscles are thought to contract. If you look at figure 2.5 you will see the muscle breakdown. Within the myofibrils there are small structures called sarcomeres which contain myofilaments. Sarcomeres are small contractile units that contain two contractile protein filaments called actin (thin filament) and myosin (thick filament). Each myosin filament has two heads, these heads attach onto binding sites on the actin filaments which surround each myosin filament. When the actin and myosin attach it forms a cross-bridge with the help from calcium and ATP, this in turn shortens the sarcomere causing muscular contraction.

For the sliding filament theory to take place the following needs to occur:

1. Calcium is released which allows the myosin head to bind with the actin.
2. The actin and myosin bind causing a cross-bridge.
3. The myosin heads pull on the actin causing the sarcomere to shorten and the muscle to contract.
4. When the muscle lengthens they return to the starting position ready to contract again.

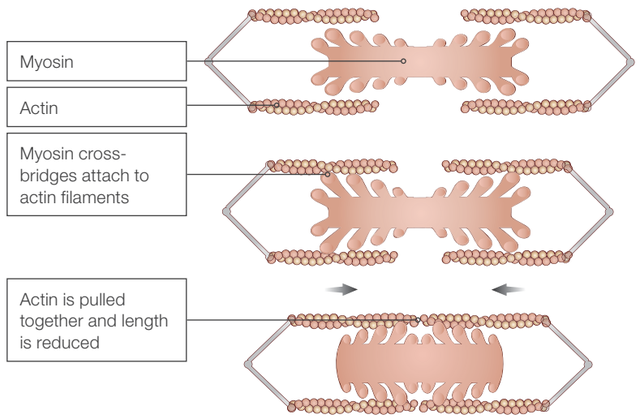



**Figure 2.6** shows the sliding filament theory

# MUSCLE ACTIONS

Whenever we use our muscles we use a variety of actions to control them. When lifting a load (our muscles shorten), lowering a load (our muscles lengthen) or pausing and holding the load (muscle stays the same length) our muscles are contracting and working throughout.

These control actions have been classified into groups, dependent on the type of muscular activity.

**Isotonic (same tone)** – which describes muscle actions involving movement i.e. eccentric and concentric

**Concentric** – a muscle generates force and shortens (when raising/lifting a weight)

**Eccentric** – a muscle generates force and lengthens (when lowering a weight)

**Isometric** – a muscle generates force and stays the same length (holding a load/weight)

**Isokinetic (same speed)** – muscle actions involving movement taking place at a constant speed

Take a Bicep curl for example, whilst raising the weight on the upward phase the Biceps Brachii works concentrically. If you then hold the weight still half way through the movement this would still be working the Biceps Brachii but now isometrically. If you then returned the weight to the start position lowering it under control, you would be working the muscle eccentrically.

## ROLES OF MUSCLES

Body movement is achieved through groups of muscles coordinating and working together using various combinations of muscle actions. There are four main roles muscles can be categorised into during movement. These categories are:

| Role | Function | Example |
|---|---|---|
| Agonist / Prime Mover | The muscle(s) that cause the desired action | Bicep Brachii in a Bicep curl |
| Antagonist | The opposite muscle(s)to the agonist, which needs to relax to allow movement to take place | Tricep Brachii in a Bicep curl |
| Synergist | The muscle(s) which assist the prime mover in its action | Brachialis in a Bicep curl |
| Fixator | The muscle(s) that stabilise the part of the body that remains fixed | Deltoids in Bicep curl |

**Table 2.4** showing the roles of muscles during movement

## MUSCLE PAIRINGS

Skeletal muscles have a natural pairing, agonist and antagonist. Antagonistic pairs are located on opposite sides of a joint or bone and each muscle brings about a set movement. Antagonistic pairs are needed in the body because muscles can only exert a pulling force, therefore when one muscle contracts the other lengthens to allow the movement to take place.

See table 2.5 Common muscular pairings:

| Agonist | Antagonist |
|---|---|
| Deltoids | Latissimus Dorsi |
| Pectoralis Major | Trapezius/Rhomboids |
| Biceps Brachii | Triceps Brachii |
| Rectus Abdominis | Erector Spinae |
| Hip Flexors | Gluteus Maximus |
| Quadriceps | Hamstrings |
| Tibialis Anterior | Gastrocnemius/Soleus |

**Table 2.5** common agonist/antagonist muscle pairings within the body



## MUSCLE FIBRE TYPES

Skeletal muscles are made from several different types of fibres, these vary in colour, contractile and metabolic characteristics. Figure 2.7 identifies two muscle fibre types, their characteristics and activities in which these fibres are used.

**Type 1 (Slow twitch)**



**Structure**

- Small muscle diameter
- High myoglobin content
- High in mitochondria
- Many capillaries
- Red in colour

**Functional features**

- Increased oxygen delivery
- Low force production
- Muscular endurance
- Resistant to fatigue
- Uses the aerobic energy system to fuel movement

**Type 2 (Fast twitch)**



**Structure**

- Large muscle diameter
- Lower myoglobin content
- Low in mitochondria
- Fewer capillaries
- White in colour

**Functional features**

- Decreased oxygen delivery
- High force production
- Muscular strength
- Low resistance to fatigue
- Uses creatine phosphate and lactate systems to fuel movement

**Figure 2.7** muscle fibre types and characteristics

## MUSCLE FIBRE TYPE CONSIDERATIONS

Skeletal muscles consist of a mixture of muscle fibre types. The role of the muscle will determine what proportion of slow and fast twitch fibres the muscle is made up of. For example the muscles in the core and back ensure continual maintenance of posture and therefore have a high proportion of slow twitch fibres.

Muscle fibre build up varies from person to person, although everyone has a mixture of fibre types some have relatively more of one type. These differences are genetically controlled and will significantly contribute to athletic abilities. For example, the leg muscles of marathon runners have a higher percentage of slow twitch fibres, whilst those of sprinters contain a higher percentage of fast twitch fibres.

# THE CORE AND PELVIC FLOOR MUSCLES

The core and pelvic floor muscles are positioned deep within the body (not near the surface) underneath other muscle groups. See figure 2.8 anterior/posterior core muscles.

The core relies on muscular control to stabilise it as well as to control movement. The core is like a cylinder, with the diaphragm at the top, the pelvic floor at the bottom, vertebral column muscles at the back, abdominal wall muscles at the front and obliques at the side. This creates a pressurised cylinder in the abdomen which helps to stabilise the area helping to maintain a neutral spine. As the core and pelvic floor muscles are under constant control they are predominately made up of Type I, slow twitch, fibres.

Damage to the pelvic floor muscles can affect urinary incontinence but can also lead to pelvic organ prolapse. This is why it is important to train and do pelvic floor exercises to improve the tone and function of the pelvic floor muscles.

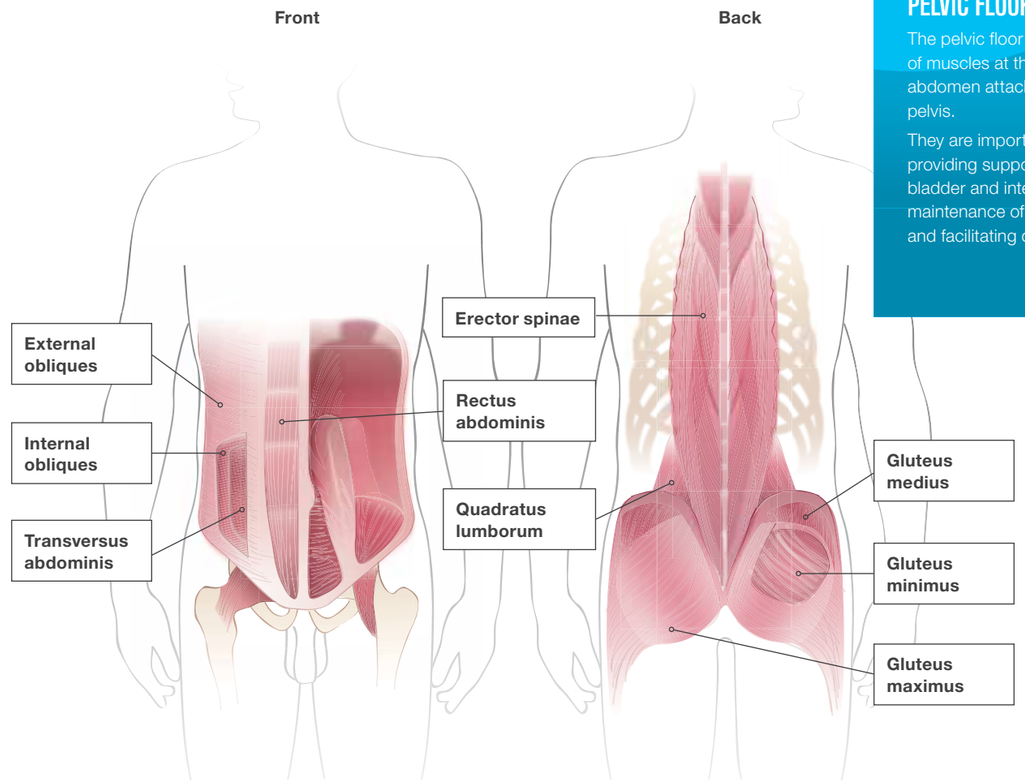



**Figure 2.8** the anterior/posterior core muscles

### VITAL FACTS

**CORE**

The core is made up of muscles that stabilise, support and move the lumber region of the spinal column.

### VITAL FACTS

**PELVIC FLOOR**

The pelvic floor is made up of muscles at the base of the abdomen attached to the pelvis.

They are important in providing support for the bladder and intestines, in the maintenance of continence and facilitating child birth.

# MUSCULAR SYSTEM SUMMARY OUTCOMES

## CAN YOU NOW...

- [ ] Identify and define the 3 types of muscle tissue in the body
- [ ] Identify the major muscles within the body, their location and movement options
- [ ] Describe and label the structure of skeletal muscle tissue
- [ ] Explain the principles of muscle contraction and muscle roles within movement
- [ ] Classify the types of skeletal muscle fibre types




## TASK 2.1

Complete the table below:

| Agonist | Antagonist |
|---|---|
| Deltoids | |
| | Trapezius/Rhomboids |
| Biceps Brachii | |
| | Erector Spinae |
| Hip Flexors | |
| | Hamstrings |
| Tibialis Anterior | |

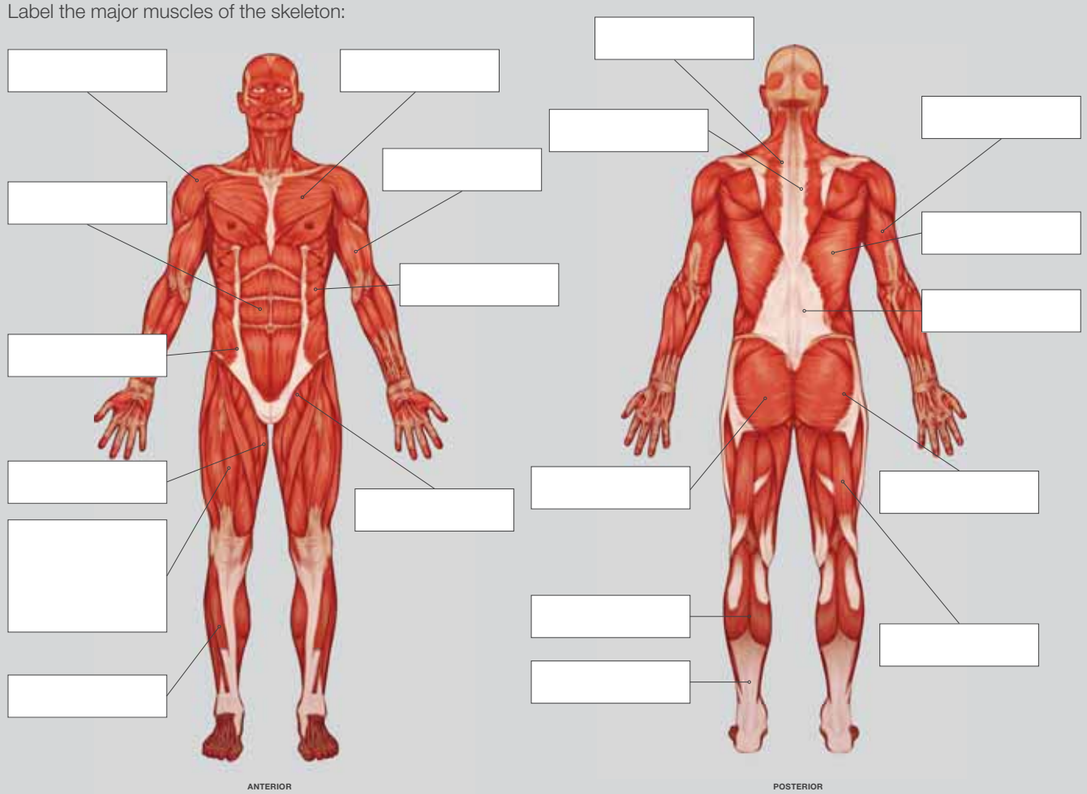
## TASK 2.2

Match muscle movements to their description:

| | |
|---|---|
| **Isokinetic** | Muscle actions involving movement taking place at a constant speed |
| **Eccentric** | This describes muscle actions involving movement i.e. eccentric and concentric |
| **Concentric** | A muscle generates force and stays the same length (holding a load/weight) |
| **Isometric** | A muscle generates force and shortens (when raising/lifting a weight) |
| **Isotonic** | A muscle generates force and lengthens (when lowering a weight) |

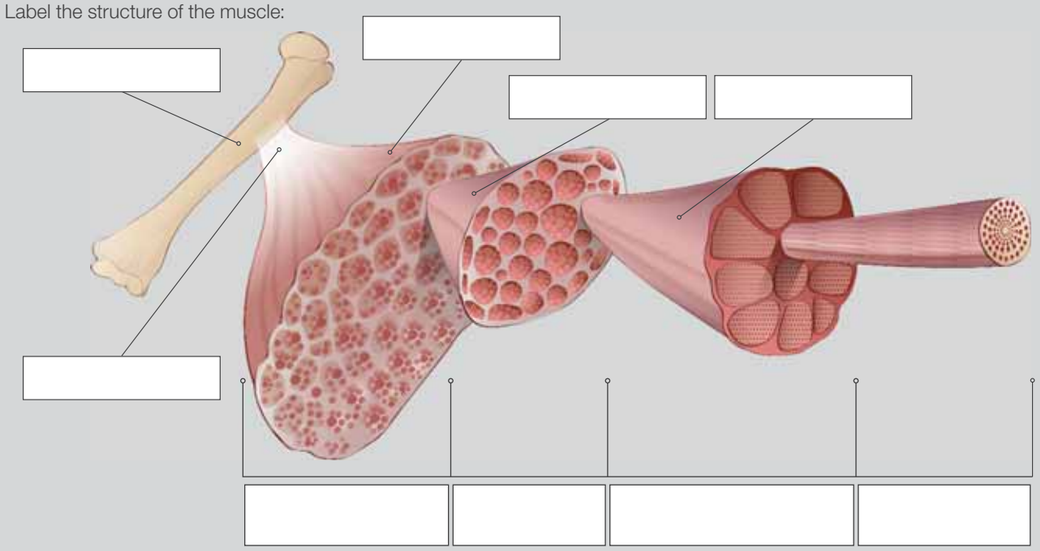
## TASK 2.3

Label the major muscles of the skeleton:




## TASK 2.4

Label the structure of the muscle:



UNIT 1

3

# CIRCULATORY SYSTEM

**By the end of this section you should be able to…**

Identify the location of the heart, its structure and function

Outline the flow of blood through the heart and the cardiac cycle

Describe the different circulations of blood and identify the vessels through which it flows

Define blood pressure and blood pressure classifications

# THE CIRCULATORY SYSTEM

There are three main parts to the circulatory system:

BLOOD

HEART

BLOOD VESSELS

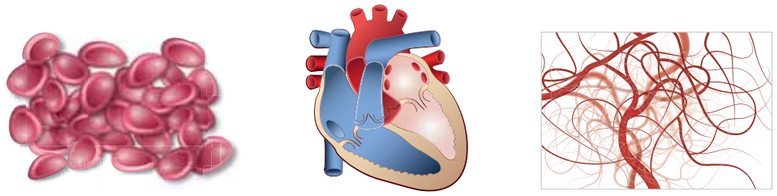


**Figure 3.1** shows the three main parts to the circulatory system

## STRUCTURE OF THE HEART

The heart is made up of four chambers:

**2 x UPPER ATRIA** (one left & one right)

**2 x LOWER VENTRICLES** (one left & one right)

The heart is made up of cardiac muscle (which we looked at in section 2) and is divided into left and right sides. The left side processes oxygenated blood and the right side processes deoxygenated blood. In general, atria receive and ventricles pump blood. The right atrium receives blood from the body, the right ventricle pumps blood to the lungs, the left atrium receives blood from the lungs and the left ventricle pumps blood to the body. The left and right sides of the heart are separated by a thick muscular wall (called the septum), this prevents blood crossing from one side to the other. The left ventricle pumps oxygenated blood around the body to working muscles and tissues, whereas the right ventricle pumps deoxygenated blood to the lungs. This results in the left ventricle being bigger and strong than the right as it has to push the blood out to the furthest parts of the body. Inside the heart, between the atrium and the ventricles, there are atrioventricular (AV) valves which prevent backflow of blood, between the ventricles and atria.

**VITAL FACTS**

**DID YOU KNOW...**

The left lung is slightly smaller to accommodate the heart

**VITAL FACTS**

**REMEMBER...**

Atrium is Latin for 'entrance' or 'hall' so it is the place that first receives the blood

**VITAL FACTS**

**2 MAIN FUNCTIONS OF THE HEART**

1. Pumps oxygenated blood to the working tissues in the body so they can function
2. Pumps deoxygenated blood to the lungs to be re-oxygenated whilst expelling unwanted gases

# THE HEART

## LOCATION & FUNCTION

The heart is the size of a clenched fist and is located in the centre of the chest cavity tilted slightly towards the left hand side, as figure 3.2 shows. The lungs sit either side of the heart, with the rib cage and sternum in front which helps to protect it from impact and damage. Simply, the heart is a muscular pump, which forces blood containing oxygen and nutrients, around the body to the working tissues.

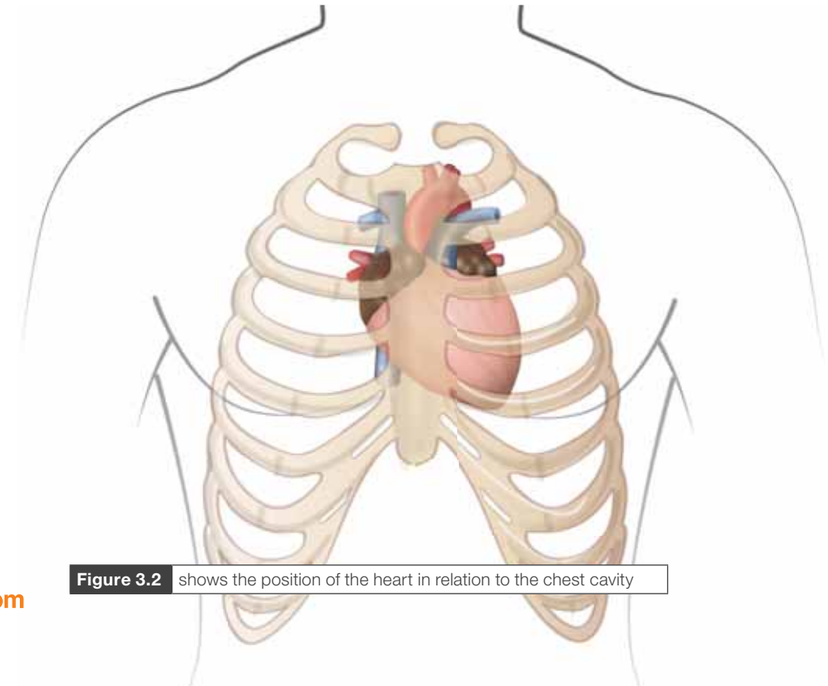


**Figure 3.2** shows the position of the heart in relation to the chest cavity

**Figure 3.3** shows the structure of the heart

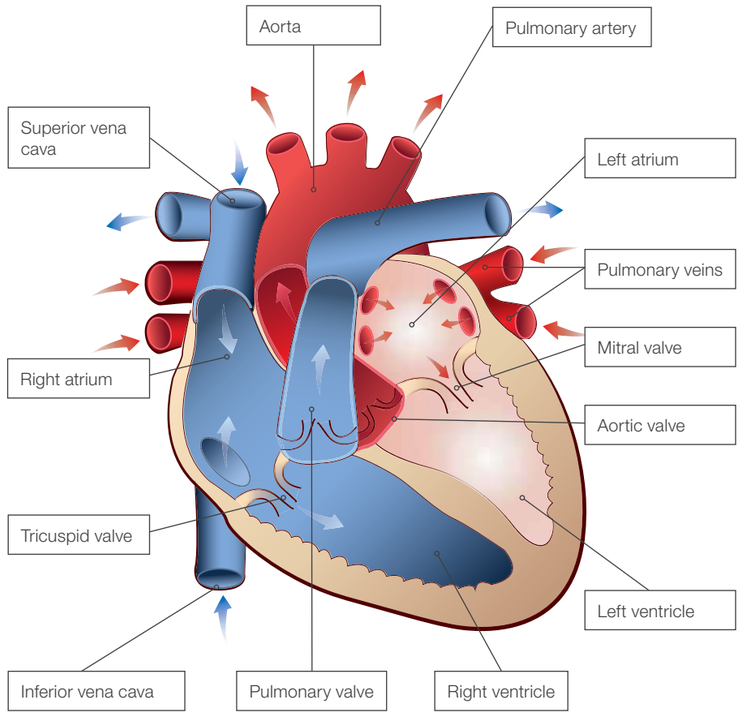



**Figure 3.3a** is a detailed heart diagram

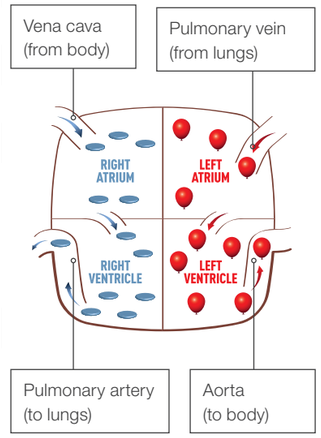



**Figure 3.3b** is a simple box diagram of the heart

## VITAL FACTS

### DID YOU KNOW...

there are approx 240-270 million red blood cells in a drop of blood

## VALVES OF THE HEART

Located in the heart are four main valves which all prevent backflow of blood either into the atria or ventricles (these can be seen in figure 3.4):

**2 x Atrioventricular (AV) Valves**

Atrioventricular valves prevent backflow of blood from the ventricles into the atria, one is located between the left atrium and ventricle and is called the mitral (or bicuspid) valve and one between the right atrium and ventricle called the tricuspid valve.

**2 x Semilunar Valves**

Semilunar valves prevent backflow of blood from the arteries back into the ventricles. One is located between the aorta and the left ventricle called the aortic valve and the other one is between the pulmonary artery and the right ventricle this is called the pulmonary valve.

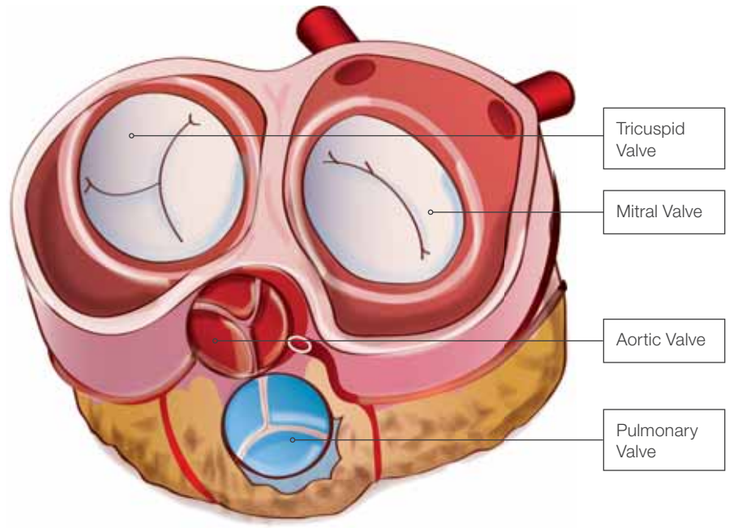



**Figure 3.4** shows the location of these valves from a superior view, to be able to view the Atrioventricular Valves the atria have been removed (as they are located in the heart)

# BLOOD

Blood is a fluid connective tissue that circulates continually around the body allowing constant communication between tissues distant from each other. It transports nutrients and oxygen to all structures of the body and removes waste products such as carbon dioxide.

Blood is made up of cells suspended in a liquid carrier called plasma. There are four main components of blood:

**Red blood cells (Erythrocytes)** – as we discussed in section one these are produced in the soft red bone marrow in the medullary cavity of long bones. They contain a protein called haemoglobin which binds to oxygen and acts as a carrier in red blood cells. It is the pigment colour of haemoglobin that gives the red blood cells their distinctive colour. Blood volume contains about 40% red blood cells.

**White blood cells (Leukocytes)** – are also produced in the red bone marrow housed in the medullary cavity of long bones. They are fewer in number than their red counterparts (around 700 times less). They are generally made up of cells of the immune system that fight infection, destroying harmful bacteria and organisms.

**Platelets (thrombocytes)** – are cell fragments, which repair damaged blood vessels and release a chemical which promotes blood clotting. They act like a repair net or gauze, to prevent loss of blood and start the repair process.

**Plasma** – is made up of water and solutes (proteins, nutrients, gases, hormones, enzymes, vitamins and waste products). It is the 'straw' coloured liquid component of the blood.

## HELPFUL HINT

Blood makes up about 7% of your body weight, 55% of this is plasma

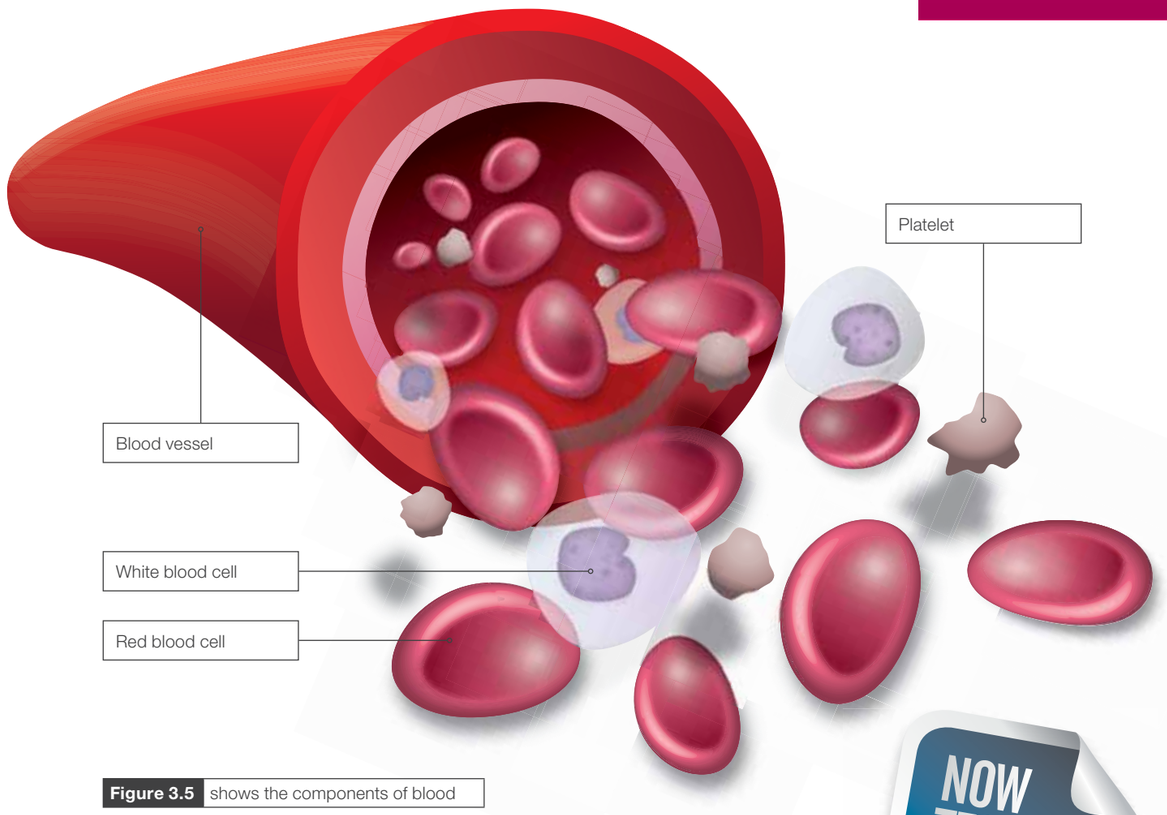



**Figure 3.5** shows the components of blood

NOW TEST YOUR SELF...
Go to page 63

## VITAL FACTS

**'A' FOR ARTERY**

carries blood 'away' from the heart!

# BLOOD VESSELS

Blood vessels are the network of tubes that transport blood around the body.

There are 3 main vessels that make up this complex network:

| Arteries | Veins | Capillaries |
|---|---|---|
| Have thick smooth (involuntary) muscular walls, smooth muscle contracts to push blood along the vessels | Use skeletal muscle contraction to help push blood back to the heart, as well as smooth muscular contraction called peristalsis. They work under low pressure | Capillaries are found in capillary beds that carry blood through an organ or a tissue from arterioles to the venules |
| Have no valves, as blood flows through them in one direction under high pressure | Have non-return valves, which ensure blood flows in one direction back to the heart | Have walls which are one cell thick to allow gaseous exchange, in and out of the body's tissues |
| Carry blood away from the heart | Bring blood to the heart | They are the smallest blood vessels |
| Carry oxygenated blood (with the exception of the pulmonary artery) | Carry deoxygenated blood (with the exception of the pulmonary vein) | |
| Aorta is the biggest artery in the body | Vena cava is the biggest vein in the body | |
| Divide into smaller vessels called arterioles | Divide into smaller vessels called venules | |

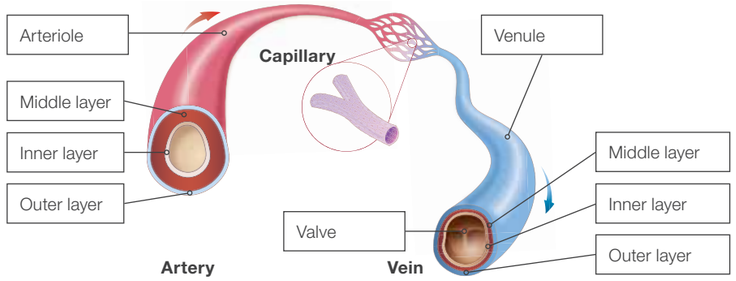



**Table 3.1** shows the characteristics and functions of the blood vessels in the body

**Figure 3.6** shows the 3 main blood vessels

The major arteries around the heart are:

**Aorta** which carries oxygenated blood from the left ventricle to the body

**Pulmonary Artery** which carries deoxygenated blood from the right ventricle to the lungs

The major veins around the heart are:

**Vena Cava** which is divided into two sections (superior and inferior) to bring deoxygenated blood back to the heart from the upper and lower body

**Pulmonary Vein** which brings oxygenated blood from the lungs to the heart

## PASSAGE OF BLOOD

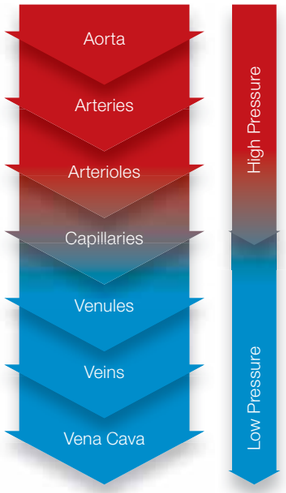



**Figure 3.7** shows the passage of blood through the blood vessels

the training room

# CIRCULATION & CIRCULATORY SYSTEM

Is the network of blood vessels connected in a series. The system resembles a figure of 8 made of two main loops, as figure 3.8 demonstrates. The bottom loop transports blood to and from the working systems of the body and the top loop to and from the lungs. Both loops are integrated by the heart completing the figure 8.

These 2 loops have specific names:

## PULMONARY CIRCULATION

This is the flow of deoxygenated blood from the right ventricle via the Pulmonary Artery to the lungs to be oxygenated, and then transported back to the left atrium via the Pulmonary Vein.

## SYSTEMIC CIRCULATION

This is the flow of oxygenated blood from the left ventricle to the body's working tissues via the Aorta and the return of deoxygenated blood to the right atrium via the superior/inferior Vena Cava

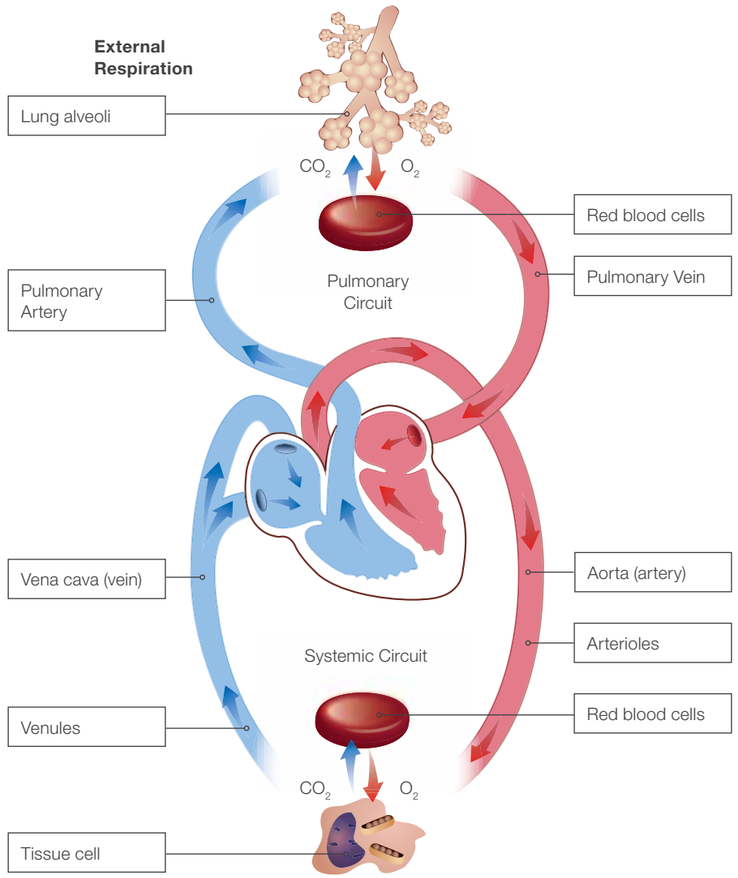



**Figure 3.8a** The circulatory system in pictures

NOW TEST YOUR SELF...
Go to page 62

## VITAL FACTS

### DID YOU KNOW...

Blood pressure is measured in mmHg, which is millimetres of mercury

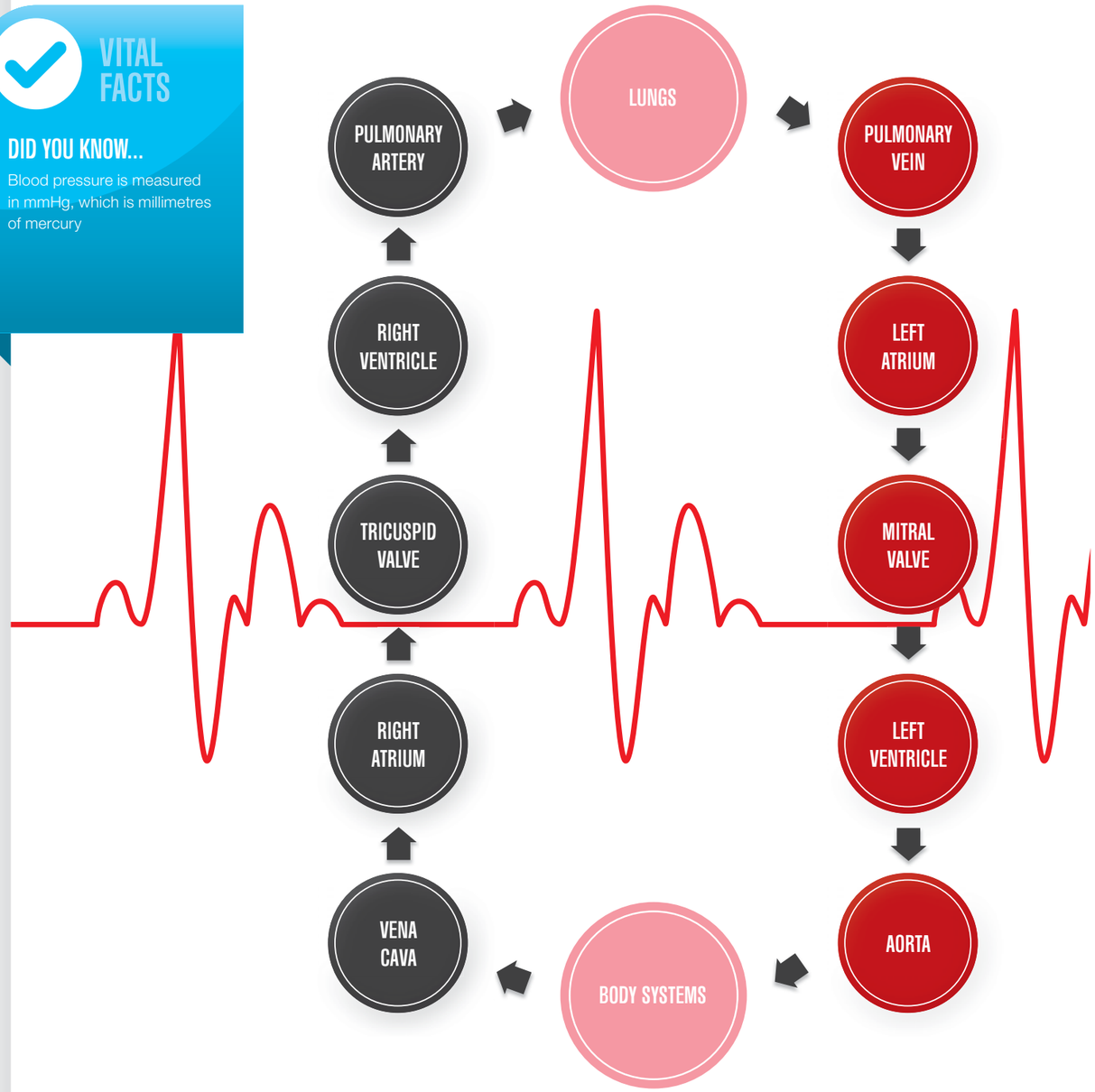



**Figure 3.8b** shows the circulatory system in a flow diagram

The circulatory system is a closed system in which blood is pumped initially under high pressure out of the heart to the working tissues where the process of gaseous exchange takes place. Deoxygenated blood then returns to the heart under low pressure and is pumped to the lungs to allow carbon dioxide to be removed from the body. There is a specific process for the return of deoxygenated blood to the heart, this is called venous return.

## VENOUS RETURN

As veins and venules have to work under low pressure there are a series of factors which assist in the return of blood to the heart.

**Gravity** – Assists in the return of blood from tissues above the heart.

**One way valves (non-return)** – Veins and venules have a system of one-way valves that work against gravity to prevent backflow of blood from the tissue below the heart. This is one of the biggest factors assisting venous return and reducing blood pooling after exercise.

**Diaphragm Shape** – The dome like shape of the diaphragm muscle, when it contracts produces a suction effect on the veins below the heart helping to draw the blood upwards.

**Heart Vacuum** – When the heart contracts and the left ventricle empties the ventricle refilling causes a small vacuum effect helping to draw blood from the vena cava.

**Skeletal Muscle Contraction** – Veins are also assisted by the squeezing action of nearby skeletal muscles which helps to force the blood upwards.

**Smooth Muscle Contraction (peristalsis)** – This is a pumping action returning blood to the heart through a wave like movement. These types of muscular contractions are how earth worms drive their locomotion.

## VITAL FACTS

### SKELETAL MUSCLE CONTRACTION

Veins are also assisted by the squeezing action of nearby skeletal muscles which helps to force the blood upwards (much like the effect when squeezing toothpaste from a tube)



# BLOOD PRESSURE

**Blood Pressure (BP)** – Blood pressure is a measurement of the force/ pressure that the blood exerts on the walls of the blood vessels. The reading is measured with two numbers, for example 120/80mmHg, these represent systolic and diastolic pressure.

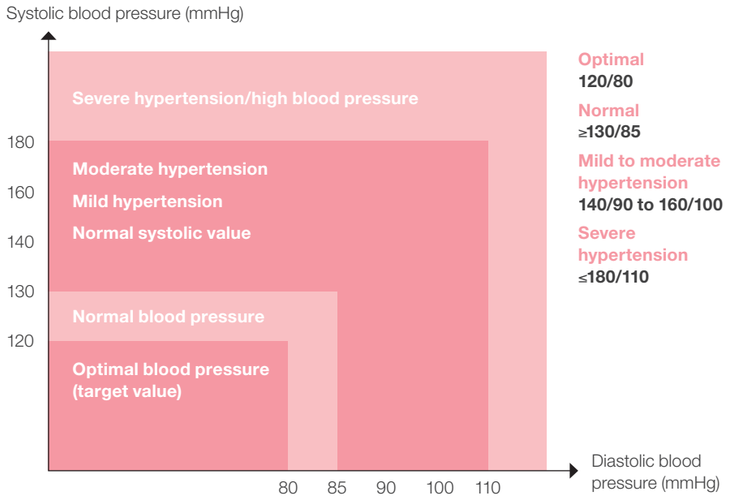
**Systolic** – This should be the higher of the two numbers and is recorded first. It is the measurement of pressure once the left ventricle has contracted and blood is pumped into the aorta, exerting force on the walls of the vessel. The optimum figure is around 120mmHg.

**Diastolic** – This is when the measurement is taken whilst the heart is during the resting phase and is refilling with blood. The pressure against the artery wall is much lower, and the optimum figure is usually 80mmHg, it is the smaller number and is recorded second.

**Blood pressure classification** – We have looked at the optimum example of 120/80 mmHg above, but not everybody (for different reasons) will fall into this optimal range. There are therefore risk categories or classifications for blood pressure as it can have a significant effect on health.

Effects of high blood pressure (hypertension)

- Atherosclerosis: narrowing of the arteries due to fat, mineral and protein deposits on the artery walls
- Stroke: haemorrhage or blood clot in the brain
- Aneurysm: dangerous expansion of the main artery either in the chest or the abdomen, which becomes weakened and may rupture
- Heart attack
- Heart failure
- Kidney failure
- Eye damage




According to the blood pressure classification by the WHO/ISH

**Figure 3.9** is a table showing the World Health Organisation (WHO) and the International Society of Hypertension (ISH) classifications of blood pressure

Blood pressure is an expression of arterial blood flow and resistance, and is calculated using the following formula:

**BLOOD PRESSURE = CARDIAC OUTPUT x TOTAL PERIPHERAL RESISTANCE**

**Total Peripheral Resistance** – this is the resistance that the blood vessels create when blood passes through them.

**Heart Rate** – this in the number of times the heart contracts in one minute (Beats per minute BPM)

**Stroke Volume** – this is the volume of blood (in litres) that is expelled from the ventricles with each contraction.

**Cardiac Output** – this is the amount of blood ejected from the ventricles each minute. Cardiac output = Stroke volume x Heart rate

# CIRCULATORY SYSTEM SUMMARY OUTCOMES

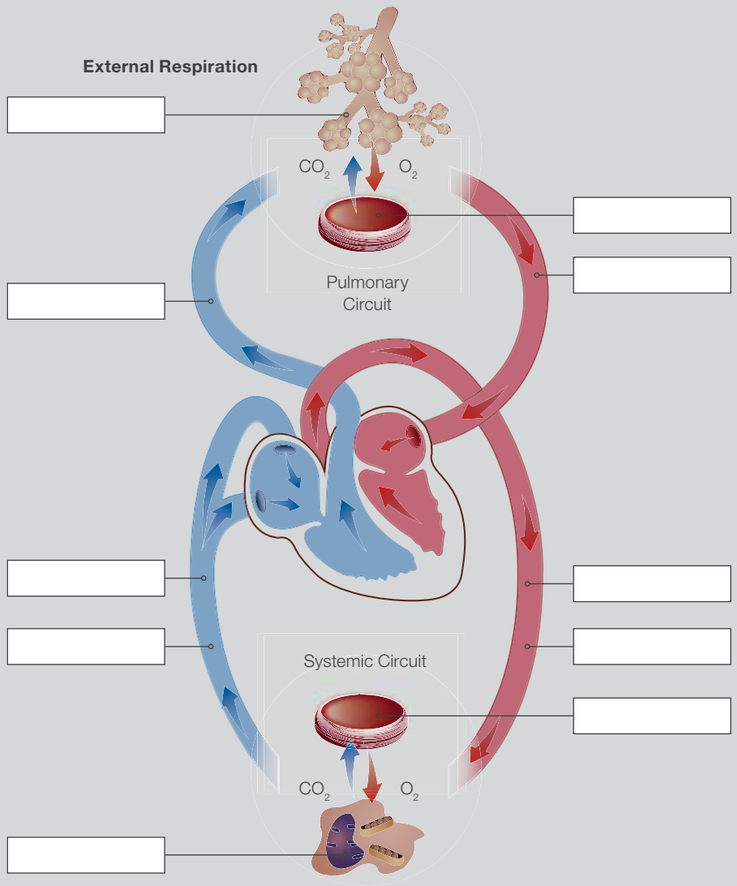
## CAN YOU NOW...

- Identify the location of the heart, its structure and function ☐
- Outline the flow of blood through the heart and the cardiac cycle ☐
- Describe the different circulations of blood and identify the vessels through which it flows ☐
- Define blood pressure and blood pressure classifications ☐




## TASK 3.1

Complete the circulatory system flow diagram below:




## TASK 3.2

Match the characteristics with the correct blood vessel:

| | | |
|---|---|---|
| Carry blood away from the heart | | Have walls which are one cell thick to allow gaseous exchange, in and out of the body's tissues |
| Have thick smooth muscular walls, smooth muscle contracts to push blood along the vessels | **Arteries** | Divide into smaller vessels called Venules |
| Divide into smaller vessels called Arterioles | **Capillaries** | Bring blood to the heart |
| They are the smallest blood vessels | **Veins** | Have non-return valves, which ensure blood flows one direction back to the heart |

## TASK 3.3

Name the 4 components of blood and their roles:

1 _____

_____

2 _____

_____

3 _____

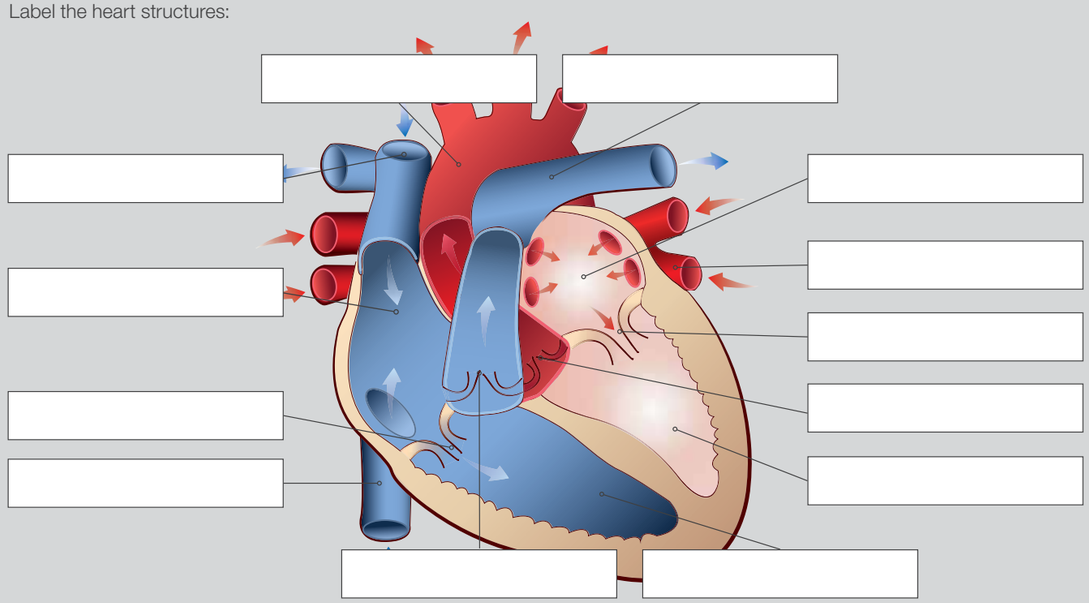
_____

4 _____

_____

## TASK 3.4

Label the heart structures:



## TASK 3.5

Complete the table:

| Category | Systolic (mmHg) | Diastolic (mmHg) |
|---|---|---|
| Optimum blood pressure | | |
| Moderate Hypertension | | |



UNIT 1

4

# RESPIRATORY SYSTEM

**By the end of this section you should be able to…**

Identify the location of the lungs and their anatomy

Outline the passage of air through the respiratory system

Describe the process of gaseous exchange

Identify the muscles involved in respiration

# THE RESPIRATORY SYSTEM AND ITS FUNCTIONS

The main functions of the respiratory system are to provide a route by which the supply of oxygen present in the atmosphere enters the body and provide a route for carbon dioxide to be expelled as a waste product. The lungs which are located in the chest cavity are the site of diffusion of gases into and out of the bloodstream.

## PASSAGE OF AIR

NOW TEST YOUR SELF... Go to page 72

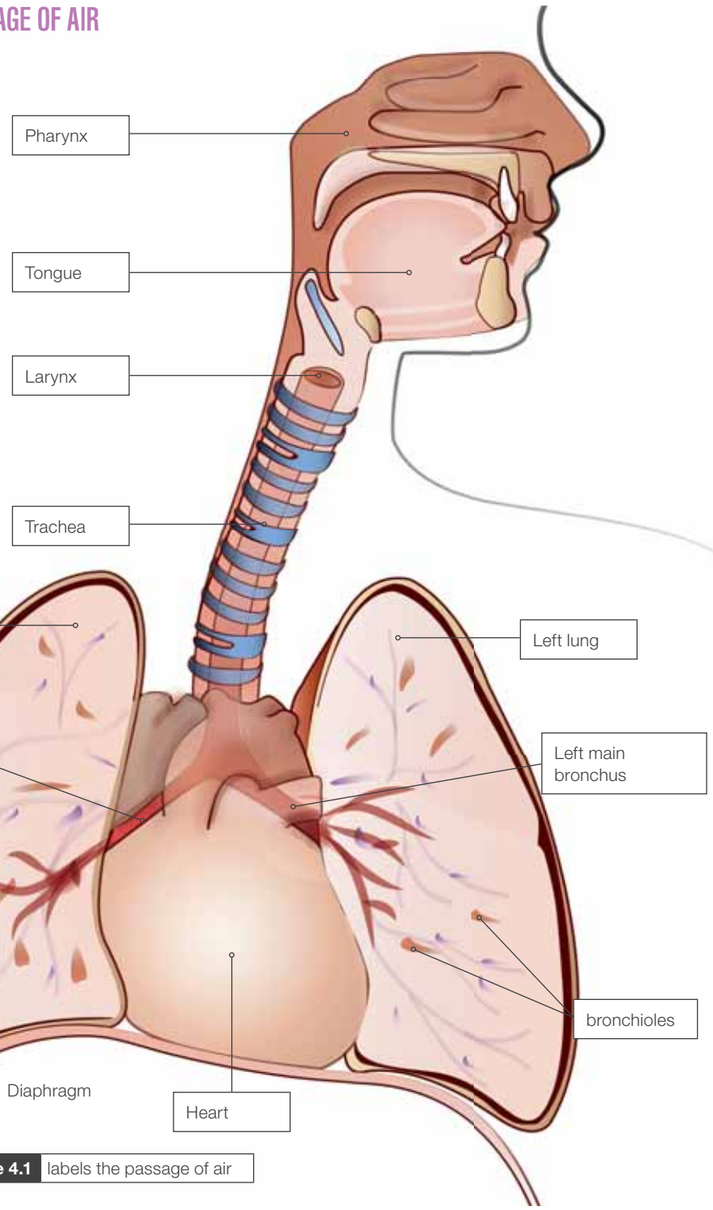



**Figure 4.1** labels the passage of air

## BRONCHIOLES/ALVEOLI

The bronchi sub-divides into smaller passages called bronchioles.

At the end of the bronchioles there are large numbers of alveoli (air sacs).

These alveoli are surrounded by a dense network of capillaries and are the site where the diffusion of gases between the alveoli and capillaries takes place.

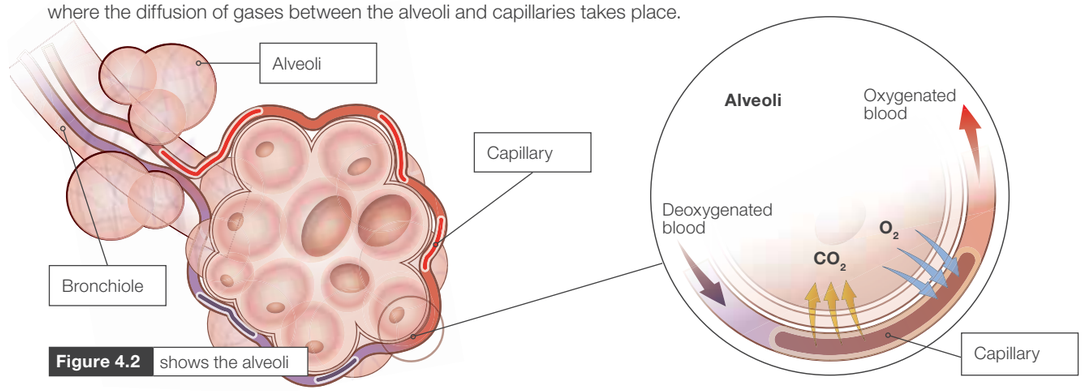



**Figure 4.2** shows the alveoli

## MECHANICS OF BREATHING & RESPIRATION

Respiration is controlled by several major respiratory muscles

- Diaphragm (the main respiratory muscle)
- Intercostals (Internal and external)

The elastic nature of the lung tissue assists in the process of breathing and respiration.

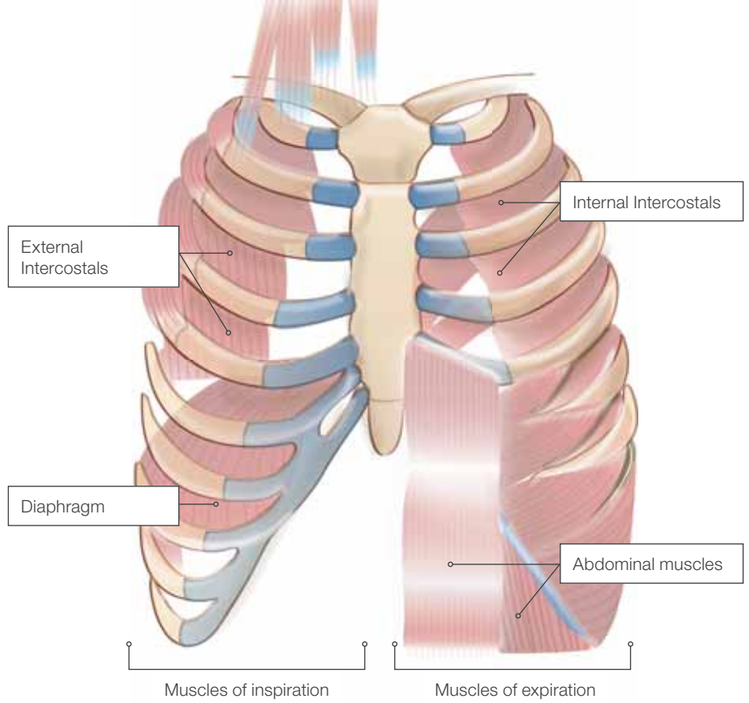



**Figure 4.3** shows the main respiratory muscles

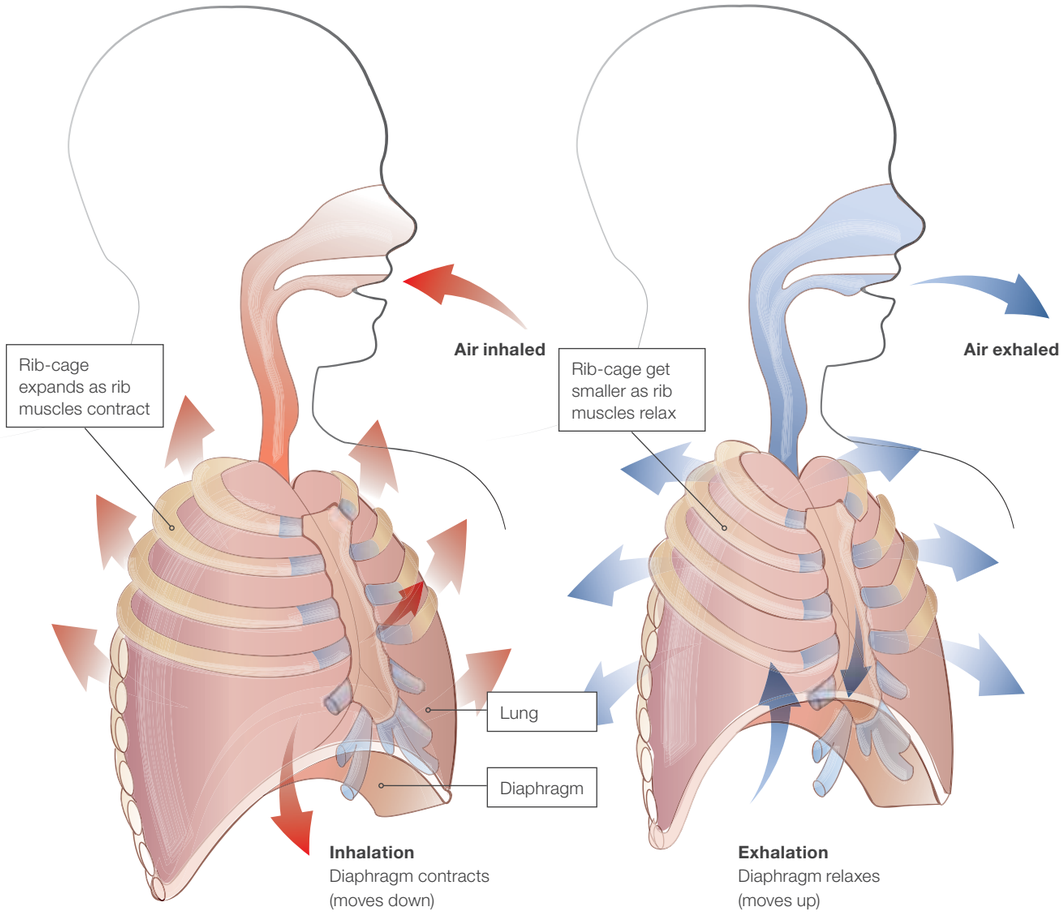
### KEY TERMS

**RESPIRATION**

The process in which we take in oxygen to the body tissues to aid in energy production aerobically.

The action of breathing is controlled by the autonomic nervous system, which means that we do not have to consciously think about it every time we want to take a breath in or breathe out.

During times of laboured breathing, e.g. during exercise the diaphragm is assisted by smaller muscles such as the internal and external intercostal muscles. When expirating during exercise the diaphragm is assisted by the intercostal muscles, obliques, rectus abdominis, and transverse abdominis to 'push out' (exhale) carbon dioxide more forcefully and quickly than when at rest.




**INSPIRATION**

Is the process of breathing in, also known as inhalation.

Diaphragm muscle flattens, increasing the chest cavity volume

This increase in volume creates a negative pressure, between the air in the lungs & that in the atmosphere, creating a vacuum effect.

This negative pressure & vacuum effect causes air to be drawn into the lungs until the pressures balance out.

Expansion of the rib cage during laboured breathing can increase the chest cavity size i.e. during high intensity exercise.

**EXPIRATION**

Is the process of breathing out, also known as exhalation.

Diaphragm muscle relaxes, decreasing the chest cavity volume

This decrease in volume creates a positive pressure, between the air in the lungs & that in the atmosphere.

This positive pressure causes air to be forced out of the lungs until the pressures balance out.

**Figure 4.4** shows the mechanics of inspiration and expiration

## GASEOUS EXCHANGE (DIFFUSION)

Gaseous exchange is the process where oxygen and carbon dioxide are exchanged within the lungs and muscle tissue. Gaseous exchange within the lungs occurs between the alveoli and surrounding capillaries. Oxygen passes through the alveoli to the surrounding capillaries through the capillary wall (which is one cell thick, the same as the walls of the alveoli which allows gases to pass through them). This oxygen is then transported through the circulatory system via blood which carries millions of red blood cells. These are made up of haemoglobin and are our oxygen carriers.

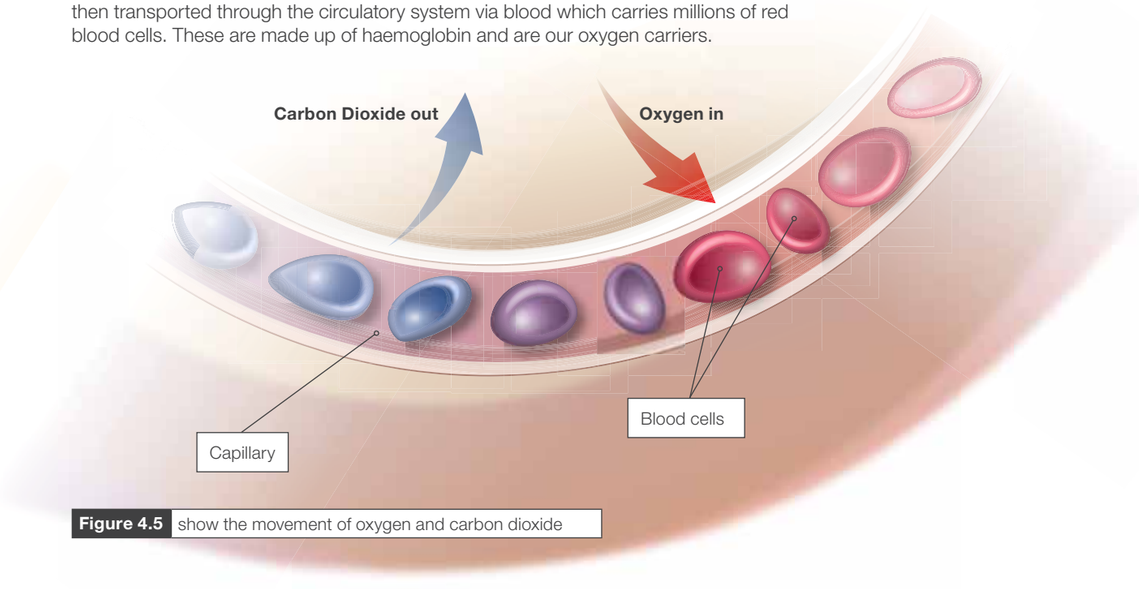



**Figure 4.5** show the movement of oxygen and carbon dioxide

Carbon dioxide ($CO_2$), the waste product from respiration is removed from the body, in a reversal of this process. Carbon dioxide molecules in the blood pass from the capillaries to the alveoli and are then exhaled.

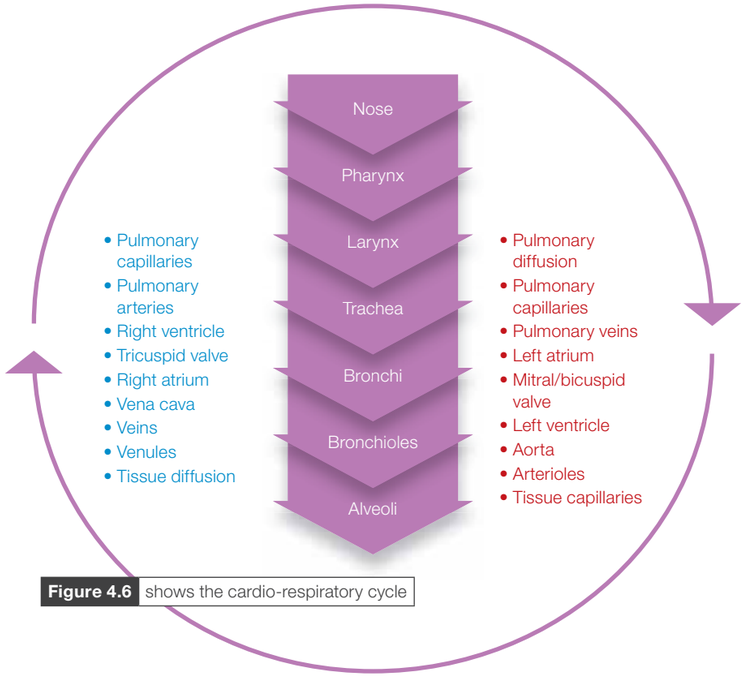



**Figure 4.6** shows the cardio-respiratory cycle

### HELPFUL HINT

Remember passage of air as:

| | |
|---|---|
| **P**lease | (Pharynx) |
| **L**eave | (Larynx) |
| **T**hat | (Trachea) |
| **B**acardi | (Bronchi) |
| **B**reezer | (Bronchioles) |
| **A**lone | (Alveoli) |

## COMPOSITION OF AIR & LUNG VOLUMES

Breathing is continuous and for the majority of time occurs unconsciously which means we don't have to think about every breath we take. It is controlled by the brain, which responds to slight changes in the carbon dioxide levels within the blood. Even very small changes in carbon dioxide levels can greatly increase the air breathed in and out. Hence why, when we exercise, we breathe more quickly and deeper. Lack of oxygen can also increase breathing rate, as the body is trying to take in more oxygen.

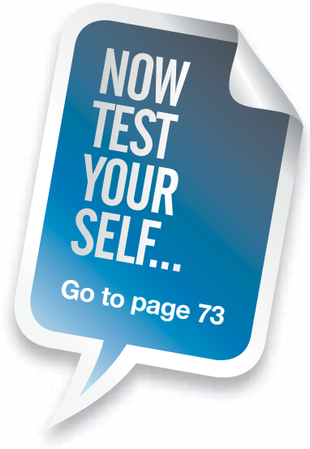
Spirometry is the study of lung function, and there are a variety of measurements that can be used that are affected by age, gender, size and stature:

- Tidal volume (TV) – the amount of inhaled/exhaled air
- Minute ventilation (MV) – the amount of inhaled/exhaled air in 1 minute
- Breathing rate (BR) – the number of breaths taken in 1 minute

At rest, breathing rate is optimally about 12-14 breathes per minute and the tidal volume about 0.5 litres per breath/6-7 litres per minute.

| Gas | Inhaled Air | Exhaled Air | Difference |
|---|---|---|---|
| Nitrogen | 79% | 79% | No change |
| Oxygen | 21% | 17% | 4% decrease |
| Carbon Dioxide | ‹1% | 4% | 4% increase |
| Trace Gases | ‹0.001% | ‹0.001% | No change |

**Table 4.1** shows the composition of air




# RESPIRATORY SYSTEM SUMMARY OUTCOMES

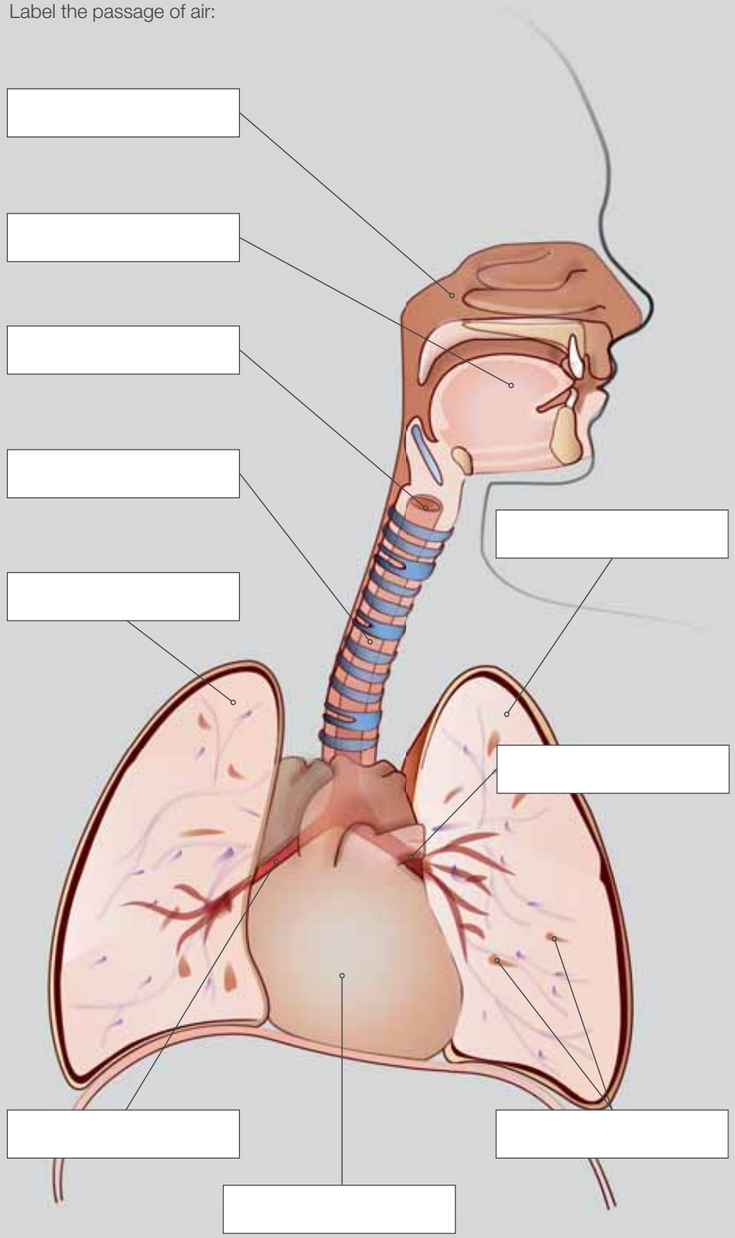
## CAN YOU NOW...

- Identify the location of the lungs and their anatomy ☐
- Outline the passage of air through the respiratory system ☐
- Describe the process of gaseous exchange ☐
- Identify the muscles involved in the respiratory system ☐




## TASK 4.1

Label the passage of air:



## TASK 4.2

Complete the table below:

| Gas | Inhaled Air | Exhaled Air | Difference |
|---|---|---|---|
| Nitrogen | | | |
| Oxygen | | | |
| Carbon Dioxide | | | |
| Trace Gases | | | |

## TASK 4.3

List the main and assisting respiratory muscles:

1 _____

_____

2 _____

_____

3 _____

_____

4 _____

_____

5 _____

_____



UNIT 1

5

# ENERGY SYSTEMS

**By the end of this section you should be able to…**

Identify the macronutrients used for energy production

Explain the ATP cycle

Describe and identify the 3 energy systems used and their characteristics

Classify activities in relation to the energy systems used

### VITAL FACTS

**WHAT DO THE MACRONUTRIENTS PROVIDE?**

Carbohydrates provide us with 4kcal of energy per gram and are stored as glycogen.

Fats provide us with 9kcal of energy per gram and are stored as triglycerides.

Proteins give us 4kcal of energy per gram and are stored as amino acids.

# ENERGY SOURCES

We get energy from the food we eat and digest. This comes from the three main food groups or macronutrients:

**Carbohydrates** (starchy based foods i.e. pasta. rice, bread) – give us sugars, called glucose which is broken down and stored in our muscles and liver as glycogen. This is the preferred fuel source of the body and can be used by all tissues.

**Fats** (dairy products, meats, nuts) – give us triglycerides, which are broken down into fatty acids to release energy. They are an energy dense fuel source; containing twice as many kcals as proteins and carbohydrates. They are stored beneath the skin as adipose tissue, which also acts as insulation and protection for the body.

**Protein** (meat, animal by-products, eggs) – is used primarily as a building material for growth and repair. It is therefore not stored in the same way as fats and carbohydrates, unless it is over consumed where it is converted to fat and stored. They are only used as an energy source in extreme cases (i.e. long endurance based events such as marathon, triathlon, cycling), whereby the amino acids are processed in the liver to provide energy.

## ATP AND ENERGY PRODUCTION

The human body requires energy to function, grow and repair. Energy is released in the body from the breakdown of carbohydrates, fats and proteins, to produce the body's energy currency adenosine triphosphate (ATP).

ATP is made up of a single adenosine molecule which is attached to three phosphate molecules, see figure 5.1 which shows the structure of ATP:

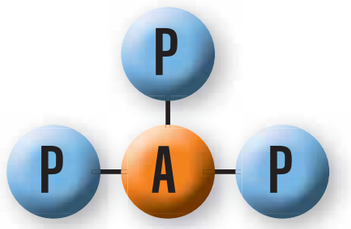



**Figure 5.1** shows the structure of a ATP molecule

The bonds that join the adenosine to the three phosphate molecules are high energy bonds and when the body breaks one of these bonds energy is produced.

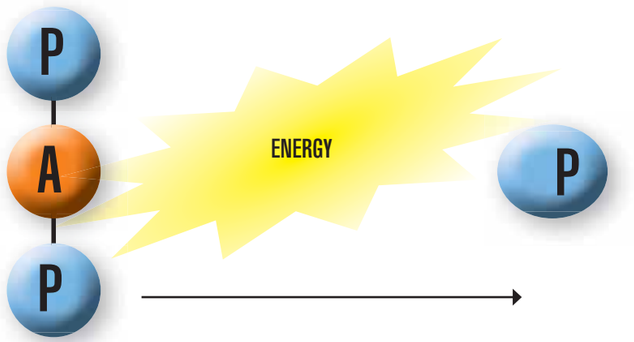



**Figure 5.2** shows the energy released from ATP

When energy is produced from the breakdown of one of its phosphate bonds the former ATP becomes adenosine diphosphate (ADP). ADP still contains the substance adenosine but now only has two phosphates attached to it, demonstrated in figure 5.3:




**Figure 5.3** shows the structure of ADP

Once this has occurred ADP is then looking to be resynthesised back into ATP, through a process called 'coupled reactions'. This is a process where ADP needs to obtain a new single phosphate molecule to become ATP again, this is called the ATP cycle. ATP needs to be in constant supply. We have a natural supply of ATP but this is very limited, so the body must be able to remake ATP in other ways. There are 3 different systems for resynthesis of ATP from ADP depending on demand. These three systems are the:

1. Creatine Phosphate System
2. Lactate System
3. Aerobic System

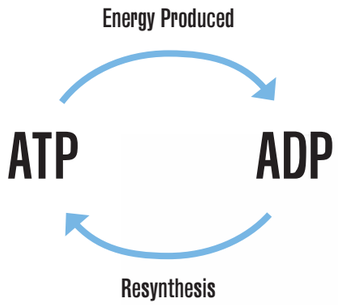



**Figure 5.4** shows the ATP cycle

### VITAL FACTS

**ADENOSINE TRIPHOSPHATE**

1 x Adenosine
3 x Phosphate molecules
Tri = 3

**ADENOSINE DIPHOSPHATE**

1 x Adenosine
2 x Phosphate molecules
Di = 2



## CREATINE PHOSPHATE SYSTEM (CP)

Exercising for a short period of time (0 to 10 seconds) requires an immediate source of energy to remake adenosine tri phosphate or ATP. The creatine phosphate system is the first energy system in which ATP is resynthesized and is anaerobic (does not require oxygen). When our body senses that we are beginning to exert maximal effort, it breaks down creatine phosphate for energy to resynthesize ATP, which is used up during maximal intensity. After prolonged activity other energy systems are required to re-synthesise ATP. This system is the primary fuel source of sprinting, weight lifting and other exercises that require a quick burst of energy. The waste product from this system is creatine.

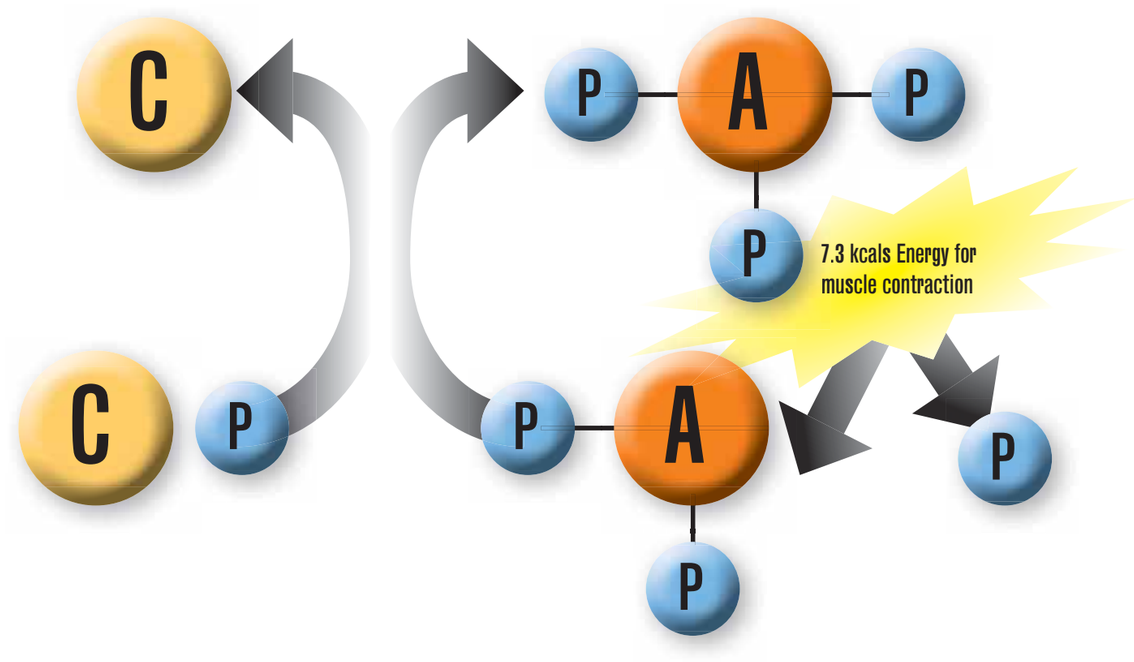



**Figure 5.5** shows the creatine phosphate system

## LACTATE SYSTEM

The lactate system is the second energy system and is also anaerobic. It releases the glucose in muscle glycogen, this glucose is broken down into lactic acid to release ATP. This process is constant and only becomes an issue when there is a large build-up of lactic acid. This lactic acid is the by-product from this system and creates the onset of blood lactate accumulation (OBLA). This is the point at which lactate build up is greater than the muscles ability to remove it causing muscle pain or a 'burn' which in turn forces the participant to stop. The lactate system only lasts up to 60 to 180 seconds of maximum effort and is the primary fuel source for short distance runs like 200m and 400m.

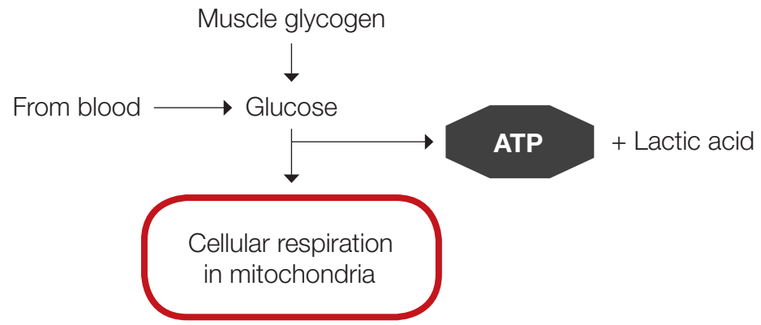



**Figure 5.6** shows the lactate system

## AEROBIC SYSTEM

This is the final energy system but requires oxygen (aerobic) When oxygen is present, glucose can be completely broken down into carbon dioxide and water, in a process called aerobic respiration. Fatty acids and glucose are the main macro-nutrients used in aerobic respiration. Aerobic respiration takes more chemical reactions to produce ATP than either of the other systems. It is therefore slower, but it can continue to supply ATP for several hours. This would be the primary fuel source for long distance events such as marathons or cycling events. The waste products of this energy system are carbon dioxide and water, which do not cause fatigue.

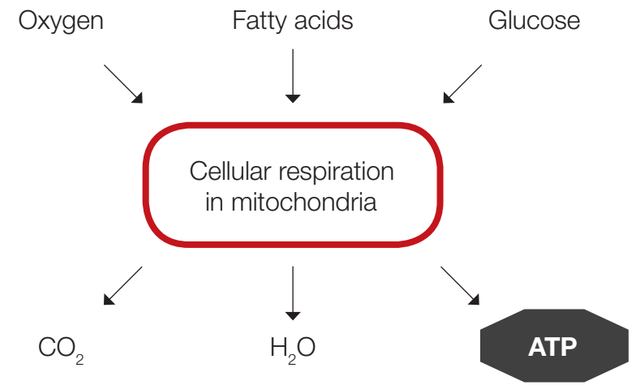



**Figure 5.7** shows the aerobic system

# ENERGY SYSTEMS & EXERCISE

The energy system that the body recruits during activity and exercise depends on the intensity, duration and type of exercise the individual is undertaking. All 3 systems work all of the time, it is not a case of the body switching on and off systems, but selecting the system which best resynthesises ATP during that activity. Table 5.1 shows the contribution of each energy system to a selection of activities/sports:

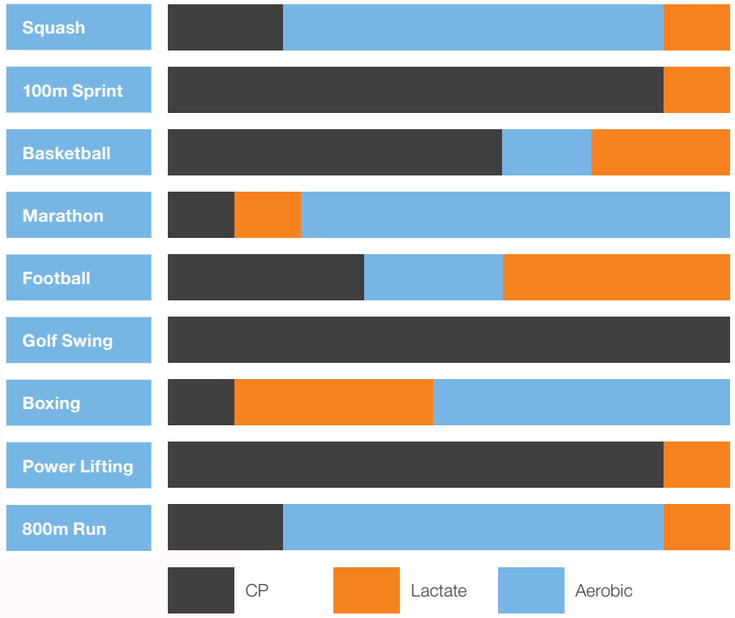



**Table 5.1** shows how the energy systems contribute to the resynthesis of ATP during sports/activities





For example in a middle distance run e.g. 800 metres the lactic acid system is the dominant system, but the creatine phosphate system will kick in at the start to drive off and with a sprint finish, but as the participant starts to fatigue the aerobic system will assist.

Some sports/activities are more endurance based where the aerobic system will be the dominant system e.g. in a marathon or triathlon. Other activities are power based and will rely heavily on the creatine phosphate system e.g. power lifting or a golf swing. There are then team sports which require a different system depending on what the participant is doing such as rugby, football and hockey. Where not involved they may be walking/jogging, using the aerobic/lactate system, then may have to sprint to get the ball using the creatine phosphate system.

# ENERGY SYSTEMS OVERVIEW

| | Creatine Phosphate | Lactate system | Aerobic system |
|---|---|---|---|
| Oxygen dependency | Anaerobic | Anaerobic | Aerobic |
| Fuel sources | Creatine phosphate | Glycogen | Glycogen/fatty acids |
| Speed of ATP production | Very rapid | Rapid | Slow |
| Number of ATP produced | 1 | 2-3 | 36-38 |
| By products | Creatine | Lactic acid | Carbon dioxide and water |
| Duration of energy system | 0-10 seconds | Up to 60-180 seconds | 180 seconds + |
| Activity type | 95-100% max effort | 60-95% max effort | Less than 60% max effort |
| Muscles fibres used | Type 2 | Type 2 | Type 1 |

**Table 5.2** shows the energy systems overview



# ENERGY SYSTEM SUMMARY OUTCOMES

## CAN YOU NOW...

- Identify the macronutrients used in energy production ☐
- Explain the ATP cycle ☐
- Describe and identify the 3 energy systems used and their characteristics ☐
- Classify activities in relation to energy systems used ☐




## TASK 5.1

Complete the table below:

| | Creatine Phosphate | Lactate system | Aerobic system |
|---|---|---|---|
| Oxygen dependency | Anaerobic | | |
| Fuel sources | | Glycogen | |
| Speed of ATP production | Very rapid | Rapid | Slow |
| Number of ATP produced | 1 | 2-3 | 36-38 |
| By products | | | |
| Duration of energy system | | Up to 60-180 seconds | 180 seconds + |
| Activity type | 95-100% max effort | 60-95% max effort | |
| Muscles fibres used | | | |

## TASK 5.2

Complete the table below:

| Activity | Main energy system used |
|---|---|
| Squash | |
| 100m Sprint | |
| Basketball | |
| Marathon | |
| Football | |
| Golf Swing | |
| Boxing | |
| Power lifting | |
| 800m run | |

UNIT 1 6

# NERVOUS SYSTEM

**By the end of this section you should be able to…**

Describe the functions and structure of the nervous system

Identify the main divisions of the nervous system

Label and explain a motor unit and motor unit recruitment

**VITAL FACTS**

**DID YOU KNOW...**

The human brain weighs approx 3lbs (about 1.5kg)

# THE NEUROMUSCULAR SYSTEM

The nervous system acts as a communication network within the body, its role is to detect and respond to changes inside and outside of the body. Changes are detected by a series of sensory receptors from both the internal and external environment. This information is then sent to the brain for analysis through a series of communication networks, from here an appropriate action (response) will be sent.

## AFFERENT (SENSORY NERVES)

| External | Internal |
|---|---|
| SIGHT | Chemoreceptors (chemical) |
| HEARING | Thermoreceptors (temperature) |
| SMELL | Baroreceptors (blood pressure) |
| TASTE | Proprioceptors (position sense) |
| TOUCH | Nociceptors (pain/damage to tissue) |

## ANALYSE/INTERPRETATION



## EFFERENT (MOTOR NERVE)

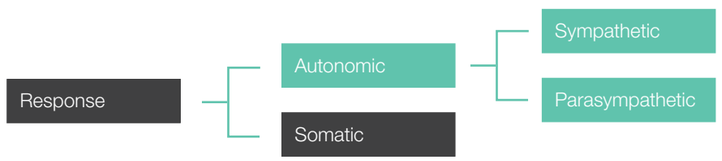



**Figure 6.1** The nervous system sequence

# CENTRAL AND PERIPHERAL NERVOUS SYSTEM

The nervous system is made of two primary divisions:

**CNS**
Central Nervous System

**PNS**
Peripheral Nervous System

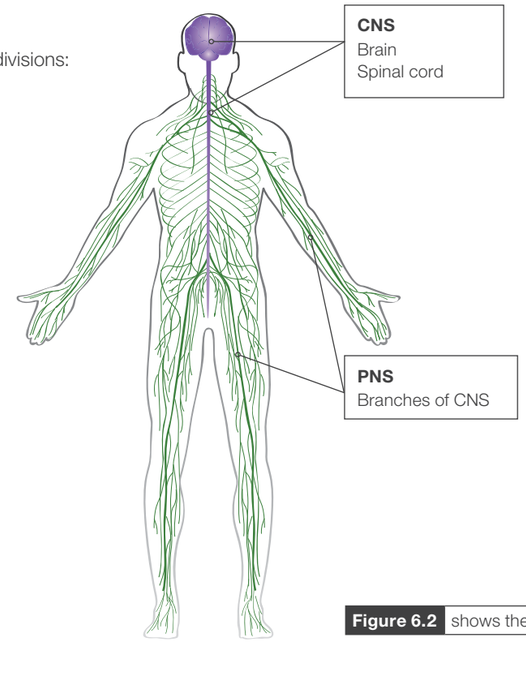



**Figure 6.2** shows the CNS and PNS

## CENTRAL NERVOUS SYSTEM (CNS)

The central nervous system is made up of the:

- **Brain**
- **Spinal Cord**

The brain is protected by the skull and the spinal cord is protected by the vertebral column. The central nervous system is the information processing centre. It receives information from the peripheral nervous system, analyses/interprets the information and then sends out a response as to how the body should react.

## PERIPHERAL NERVOUS SYSTEM (PNS)

The peripheral nervous system is made up of all of the nerves that branch off the CNS, they connect and communicate with the receptors in the muscles, glands, blood vessels and organs. They relay messages from these receptors into the CNS.

The peripheral nervous system contains 2 main branches:

- **Somatic**
- **Autonomic**

The somatic part of the PNS is responsible for all of the voluntary actions, which we have direct control over such as lifting a weight or picking up a pen.

The autonomic section is responsible for all involuntary actions. These are the actions which we have no control over such as heart and lung function and the digestion of food.

**VITAL FACTS**

There are 31 pairs of nerves that extend from the CNS. They supply the body through either somatic or autonomic branches of the PNS

The autonomic then subdivides into 2 sections:

**Parasympathetic** – slows down functions i.e. reduces heart rate after exercise
**Sympathetic** – speeds up functions i.e. increases heart rate during exercise

These 2 subdivisions are crucial in keeping the body in balance, which it is always striving to do by speeding up and slowing down reactions and functions, this process is called homeostasis.




**Figure 6.3** shows the nervous system overview

# MOTOR UNIT ANATOMY

A motor unit is made up of a motor neuron and the muscle fibres that it innervates, figure 6.5 looks at a motor unit and their makeup. A motor neuron has several main structures:

- **Nucleus** – control centre or brain of the neuron, interprets the electrical stimulus (message)
- **Dendrites** – which receive electrical stimulus (messages)
- **Axon** – the tail of the neuron, which takes the stimulus/impulse (message) to the muscle fibre
- **Myelin Sheath** – a fatty sheath surrounding the axon, speeds up the transport of the electrical impulse (message) to the muscle fibres

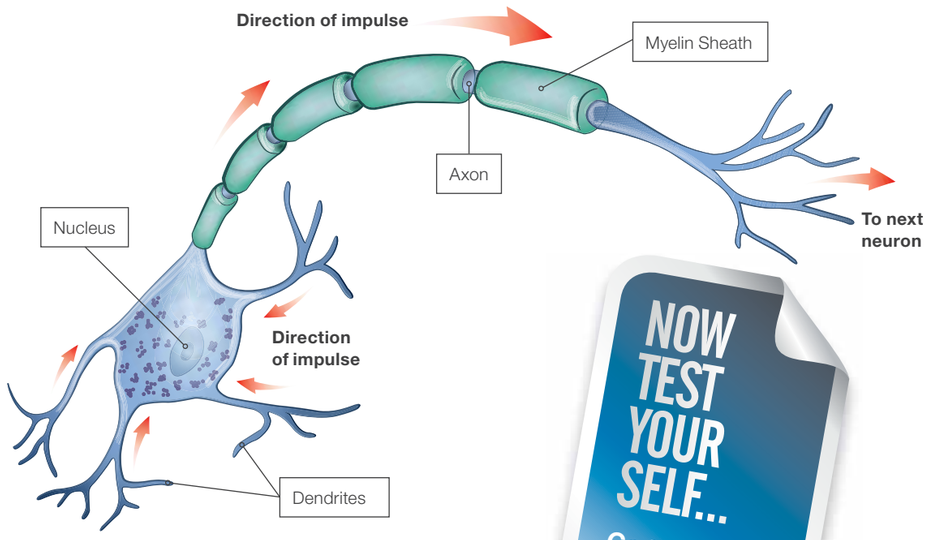



**Figure 6.4** shows the structure of a motor neuron

NOW TEST YOURSELF... Go to page 95

## MOTOR UNITS

A motor unit is made up of a single motor neuron and all of the corresponding muscle fibres it innervates. All of these fibres will be of the same type (either fast twitch or slow twitch). When a motor unit is activated, all of its muscle fibres will contract and the number of fibres could range from 10 to 1000.

Once the brain has interpreted the afferent nerve signal and selected the correct motor response this signal will need to be communicated via the peripheral nervous system to the correct muscle fibres. If the motor response is sent to skeletal muscle tissue then a small electrical impulse is sent to a motor neuron. Motor neurons transmit signals from the central nervous system (CNS) to the required muscles.

The motor neuron receives this signal in the form of an action potential, which causes the motor unit to stimulate the muscle fibres that it innervates to contract simultaneously. This is known as the 'All or none law.' To increase the strength of the muscular contraction more motor units will need to be activated, motor units are recruited from smallest to largest. The number of motor units recruited is decided automatically, unconsciously.

Regular training will improve a gym user's ability to recruit more motor units quickly by strengthening neuro-muscular connections, this in turn can enhance motor skills fitness i.e. better co-ordination during speed ladder training.

### VITAL FACTS

A motor unit consists of:
1. A motor neuron
2. All muscle fibres innervated

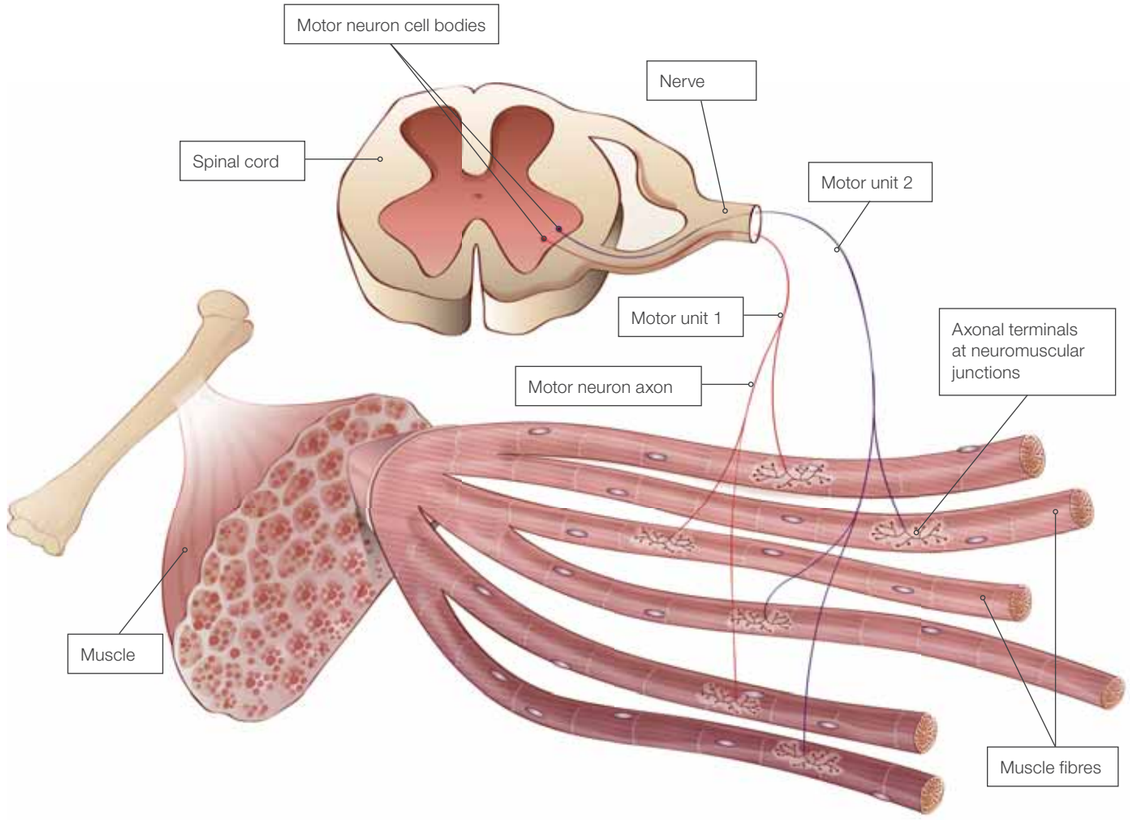



**Figure 6.5** shows a motor unit within a muscle fibre

## EFFECTS OF EXERCISE ON THE NEURO-MUSCULAR SYSTEM

Exercise has a direct effect on the neuromuscular system. Properties of a muscle are changed depending on the regularity, duration and intensity with which a muscle is used leading to motor fitness development by:

- Developing and reinforcing the neural pathways, the more you practice something with correct technique the more permanent and efficient that movement becomes
- Improved co-ordination and recruitment of motor units
- Increased motor unit recruitment, which will develop and improve the firing frequency of motor units (which is the speed of activation through nervous impulse). These will then in turn develop and increase strength and power
- Increasing the number and size of mitochondria in the muscle fibres
- Increasing the number of capillaries surrounding these fibres
- An increase in the number of aerobic enzymes, stored glycogen and triglycerides in the muscle fibres
- Increasing the diameter of the recruited fibres (hypertrophy) due to an increase in the myofilaments within the fibres
- Increasing the glycolytic activity of the muscle allowing more work to be performed under anaerobic conditions or high stress conditions

Motor skill training is a recognised method of developing and training the nervous system for example plyometric training such as bounding, hurdles and speed ladders. As motor skills are learnt, sequences of movements are developed ensuring the actions required to perform specific tasks are smooth and efficient. As they are learnt skills this means they are able to be trained, developed and ultimately improved.

# NERVOUS SYSTEM SUMMARY OUTCOMES

## CAN YOU NOW. . .

Describe the functions and structure of the nervous system ☐

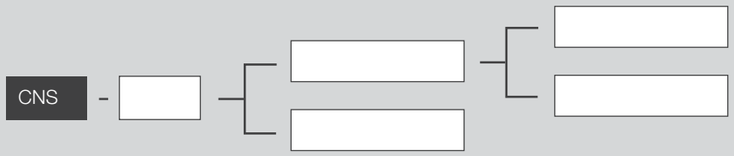
Identify the main divisions of the nervous system ☐

Explain a motor unit and motor unit recruitment ☐




## TASK 6.1

Complete the diagram below:



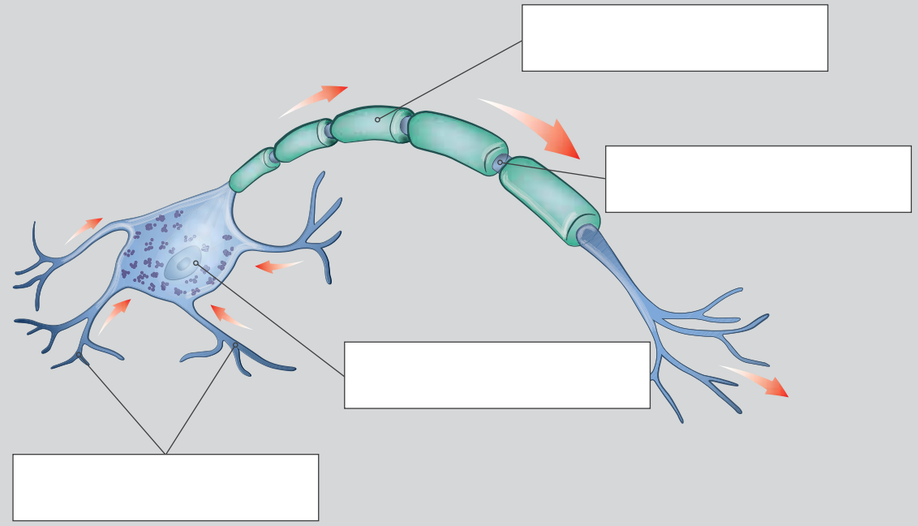

## TASK 6.2

Match the boxes:

| | |
|---|---|
| Regulates chemical balance | Nociceptors |
| Regulates temperature of the body | Chemoreceptors |
| Regulates pressure | Thermoreceptors |
| Senses body position | Baroreceptors |
| Senses pain/tissue damage | Proprioceptors |

## TASK 6.3

Label the motor unit diagram:



UNIT 1

7

# UNDERSTANDING LIFE COURSE OF THE HUMAN BODY IN RELATION TO SPECIAL POPULATIONS



By the end of this section you should be able to…

Describe the life course of;
a. Muscular system
b. Skeletal system
c. Circulatory system

Identify the changes and implications of the life course of the musculoskeletal system on;
a. Young people
b. Pre/Post Natal
c. Older Adults
d. Disabilities

# LIFE COURSE OF THE HUMAN BODY AND ITS IMPLICATIONS FOR SPECIAL POPULATIONS

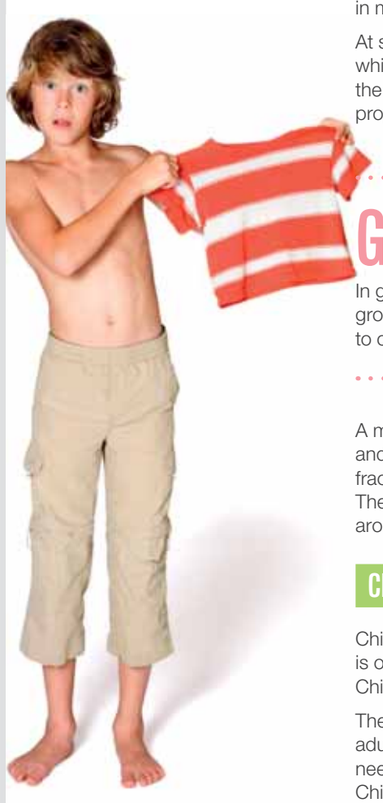
As an instructor it is important to understand the anatomical and physiological changes that the body undergoes as a result of the aging process, pregnancy and in a range of disabilities.

# YOUNG PEOPLE

## CHANGES TO THE MUSCULOSKELETAL SYSTEM

At birth a child's weight is approximately 25% muscle mass. As they grow and develop this increases to 40% in adulthood. During puberty an increase in hormone production results in a muscle mass increase. Growth and development prior to puberty is controlled by human growth hormone (HGH). The onset of puberty sees testosterone in males and oestrogen in females take over.

At some point during this maturation period a child will undergo a 'growth spurt', which means that their bones will suddenly develop at a rapid rate. This is where the 'clumsy teenager' association comes from as their bones grow rapidly effecting proprioception and spatial awareness. These 'growth spurt' phases tend to occur:



### GIRLS

In girls between the ages of 10-12, growing fastest at 12-13. This tends to cease at the age of 18

### BOYS

For boys between the ages of 12-14, growing fastest at 14-15. This tends to end later around the age of 20

A major concern with the development of a child's musculoskeletal system is damage and trauma to the growth cartilage and epiphyseal growth plate fractures. These fractures are more common in boys than girls, and occur around the age of 14-16. These types of fractures and damage occur between the shaft and head of the bone around the growth area.

## CHANGES TO THE CARDIORESPIRATORY SYSTEM

Children have a decreased blood volume compared to fully developed adults, this is one of the reasons why children are less efficient at regulating their temperature. Children heat up faster and are more at risk of overheating than an adult as a result.

The chambers of a child's heart are smaller and therefore less powerful than an adult's which results in a higher heart rate. As their stroke volume is reduced the heart needs to work harder to pump oxygenated body to the working muscles and tissues. Children are less efficient at processing oxygen and need a higher intake of oxygen for aerobic activity.

## CHANGES TO THE ENERGY SYSTEM

Children have an increased number of mitochondria in their muscles and therefore are able to utilise oxygen more effectively. They have a high aerobic threshold, so if they are working at an appropriate level they are able to keep going. However they have limited supplies of muscle and liver glycogen, so reduced stores of anaerobic fuel and the ability to use it. This in turn limits anaerobic capacity and whilst creates an inability to tolerate short bursts of energy/exercises that require high intensity and short repetitions such as high intensity interval training.

# PRE AND POST NATAL

## CHANGES TO THE MUSCULOSKELETAL SYSTEM

During pregnancy the effects of the hormone relaxin will have a major impact on the stability of the synovial joints in the body, due to increasing the flexibility of connective tissues. This will increase the range of movement around the synovial joints making them less stable. There will also be a reduction in motor skill ability, due to the change in centre of gravity. This combined with the joint instability means the participant should avoid undertaking high impact, quick rotation/twisting exercise movements and developmental or assisted stretching during pregnancy.

Post pregnancy the effects of relaxin can be present for 5 or more months, especially if breast feeding, so caution should be taken when returning to exercise, avoiding developmental stretching and high impact exercise. All physical stress should be avoided for 2 weeks after giving birth and daily activities reintroduced after 6 weeks, GP advice should be obtained before returning to exercise.

## CHANGES TO THE CARDIORESPIRATORY SYSTEM

During pregnancy blood volume increases by 30%, but actually becomes diluted, so there are less red blood cells (cells that transport oxygen). (Bothamley and Boyle, 2009) explain that during pregnancy, stroke volume, heart rate and consequently cardiac output increases. Heart rate and increased blood volume are the main factors in determining the increasing cardiac output. Heart rate also increases in response to an increased cardiac output, by approximately 10-15 beats per minute, this is due to the gradual increase of the oxygen requirement of the foetus.

(Hytten and Leitch, 1971) explain that oxygen consumption rises progressively during pregnancy, reaching a peak of 20% above non-pregnant levels. This can lead to the mother becoming breathless and hyperventilating due to the increased need to exchange oxygen and carbon dioxide.

Lung capacity is also affected as the diaphragm rises to make room for the foetus in the latter stages of pregnancy, reducing the space in the lung cavity.

Supine exercises should be avoided, as supine hypertensive syndrome can occur when lying on the back. This is when the uterus presses on the blood vessels affecting venous return. This can lead to dizziness, loss of consciousness and reduce the blood supply to the baby.

## CHANGES TO THE ENERGY SYSTEM

During pregnancy there is also a gradual increase in energy expenditure as pregnancy advances. Pregnant exercisers use the carbohydrate stores more than fat when exercising moderately. This causes blood sugar levels to fall very quickly, causing dizziness and tiredness.

### KEY TERMS

**RELAXIN**

A hormone produced by the ovaries during pregnancy

### MYTH BUSTER

**"WHEN PREGNANT THERE IS NO SUCH THING AS EATING FOR TWO!!"**

Energy intake should only be increased by 150-300 Kcals per day



**HELPFUL HINT**

Anything **OSTEO** is to do with bones, for example:

- Osteopath
- Osteoarthritis
- Osteoblast / Osteoclast
- Periosteum

# OLDER ADULTS

During the aging process there are a few key physiological changes that need to be recognised. Not all adults will experience changes in the same way, this is because genetics and environmental factors play a large role in musculoskeletal/ cardiorespiratory development.

## CHANGES TO MUSCULOSKELETAL SYSTEM

**Osteoarthritis** – The degeneration and wearing away of the articular cartilage thus exposing bone, which creates joint pain and can lead to a reduction in range of movement. Low impact exercise should be given to reduce the pain in joints (commonly knees). For example walking up a gradient rather than running. Exercises that are unstable should also be limited within the programme as a fall will have a higher chance of causing serious damage due to weaker bones.

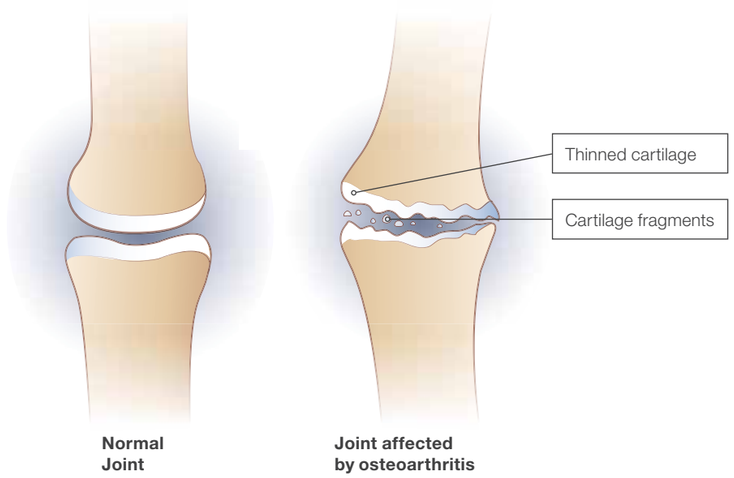



**Figure 7.1** shows the onset of osteoarthritis

**Osteopenia** – This is a condition where bone mineral density is lower than normal. It is considered by many doctors to be a precursor to osteoporosis. However, not every person diagnosed with osteopenia will develop osteoporosis.

**Osteoporosis** – The reduction in bone density, common in women post menopause due to hormonal changes. This creates a more porous bone susceptible to fractures.

**Sarcopenia** – The degenerative condition of muscle mass and strength associated with aging.

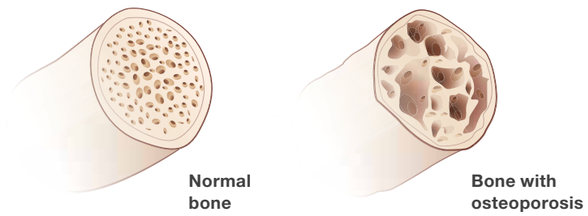



**Figure 7.2** shows osteoporosis in a bone

## GENERAL SKELETAL CHANGES

- Changes in posture kyphosis/lordosis (refer to topic 1 for spinal abnormalities)
- Compression of the intervertebral discs, causing back pain and reduction in spinal flexibility
- Increased curvature of the hips and knees, leading to cartilage and bone damage
- Flattening of the arches, this can cause posture changes throughout the body
- Ligaments become thicker and less supple

## CHANGES TO THE CARDIORESPIRATORY SYSTEM

Alveoli function remains unchanged with age, though over time some alveoli may be replaced by fibrous tissue, this is further aggravated through smoking. This leads to a reduction in gaseous exchange between the capillaries and alveoli, which will make high intensity cardiovascular exercise harder due to the reduction in oxygen transfer.

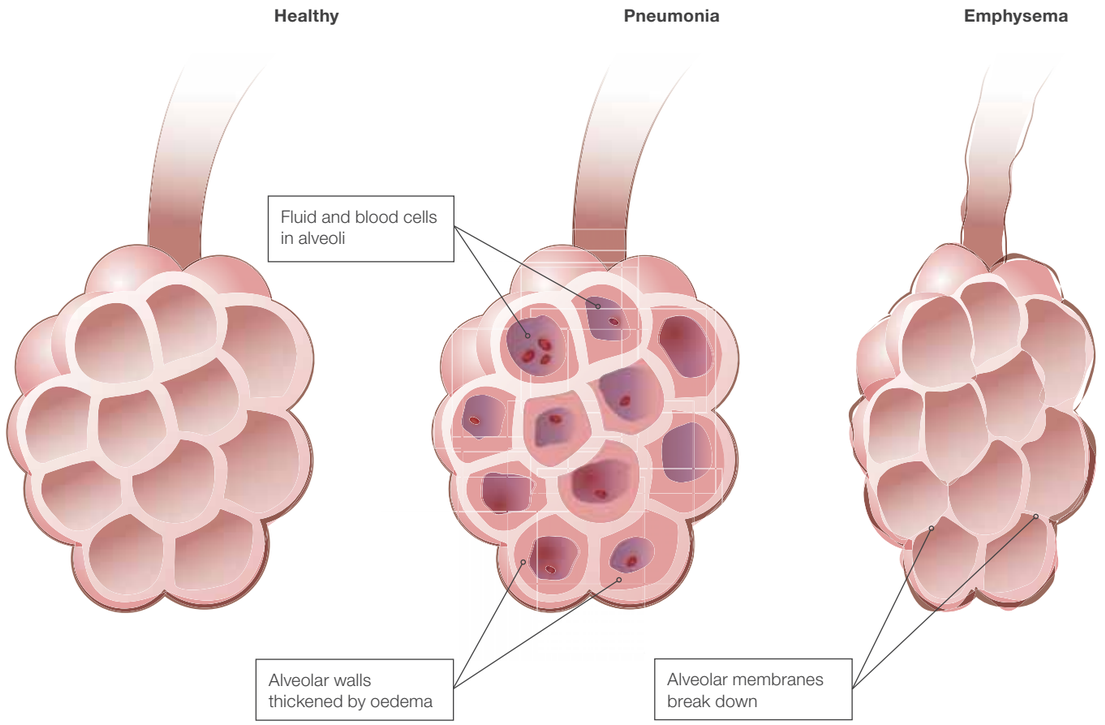



**Figure 7.3** shows alveoli damage

A loss of elasticity and reduction in strength of respiratory muscles can reduce usable lung capacity by up to 50% by the age of 85.

Most significant alterations in arteriole structure occur in the large elasticated arteries through either deposits within the arteries (atherosclerosis) or loss of arteriole elasticity (arteriosclerosis). This is referred to as arterial disease and increases resistance to blood flow through narrowing of lumen (inside of the artery) which in turn leads to an increase in blood pressure.

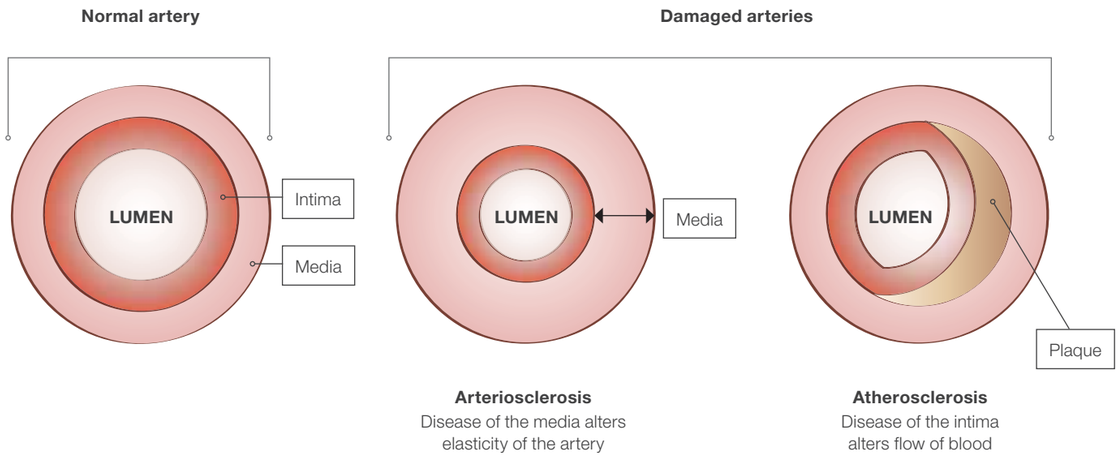



**Figure 7.4** shows alveoli damage

# DISABILITIES AND THEIR EFFECT ON THE HUMAN BODY

Disabilities is an umbrella term, covering impairments, activity limitations, and participation restrictions. *An impairment* is a problem in body function or structure; an *activity limitation* is a difficulty encountered by an individual in executing a task or action; while a *participation restriction* is a problem experienced by an individual in involvement in life situations. Thus disability is a complex phenomenon, reflecting an interaction between features of a person's body and features of the society in which he or she lives. — World Health Organization

As a fitness professional you may come across a varying number of disabilities. Although there are specific qualifications to work with this specialist group it is important to identify and understand how it affects their training. There is no golden rule as disabilities are hugely diverse. The best way to approach exercise is to enter it with an open mind as there are many adaptations and regressions that you may not have seen before.

People with disabilities need to be guided through exercise with a programme that is tailored to their specific individual requirements.





# UNDERSTANDING LIFE COURSE OF THE HUMAN BODY IN RELATION TO SPECIAL POPULATIONS SUMMARY OUTCOMES

## CAN YOU NOW. . .

Describe the life course of;

a. Muscular system
b. Skeletal system
c. Circulatory system

Identify the changes and implications of the life course of musculoskeletal system on;

a. Older adults
b. Young people
c. Pre/Post natal
d. Disabilities






## TASK 7.1

Link the following statements and conditions:

| | |
|---|---|
| Atherosclerosis | Loss of arterial wall elasticity |
| Osteoporosis | The degeneration and wearing away of the articular cartilage thus exposing bone, this creates joint pain and can lead to a reduction in range of movement. |
| Osteopenia | Deposits of proteins, fats and minerals in the arteries, which restrict blood flow |
| Arteriosclerosis | This is a condition where bone mineral density is lower than normal. It is considered by many doctors to be a precursor to osteoporosis. |
| Osteoarthritis | The reduction in bone density, common in women post menopause due to hormonal changes. This creates a more porous bone susceptible to fractures. |

## TASK 7.2

Complete the following statement:

The hormone _____ is produced during pregnancy.

It decreases the _____ of the joints due to the increasing

_____ of the connective tissues.

## TASK 7.3

Answer the following question:

At what age are growth plate fractures most likely to occur at?

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GYM INSTRUCTOR WORKBOOK / MANUAL 2

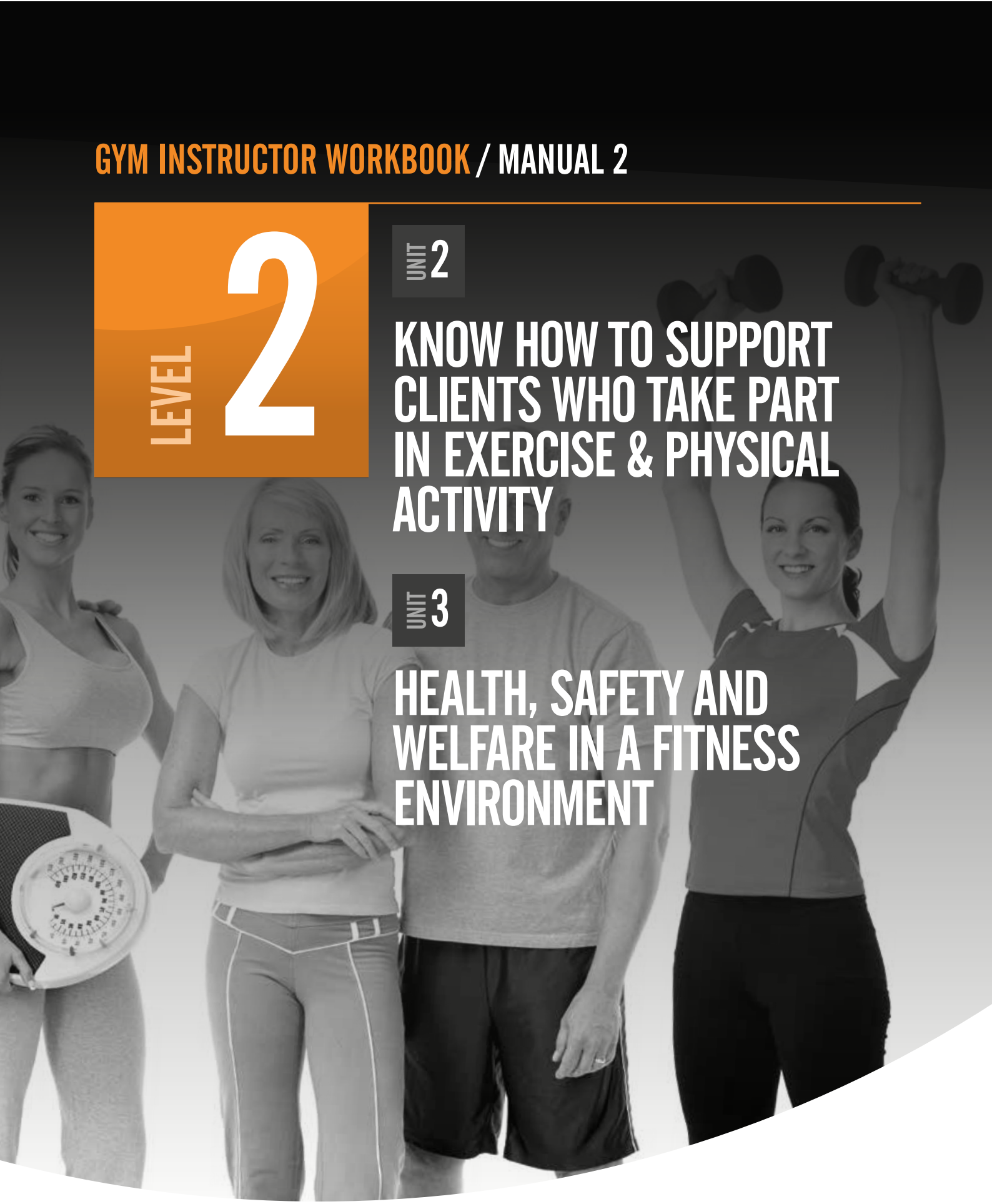
LEVEL 2

UNIT 2

# KNOW HOW TO SUPPORT CLIENTS WHO TAKE PART IN EXERCISE & PHYSICAL ACTIVITY

UNIT 3

# HEALTH, SAFETY AND WELFARE IN A FITNESS ENVIRONMENT



the training room



# MANUAL CONTENTS


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| **Unit 3** | Health, Safety & Welfare in a Fitness Environment | **27** |



UNIT 2

# KNOW HOW TO SUPPORT CLIENTS WHO TAKE PART IN EXERCISE & PHYSICAL ACTIVITY

**By the end of this section you will be able to understand how to...**

Form effective working relationships with clients

Address and overcome barriers to physical exercise and activity promoting motivation and exercise adherence

Apply the principles of customer service to clients

# WORKING RELATIONSHIPS

## WHAT IS A RELATIONSHIP?

'A co-operative relationship between people or groups who agree to share responsibility for achieving some specific goal' (WordNet Princeton University 2006)

As a fitness professional it is important to build effective relationships with many people, this will include both work colleagues and clients.

## EFFECTIVE CLIENT RELATIONSHIPS

Developing and maintaining an effective relationship is important between the instructor and clients to help promote:

- Adherence
- Trust and respect
- Motivation
- An open environment

## EFFECTIVE BUSINESS RELATIONSHIPS

Society is a web of relationships, requiring all parties to work together in order to create something that is successful. In business such relationships aid in:

- Repeat business
- Word of mouth, praise and marketing
- Increase of profit
- Longevity of the training programme
- A more relaxed working environment
- A greater understanding of each parties' needs

As a fitness professional there are a number of people that you will have a working relationship with, these include both internal and external personnel. For example:

- Personal trainers and other instructors
- Class instructors
- Gym manager
- Physiotherapists
- General manager
- Receptionists
- Clients
- Class participants

This can be achieved by:

- Following industry code of practice (as outlined by Register of Exercise Professionals)
- Maintaining professionalism
- Communicating effectively
- Respecting equality and diversity
- Recognising barriers and promoting adherence

The REPs code of ethical practice 2011, gives 5 principles to adhere to, they are:

## PRINCIPLE 1: RIGHTS

***'Exercise professionals should deal openly and in a transparent manner with their clients. They should at all times adopt the highest degree of professionalism in dealing with their clients' needs.'***

Compliance with this principle requires exercise professionals to maintain a standard of professional conduct appropriate to their dealings with all client groups and to responsibly demonstrate:

- Respect for individual difference and diversity
- Good practice in challenging discrimination and unfairness
- Discretion in dealing with confidential client disclosure

## PRINCIPLE 2: RELATIONSHIPS

***'Exercise professionals will seek to nurture healthy relationships with their customers and other health professionals.'***

Compliance with this principle requires exercise professionals to develop and maintain a relationship with customers based on openness, honesty, mutual trust and respect and to responsibly demonstrate:

- Awareness of the requirement to place the customer's needs as a priority and promote their welfare and best interests first when planning an appropriate training programme
- Clarity in all forms of communication with customers, professional colleagues and medical practitioners, ensuring honesty, accuracy and co-operation when seeking agreements and avoiding misrepresentation or any conflict of interest arising

## PRINCIPLE 3: PERSONAL RESPONSIBILITIES

***'Exercise professionals will demonstrate and promote a responsible lifestyle and conduct.'***

Compliance with this principle, requires exercise professionals to conduct proper personal behaviour at all times and to responsibly demonstrate:

- The high standards of professional conduct appropriate to their dealings with all their client group which reflects the particular image and expectations relevant to the role of the exercise professional working in the fitness industry
- An understanding of their legal responsibilities and accountability when dealing with the public plus awareness of the need for honesty and accuracy in substantiating their claims of authenticity when promoting their services in the public domain
- An absolute duty of care to be aware of their working environment and to be able to deal with all reasonably foreseeable accidents and emergencies and to protect themselves, their colleagues and clients

## PRINCIPLE 4: PROFESSIONAL STANDARDS

***'Exercise professionals will seek to adopt the highest level of professional standards in their work and the development of their career.'***

Compliance with this principle requires exercise professionals to commit to the attainment of appropriate qualifications and on going training, to responsibly demonstrate:

- Engagement in actively seeking to update knowledge and improve their professional skills in order to maintain a quality standard of service, reflecting on their own practice, identifying development needs and undertaking relevant development activities
- Willingness to accept responsibility and be accountable for professional decisions or actions, welcome evaluation of their work and recognise the need when appropriate, to refer to another professional specialist
- A personal responsibility to maintain their own effectiveness and confine themselves to practice those activities for which their training and competence is recognised by the Register

## PRINCIPLE 5: SAFE WORKING PRACTICE

***'Exercise professionals will systematically prepare for all activities ensuring the safety of their clients is of paramount consideration'***

Compliance with this principle requires exercise professionals to maintain a safe exercise environment for all clients, and at all times and to responsibly demonstrate:

- A responsible attitude to the care and safety of client participants within the training environment and in planned activities, ensuring that both are appropriate to the needs of the clients
- An appropriate ratio of instructors to clients within any group sessions to ensure that at all times the safety of all clients is paramount
- All clients have been systematically prepared for the activity in terms of safety including the safe use of equipment



## PROFESSIONALISM

Professionalism means commitment to the client, community and your own profession through ethical practices.

As a fitness professional it is important that you present yourself with professional conduct at all times. This will ensure you give the highest standards of customer care and have a sound grounding of equality. Great customer service will in turn lead to repeat business, positive word of mouth marketing and reputation. As a personal trainer this improves client retention and for a gym it will increase membership sales and profitability.

To ensure a professional approach to work it is good practice to include some of the qualities and skills outlined below:



## COMMUNICATION

Effective communication skills are essential in any working environment. There are two main types of communication:

### Verbal Communication

Verbal communication is a way of exchanging information or messages in a spoken or written format.

### Non Verbal Communication

Non verbal communication is behaviour, which is not in a spoken or written format that creates or represents meaning. It can include facial expressions, body movements and gestures. It is a very effective and important method of communication, sometimes even more so than speech. Remember the saying, "Actions speak louder than words!"

### Methods of Communication

Communication consists of listening, acknowledging and responding. Therefore there are a number of key areas to consider when looking at communication:

### Listening

Active listening and observation skills go hand in hand. Non-verbal communications such as facial expressions, body position and eye contact will be used throughout the conversation to add context to what is being discussed. Other ways to promote active listening with your client include paraphrasing key points, nodding and asking questions on what they have asked. This non-verbal communication is very important when communicating. A disinterested posture can be a barrier when approaching cliental (i.e. arms crossed).

### Acknowledgement

Acknowledgement is vital as it shows you are listening to what is being said and showing interest. There are many ways in which to show acknowledgement:

- **Eye contact** – Shows interest and that client has your full attention
- **Nodding** – Shows that you have an understanding of what they are telling you
- **Hand gestures** – Adds context to what you are saying
- **Body language** – An instructor should always try and show open body language. E.g. crossed arms can be perceived as defensive, whereas unfolded arms make you more approachable

### Responding

When responding, the instructor must take the client's views on board and comment in a positive attitude without being flippant or patronising. The instructor will then need to facilitate client responses to continue showing interest. There are many ways to do this:

- **Paraphrasing and Summarising** – The instructor uses his/her own words to state their understanding of what the client is saying
- **Clarifying** – The instructor could ask for the meaning of a phrase or a saying within the conversation
- **Use of Silence** – The instructor should leave silence periods to give the client time to reflect on what has been discussed and to question as appropriate

## EQUALITY AND DIVERSITY

Equality is about creating a fairer society where everyone can participate and is given the same opportunity to fulfill their potential. Whereas diversity is about recognising that everyone is different in a variety of visible and non-visible ways and respecting the values and differences of all these people. Equality and diversity are supported by legislation designed to address unfair discrimination. Some of the common and original pieces of legislation relating to equality and diversity are:

- Race Relations Act 1976
- Sex Discrimination Act 1975
- Disability Discrimination Act 1995

Lawscot (2012) explain that these have now been incorporated into a new single piece of legislation (The Equality Act 2010), which now encompasses these previous individual acts.

Valuing equality and diversity is important to the instructor, to ensure that clients and prospective customers are all treated equally, fairly and with the highest standards of customer care, irrespective of race, colour, nationality, ethnic origin, educational achievement, gender, sexual orientation, marital or parental status, age, disability, political or religious belief or socio-economic class.

The REPs code of ethical practice 2011 principle 1 discusses the rights of the individual, these include:

### Age

This should not cause less favorable treatment in a workplace or within a fitness environment, unless there is an objective justification for doing so.

### Religion and Belief

Religion or belief should not interfere with anybody's right to be treated fairly.

### Disability

If one has a physical or mental impairment, that person has specific rights that protect them against discrimination. Employers and service providers are obliged to make relevant adjustments.

### Gender

Men, women and transgender people should not be treated unfairly because of their gender.

### Race

Whatever origin or colour of their skin, they have a right to be treated fairly and be protected against racial discrimination and prejudice.

### Sexual orientation

Whether straight, gay, lesbian or bisexual they should not be put at a disadvantage.

Adherence to the above will ensure that all members and clients are treated fairly and equally whilst operating within a legal framework.

This will ensure that the instructor and organisation operates within the legal framework of various pieces of legislation, such as the new 'umbrella' – Equality Act 2010.

More information on The Equality Act 2010 can be found at www.legislation.gov.uk



# ADDRESSING/OVERCOMING BARRIERS TO PHYSICAL EXERCISE AND ACTIVITY PROMOTING MOTIVATION AND ADHERENCE

As a fitness instructor your job is not just teaching clients how to exercise, but helping them overcome common motivational and adherence barriers. This will ultimately affect the achievement of goals and objectives. As an instructor you will develop a feel for what's really at the bottom of a client's training and exercise problems, even if they do not say it outright. You will need to develop skills to 'scratch beneath the surface' to then make suggestions to help overcome those problems. Remember you can give them all the help and advice possible, but it is down to the client to implement the changes for themselves.

## BARRIERS TO EXERCISE

| Reasons for stopping exercise | Men | Women |
|---|---|---|
| Work reasons | 23% | 17% |
| Lost interest in activity | 19% | 16% |
| Needed time to do other things | 13% | 10% |
| Marriages/change in partnership | 6% | 10% |
| Having children/looking after children | 2% | 10% |
| Facilities closed or changed | 7% | 6% |
| Moved house | 4% | 7% |
| Training partner no longer available | 4% | 4% |
| Injury or health problem | 4% | 4% |
| Sports injury | 3% | 2% |
| Getting too old/health failing | 3% | 1% |
| Could no longer afford it | 1% | 2% |
| Difficulty getting there | 1% | 1% |
| Other reasons | 10% | 10% |

**Table 2.1** shows the reasons for stopping exercise identified in the Allied Dunbar National Fitness Survey (1992)

## WHY DO PEOPLE STOP EXERCISING?

Table 2.1 shows the findings from the Allied Dunbar survey on why people stop exercising. As a fitness professional it is likely that when setting goals with clients, barriers will arise. There are numerous reasons for stopping exercise, one of the main reasons is because people find it hard to break the cycle of old habits and introduce new behaviours.

As a fitness professional it is important that you are able to identify these barriers with your clients early on within their fitness journey. Overcoming these barriers is a key part of exercise adherence. It is vital that these are planned and discussed with the client so that they have a part in implementation of these strategies.

These barriers can be classified into 4 categories:

### Physical

It is common for people to give physical reasons not to embark on a fitness programme i.e. lack of fitness, health concerns or injuries. As a fitness professional you will be able to plan an exercise programme for those who are unfit and new to exercise, which will include education on types of training, basic nutrient information around the eat well principles (eat-well plate) and specific exercises for their goals. Goal setting will be essential for those who lack fitness as it will give clear indications that they are improving when they reach their targets. If the client has injury or fitness concerns that are evident after the PAR-Q screening, they need to be referred to a health professional. This will give you the information required to develop a programme suitable for the individual. The client could then be transferred to an exercise referral specialist for training.

### Emotional

There are many reasons for emotional barriers. These could include frustration that current or past training has failed to deliver results, or that fear, shame or embarrassment will prevent them from achieving their goal. When a client shows frustration, SMART goal setting is very important. You will also need to get an understanding of their current fitness programme and any barriers within this that has caused problems. It is important to include exercises that they enjoy as this will help in exercise adherence. If the client feels embarrassed of training in a busy environment then additional venues for training need to be considered. These can include a studio, a clients home or outdoor in a secluded area such as the forest or local park.

### Motivational

Many people within the fitness environment may experience lack of motivation, which is a massive problem for gyms, with many users leaving after 3 months. One of the main reasons for this is that the clients may reach their planned goals, leading to a reduction in motivation with their current training programme. At this point new goals and targets need to be set to stop the client from plateauing. When writing a programme for clients, short, medium and long terms goals need to be set, using a variety of equipment, training systems and exercise classes to retain their interest. If goals set are unrealistic and UNSMART the client may lose interest as they are not seeing any results.

### Time

Lack of time is a very common barrier to exercise. Time restraints could be for a number of reasons including family or work. For this type of client the introduction of fitness into everyday activities such as walking/cycling to work can help, when going to the gym is not possible. As a fitness professional you may choose to train this client during lunch breaks, before work, or at their place of work/home to ensure it's convenient for them.

## IDEAS FOR PROMOTING EXERCISE ADHERENCE

**Rewards or Incentives** – instructors and organisations use these to help develop and strengthen client's motivation and adherence. This method of positive reinforcement let clients and members know that their efforts have been noted and rewarded, when they achieve a set target or goal. It could be something as simple as a t-shirt or water bottle, but the fact that their effort has been rewarded is a strong motivator.

**Identifying Exercise Preferences** – it is important as an instructor to identify clients exercise likes. As simple as it sounds if their exercise programmes contain activities and tasks that the client enjoys doing they are more likely to stay motivated and improve adherence.

**Discounted sessions if price is a concern** – if clients are unable to afford one to one sessions then a price discount may negotiated. A common way an instructor addresses this to get clients to train with a friend, where they split the fee, meaning sessions become affordable but also addresses adherence and motivation by training with a friend, creating a social element. This can also be done through offering group training sessions.

**Home Workouts and Programmes** – the instructor could pre-write programmes and session plans for clients to follow at home or in the gym environment in their own time. This would be beneficial to the client as they have something to follow to keep them motivated and would help adherence as they have to take responsibility of completing the pre-planned workout in their own time.

## GOAL SETTING TO PROMOTE EXERCISE ADHERENCE/MOTIVATION

A goal has an observable and measurable end result having one or more objectives to be achieved within a more or less fixed timeframe.

Goal setting and planning ("goal work") promotes long-term vision and short-term motivation. It focuses intention, desire, acquisition of knowledge, and helps to organise resources.

When setting goals with clients it is important that you target their reasons for exercising. There are many reasons for the participation in exercise/fitness.
For example:

- Enjoyment
- Health
- Appearance and weight control
- Social/fashion status
- Injury rehabilitation
- General fitness/well being
- Sports specific
- Relaxation
- Confidence/self esteem
- Change

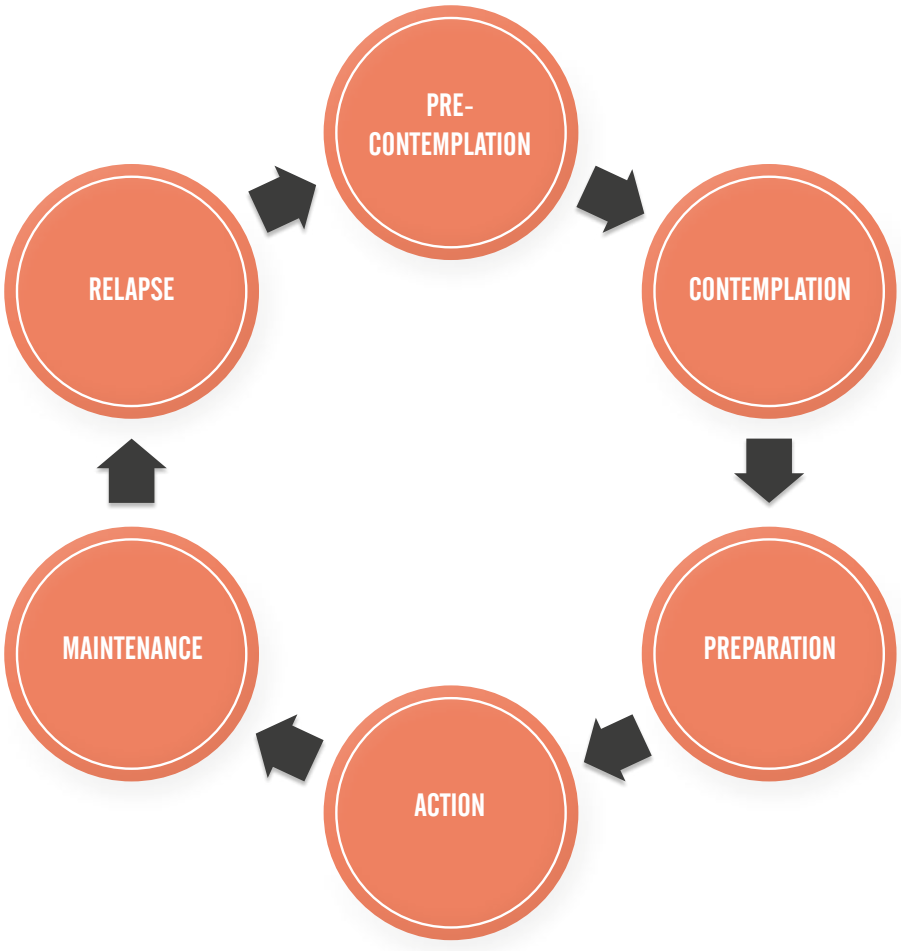
## DEVELOPING CHANGE

It is important for the client to take responsibility for change as it is a long term commitment. Exercise and nutritional adherence is vital to ensure a lifestyle change rather than a short term fix. The more the client understands the importance of self-motivation the more driven they will be to achieve goals, rather than relying upon someone else to help them achieve. Some people are very self-motivated and are willing to change, one explanation of this could be the point in which the client is in the stages of change model.

The stages of change model looks at the thought process a client will go through when looking to change their behaviour. This can be easily linked to the thought process of starting an exercise programme. These can be influenced by:

1. Persuasion by authority
2. Observation of others – family and friends notice change
3. Physiological feedback – loose clothes, or tight clothes when in hypertrophy
4. Successful performance – easily achieved

## STAGES OF CHANGE



| Stage of Change | Client Attitude and Behaviour | Instructor Action |
|---|---|---|
| **Pre-Contemplation** | ***I won't or I can't***<br>Not interested in help<br>Can be defensive of current habits | Educate potential clients, offer incentives and advice, banish myths and preconceptions |
| **Contemplation** | ***I might***<br>Spend time thinking about their problem<br>They decide on how changes are going to affect them | Provide realistic goals, offer a choice of enjoyable activities to stimulate interest and uptake |
| **Preparation** | ***I will***<br>They understand they have to change what they are doing<br>They start to think how they can change | Implementation of SMART goals, and preferred activities, start to work with clients |
| **Action** | ***I am***<br>They are starting to change what they are currently doing<br>They may start to implement changes decided | Provide feedback and support, motivation, encouragement and provide incentives |
| **Maintenance** | ***I am currently***<br>They have committed to change and are resisting temptation to stop<br>They are currently undertaking planned changes and are open to new ideas to continue change | Reinforcing and updating goals, changing training activities and exercise to keep clients motivated |
| **Relapse** | ***Before I used to***<br>They have stopped adhering to changes<br>They revert back to old habits | Reassess goals and amend accordingly, provide additional support and motivation |

**Table 2.2** shows common behaviours within the various stages of change

## GOAL SETTING

Once the personal trainer and client have mutually agreed the desired goals, a structured exercise programme needs to be designed to help with exercise adherence and boost motivation. There are several items that a fitness professional could look at:

- Outlining the goals and achievement dates
- Ensuring the goals are achievable
- Executing fitness tests
- Providing useful resources, these could include an email with exercises to complete when training alone or nutrition information
- Including exercises that the client enjoys/finds challenging

## PREVIOUS EXERCISE QUESTIONS

Before setting goals it is important to look at the client's exercise history as this may give an indication as to the appropriateness of goals. It can also indicate the previous physical condition of the client.

The FITT principle is an easy way to look at this:

# FITT



F – Frequency of exercise (number of times in a set period)

I – Intensity (% of max HR, RPE levels, % of 1RM, Range of movement and rest)

T – Time (how long was each session)

T – Type (type of activity completed)

The FITT principle can be applied to past and present exercise programmes.

Once a goal has been decided you need to ensure that the goal is measurable. For example, if a client asks to tone up, it is difficult to measure as it's very subjective. However, reducing body fat to a given percentage in a set period of time is a measurable figure. You can use the SMART principle to ensure the goals are suitable for the client, this will include the client's current fitness levels.

## SMART GOALS

# SMART



S – Specific
Are the goals in line with the clients' needs?

M – Measurable
How are you going to measure the results? Ensure there is a number to compare test results.

A – Achievable
Are the results achievable within the time frame given? (This is very important to keep clients motivated).

R – Realistic
Are the goals realistic for the client?

T – Time bound
What time frame is being adhered to?

| Example 1 Acronym | Example 2 Statement |
|---|---|
| **S** – Lose 12lbs of body fat in weight<br>**M** – Weight, skin fold callipers and BMI measurements to be taken<br>**A** – Client will start a healthy eating and exercise programme<br>**R** – 1-2lbs a week is seen as safe weight loss<br>**T** – 3 Months | I want my client to lose 12lbs of body fat in 3 months. This will be measured by recording clients' weight, BMI and body fat percentage throughout the programme. This is realistic as it is recognised that safe weight loss is 1-2lbs per week, by following a exercise programme and healthy eating plan. |

## SHORT AND LONG TERM GOALS

When setting goals it may be necessary to set these in stages to help motivate the client. Goals can be broken into long, medium and short term. The length of these varies according to the time available.

| Goal Type | |
|---|---|
| Short term goals<br>Or Micro-cycle | These goals are set over a short period varying from 1 session to 1 month depending on the total length of time available. |
| Medium term goals<br>Or Meso-cycle | These goals can vary from one month to 6 months depending on the total time available. |
| Long term goals<br>Or Macro-cycle | The length of these can be from 6 to 12 months or in line with sporting seasonal variations. |

**Table 2.3** shows definitions of short, mid and long term goal setting

## SMART GOAL REVIEW

Reviewing progress towards a goal is one of the key parts of a training programme. One of the best ways of ensuring the client is on track is by carrying out a variety of fitness tests. These will look at previous measurable data and then compare the client's current fitness levels. There are numerous measurements that can be recorded and a variety of tests that can be used, run times, strength tests and body composition to name a few.

A second means to goal reviewing is to look at motivation and adherence; this could include regular participation in exercise or healthy eating. This method of goal reviewing looks at small components of long term change. You could ask your clients to keep a diary to display this information.

The review timings will depend on the short, medium and long term goals. It is advisable not to measure too regularly as you need to allow time for training adaptations to take place, once a month for many clients would be suitable. Fitness testing days add huge motivation and targets for your clients to work towards and help to keep them on track.

For example with the weight loss goal, previously used (under SMART goal setting), as an instructor you would use the measurable section to review the goal, at time frames set for short, mid and long term reviews i.e. 4 weeks, 3 months and 6 months.

In this example the instructor would retake measurements through weighing on scales and skin fold tests to measure body fat percentage. The new results can then be recorded and compared to previous SMART goals, making changes and adaptations which are agreed between trainer and client as necessary.

## WAYS TO INCREASE MOTIVATION

It is important that clients understand they have personal responsibility for reaching their desired goals, as a fitness programme is often a lifestyle change. Clients will need to ensure their nutritional intake is as it should be, their training sessions (when alone) are still at the correct intensity and that they are fully committed to reaching their goals. The instructor should make this clear at the start of it and explain to the client that they have overall responsibility on the success of the programme. As a fitness professional there are many tools you can use to increase a client's motivation if required, these include:

**A Diary** – ask the client to complete a diary for both training and food intake, this can be used to show progression and help motivate as it shows clear change.

**Trainer Support** – as a professional you should be able to give continual advice and training support as the client needs it. Giving basic nutritional advice may be a part of this once the client understands training principles.

**Client Folder** – use an individual folder for each client and offer them copies of all paper work so they are able to see goal and training progressions.

**Reminders** – use of social networking sites, calls or texts to continually remind clients of forthcoming sessions, targets and weigh-ins.

**Goal reviews** – set regular dates to re-do all relevant fitness tests, giving you the opportunity to review progress and update goals.

**Rewards/incentives** – there are numerous rewards that you can give to your client, for some, achieving their goal is enough. For others tangible products are more motivational, such items could include drinks bottles, gym towels, bags, t-shirts and cheap gym equipment. If branded, these could also be used to help promote your services and company.



# CUSTOMER SERVICE

## CLIENT CARE AND CUSTOMER SERVICE

**Client Care** – is about building and establishing good relationships with all clients and members, ensuring the systems and procedures are in place to support their needs and expectations, such as complaint handling, data collection and needs analysis.

**Customer Service** – is about creating a relationship of trust and loyalty with customers, along with the ability to meet your customer's needs, wants and expectations.

Customers, and in the instructors case clients, are essential to any organisation and by using the methods looked at previously in this unit (creating effective relationships, using effective communication and helping to overcome client barriers) all assists in retaining clients and improving customer satisfaction.

### Types of Customer

**Internal** – These people work within the organisation and rely on the work you do to complete their own tasks.

- Colleagues
- Employers/Employees
- Team members

**External** – These people are external and buy goods or services from your organisation.

> ***"Customer service is a series of activities designed to enhance the level of customer satisfaction – that is, the feeling that a product or service has met the customer expectation.*** Turban et al. (2002)

## AN EXAMPLE OF GOOD CUSTOMER SERVICE

***Ryan Air received less than 1 complaint per 1,000 passengers in January 2012. It answered 99% of complaints within 7 business days.***

## CUSTOMER SERVICE FACTS

**86%**

of consumers will pay more for a better customer experience. (Right Now Customer Experience Impact Report 2011)

**89%**

of consumers began doing business with a competitor following a poor customer experience. (Right Now Customer Experience Impact Report 2011)

**24%**

of consumers who had unsatisfactory service interactions shared their experiences through social networks in 2010, a 50% increase over 2009. (Forrester Technographics Customer Experience Online Survey)

## DEALING WITH CLIENTS NEEDS

Dealing with clients' needs is a vital part of every business, this will help grow the business and profitability whilst promoting long term health change within the fitness environment. Customer service starts from the moment the client walks into the club. As a fitness professional you should have a lot of face to face contact time with the customers in the fitness environment, therefore ensuring you give the best client care is essential. No matter how big or small the need is, the organisation should be able to help the customer. Remember the customer is always right as they are the livelihood of the business.

If you are unable to source relevant information or assist in meeting the clients' needs you will need to source additional help. It may be necessary to contact the:

- Gym manager if the client has issues with the gym facilities
- Group exercise co-ordinator if the client has class based problems'
- Maintenance manager if there is a technical problem with the facilities
- If the client has dietary concerns referral to a dietician may be appropriate. If there are injury concerns referral to a physiotherapist may be necessary

When dealing with clients' needs it is important to communicate them as to when their needs are likely to be met. If there is going to be a delay this must be explained to ensure the client knows they are being dealt with in a professional manner. If the delay is not explained to the client, they may feel that their needs are not valued by your organisation, which in turn can lead to bad publicity, termination of contracts and poor company reputation, leading to loss of customers.

## THE SERVICE PROFIT CHAIN

In its simplest form, the service profit chain is about developing a working environment, in which carefully selected, highly capable, engaged employees interact with customers to create customer value far superior to that offered by the competition (James L. Heskett, W. Earl Sasser, Joe Wheeler 2010). In a highly competitive environment fitness facilities must ensure that all staff are working towards providing the best possible customer service to retain and attract customers! Below shows the service profit chain cycle:



## THE GUEST METHOD OF CUSTOMER SERVICE

# GUEST



G – Greet the customer

U – Understand the needs of the customer (clients goals and training needs)

E – Explain the features and benefits (explain the training prescribed and its benefits toward goals)

S – Suggest additional items available (Suggest other training methods, exercises or group exercise)

T – Thank the customer

## CLIENT EXPECTATIONS

- To be treated with courtesy and respect
- To receive service from knowledgeable, competent and co-operative staff
- To receive value for money
- To ask questions when they don't understand

## EXCEEDING EXPECTATIONS

It is important that every member feels valued!

As a fitness professional you should be aiming to go above and beyond (going the extra mile!). One of the key ways to exceed expectation is to handle complaints in a swift and effective manner. Other ways to exceed client expectations are:

- Giving current clients access to offers and deals available to new members
- Communicating in a professional way, calls, emails or texts to ensure everything is on track with the programme
- Offer incentives/gifts if goals are achieved throughout the programme
- Using effective communication
- Developing effective relationships
- By assisting customers and client to overcome and address barriers and concerns
- GO THE EXTRA MILE!!

## CLIENT COMPLAINTS

Client complaints are opportunities... Not problems!

96 percent of dissatisfied customers never bother to complain (Le Boeuff), it is therefore vital that once a complaint is received it is dealt with in the correct manner. This will lead to rapport building and better customer satisfaction!

## DEALING WITH CLIENT COMPLAINTS

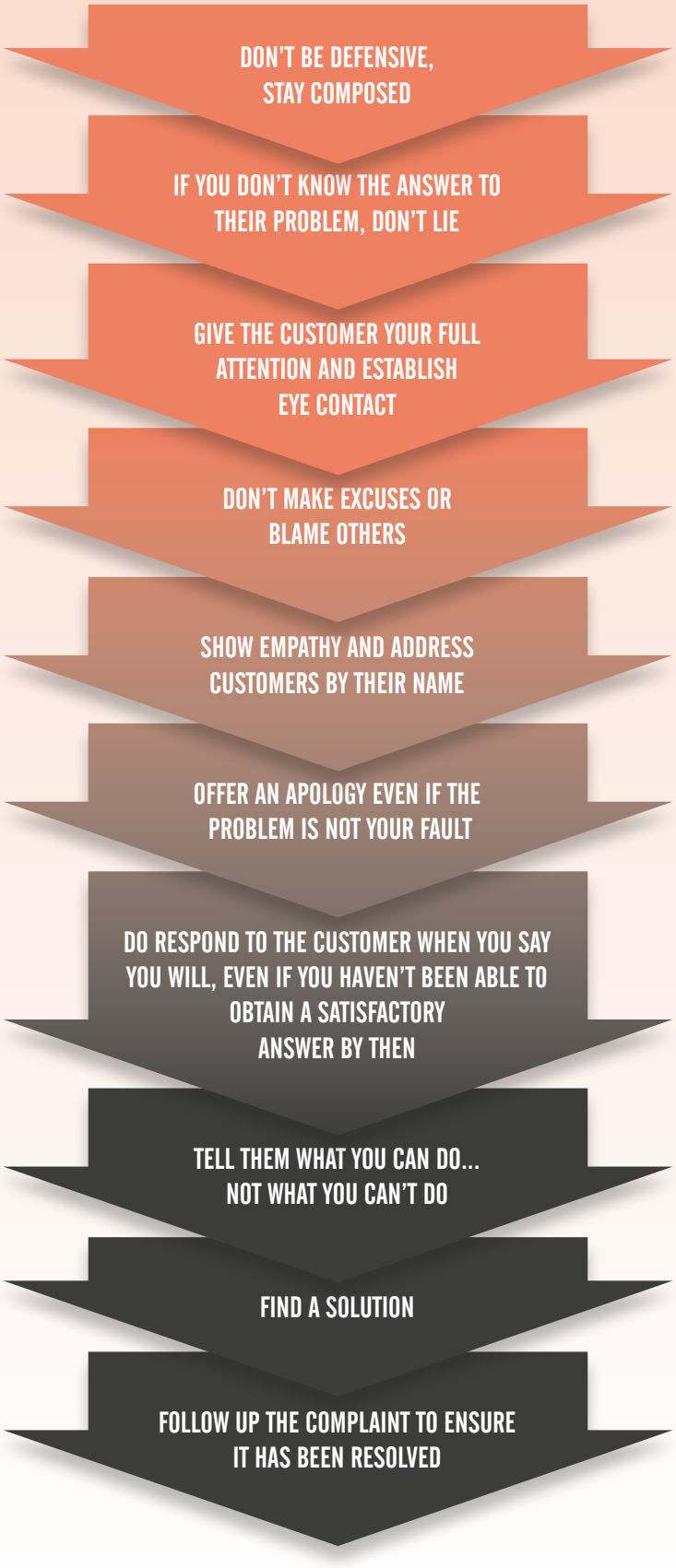



**Table 2.4** shows a flow diagram on complaint handling

# KNOW HOW TO SUPPORT CLIENTS WHO TAKE IN EXERCISE & PHYSICAL ACTIVITY SUMMARY OUTCOMES

## CAN YOU NOW...

- Form effective working relationships with clients? ☐
- Address and overcome barriers to physical exercise and activity promoting motivation and exercise adherence? ☐
- Apply the principles of customer service to clients? ☐



UNIT 3

# HEALTH, SAFETY & WELFARE IN A FITNESS ENVIRONMENT

**By the end of this unit you will be able to...**

Understand the emergency procedures within a fitness environment

Outline the health and safety requirements in a fitness environment

Know how to control risks within a fitness environment

Safeguard children and vulnerable adults in a fitness environment

# TYPES OF EMERGENCY

There are many types of emergency that can occur within the fitness environment. It is highly likely that as a fitness professional you will encounter an emergency situation. Covering this topic is an essential aspect of staff induction and training. An emergency action plan outlines how to deal with emergencies. Staff will need to be trained to deal with accidents and emergencies. There are 5 main types of emergency you may come across:

**Fires**

**Accidents**

**Medical emergency**

**Chemical Spill**

**Bomb threat**

Even if you take precautions to avoid incidents and accidents, there is potential for countless accidents within the fitness environment. Some more common than others, but as an instructor you need to be aware of these potential hazards and the emergency procedures to follow if a situation arises. A risk assessment should be carried out which will attempt to minimise the likelihood of an accident.

## EMERGENCY ACTION PLAN

An emergency action plan (EAP) is a written document that an organisation is required to have and display within the workplace. This document should detail step-by-step procedures to follow in emergencies such as fire, chemical spill, or a major accident. An emergency action plan also includes information as to who to notify, roles of individuals and location of emergency equipment.

Regular staff training, first aid and evacuation days are held to ensure all staff members are competent in their particular duties in the different events that can occur.

For example your role could include:

1 2 3 4

1. Responsibility for evacuation of a specific area
2. Ensuring roll calls are undertaken to identify missing persons
3. Communication of missing persons to central emergency service
4. Administering First Aid

## AS AN INSTRUCTOR YOU SHOULD KNOW

- The exact location of the venue to ensure you can give precise details of the venue's location and access points, in case you need to call for emergency assistance
- The location of the nearest telephone and how to dial out
- The availability/location of first aid facilities/appropriately stocked first aid kit and how to access them
- Who the on-site first-aider is and how to contact them
- Building evacuation plan, including how to exit in an emergency, safe routes to assembly points, location of emergency exits, fire assembly points, and the ability to conduct a roll call in the case of an evacuation
- Procedures for dealing with missing persons
- The system for recording and reporting all incidents, including what information will be recorded, who the incident should be reported to and when the report should be made

## WHEN MANAGING ACCIDENTS AND INJURIES REMEMBER

- Remain calm, walk to the scene if possible
- Evaluate the situation while approaching it
- Maintain your own safety at all times
- Protect the casualty and/or other people from further risk
- Record the details of the incident and your management of the situation, as soon as possible after the accident (accident or incident report form)
- It is important to act calm and follow procedures correctly. This will enable all the steps of the emergency action plan to be completed, ensuring the best possible outcome.



## ROLES OF VARIOUS STAFF DURING AN EMERGENCY

### General Manager

The general manager will have overall responsibility of the facility on a day to day basis. All accident and emergency procedures should be put in place and enforced by the general manager. Any incidents or accidents that arise should be reported to them. They should ensure that procedures are being followed and are responsible for evaluating and reviewing the emergency procedures on a regular basis.

### Duty Manager

Duty managers are the facilities shift managers. They will deal with day to day management issues i.e. customer complaints, operations and staffing issues. The duty manager will usually be the person who will oversee procedures during an emergency situation, dealing with the customers, following EAP and reporting the incident.

### First Aid Personnel

In all facilities it is a requirement to have qualified first aid staff in the building and on every shift to deal with any incidents or accidents that may occur. There are different first aid qualifications that allow certain first aid procedures to be performed, for example:

**Emergency responder**

**First aid at work**

**Defibrillator**

**Resuscitation**

A list of the qualified staff and their contact details should be readily available in the facility. During an emergency or accident situation it will be their responsibility to administer first aid, and possibly stay with the patient until further help from the emergency services arrive to update them. If staff are not suitably qualified then they should pass responsibility on to a qualified first aider.

## ROLES OF EMERGENCY SERVICES

During an emergency, specialist help is outsourced to the relevant service depending on the incident. A brief description of their roles is outlined below:

**Police**
Providing community safety and acting to reduce crime to persons and property.

**Fire and Rescue Service**
Reduce the risk of fire and other emergencies in all communities through a combination of prevention and protection, working in partnership with other service providers.

**Emergency Medical Service**
Providing ambulances and medical staff to deal with medical emergencies.

# MAINTAINING THE SAFETY OF SPECIAL POPULATIONS

It is important that all employers and organisations providing services to the public take responsibility for everyone that uses their services and facilities. If they do not make provisions or have suitable procedures in place for the safe evacuation of special populations, then this can be viewed as discrimination. Organisations therefore have to identify the needs of special population groups, such as children, older adults and disabled people, when putting together emergency action plans (EAP's) and evacuation procedures for their facility in the event of an emergency situation. These procedures and special arrangements need to be passed on to the relevant staff, through training and by practicing regularly to ensure everyone is fully aware of their roles and responsibilities in maintaining the safety of these groups.

## MAINTAINING THE SAFETY OF CHILDREN

In emergencies it is common to see changes in a child's behaviour, as they may become distressed. By preparing for emergency situations this change in behaviour can be minimised. Children express their feelings in different ways and it is important that the instructor does not trivialise the situation. You should remain calm and positive to avoid this and tell them in simple terms what is happening and what needs to be done.

Children become dependent on adults in times of distress and worry, so it is important the message they receive is that they are not alone and that you will help them. For example, by practising fire drills and buddying children up and allocating them an adult or member of staff to stay with them whilst they evacuate the building.



## MAINTAINING THE SAFETY OF DISABLED PARTICIPANTS

The procedure of evacuating disabled participants will need to be specific to the disability of the group. It is important that when preparing or planning for procedures for a group, the number of disabled participants, the location of facilities or activities and the characteristics of the building are all taken into account as evacuation of these groups shouldn't rely solely on the intervention of the fire and rescue services. The access and appropriateness of the facility needs to be identified for safe evacuation in an emergency, by identifying evacuation routes and equipment that may need to be used i.e. If a wheelchair user is on a first floor when there is a fire evacuation, lifts cannot be used so the availability of staff and evacuation-chairs for wheelchair users will need to be considered.

As this group covers a variety of sub groups, staff may be trained in different roles and responsibilities from guiding visually impaired participants to safely transporting mobility impaired participants. Because of this diversity, training and practicing of these procedures is a must and should be regularly undertaken by organisations and employees.

## MAINTAINING THE SAFETY OF OLDER ADULTS

In planning and evacuating older adults the principles are similar to disability groups, especially if there are mobility issues. With the recent push on leading active lifestyles and the population generally living longer, the amount of older adults exercising has increased over recent years.

As unit 1.7 identified ageing is associated with a gradual deterioration of both physiological and psychological functions, so assistance and 'buddying up' maybe required ensuring a safe evacuation.

Again, this will be planned and prepared for in terms of looking at locations and access when putting on activities for older adults, to ensure safe and effective evacuation in an emergency situation.



# HEALTH AND SAFETY

Health and Safety is important in all environments to ensure workers and customers are protected from harm as far as reasonably practical.

## HEALTH AND SAFETY AT WORK

**The Health and Safety at Work Act 1974** is the primary piece of legislation covering work-related health and safety in the United Kingdom.

The Health and Safety Executive (HSE) is responsible for enforcing health and safety at work.

## EMPLOYER'S RESPONSIBILITIES

Employers must ensure the constant maintenance of health, safety and welfare of employees. Employers must:

- Provide and maintain equipment
- Deal with substances, such as chemicals, safely
- Provide information, instruction, training and supervision
- Maintain safe and healthy workplaces with the necessary facilities
- Provide a Health and Safety Policy Statement when employing five or more people
- Ensure that visitors and members of the public are not put at unnecessary risk

## EMPLOYEE'S RESPONSIBILITIES

Employees also have legal responsibilities, they must:

- Take care of their own health and safety at work
- Take care of the health and safety of others
- Co-operate with their employer
- Not misuse or interfere with anything provided for health and safety purposes

## ADDITIONAL REGULATIONS A FITNESS PROFESSIONAL NEEDS TO KNOW

### COSHH

**Control of Substances Hazardous to Health Regulations 2002**

COSHH is a law that requires employers to control substances that are hazardous to health. They will need to:

- Carry out a risk assessment
- Provide control measures and ensure these are used and are in good working order
- Provide information, instruction and training for employees and others
- Plan for emergencies

COSHH covers substances that are hazardous to health, for example; chemicals, fumes, dusts, vapours and mists.





## RIDDOR

**Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995**

RIDDOR is the law that requires employers and anyone else with responsibility for health and safety within a workplace, to report and keep records of:

- Work-related deaths
- Serious injuries
- Cases of diagnosed industrial disease
- Certain 'dangerous occurrences' (near miss accidents)

RIDDOR puts duties on employers, the self-employed and people in control of work premises (the Responsible Person) to report serious workplace accidents, occupational diseases and specified dangerous occurrences (near misses). The law changed on 6 April 2012 to state that if a worker sustains an occupational injury resulting from an accident, their injury should be reported if they are incapacitated for more than seven days.



## PPE

**(Personal Protective Equipment at Work Regulations 1992)**

PPE law requires personal protective equipment to be supplied and used at work wherever there are risks to health and safety that cannot be adequately controlled in other ways. The Regulations also require that PPE:

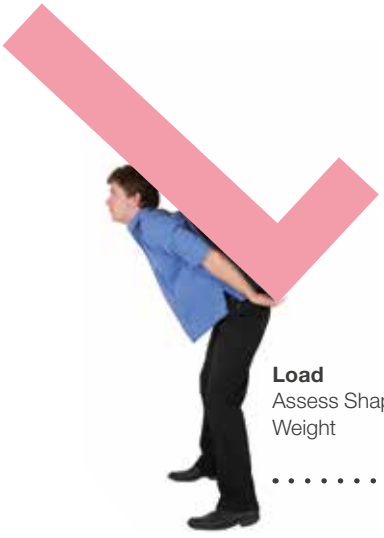
- Is properly assessed before use to ensure it is suitable
- Is maintained and stored properly
- Is provided with instructions on how to use it safely
- Is used correctly by employees

## Manual Handling

**(Operations Regulations 1992)**

This law looks at and includes injuries from lifting, pushing, pulling, carrying and putting down an object.

Safe manual handling is not simply determined by the weight being handled. Items that need to be assessed include:



I T E

**Load**
Assess Shape / Weight

**Individual capability**
Age / Strength

**Task**
Duration / Frequency

**Environment**
Confined spaces / Steps

Ideally avoid all heavy and awkward manual handling. Providing manual handling training is essential, but will not eliminate potential risks alone.

There are additional ways in which to reduce the risk:

- Change the **load**
- Change the **work area** to make handling safer
- Provide manual handling **aids** to handle the load where applicable. e.g. weight trolleys

## DUTY OF CARE AND PROFESSIONAL ROLE BOUNDARIES IN RELATION TO SPECIAL POPULATIONS

Duty of care is the obligation to exercise a reasonable level of care towards an individual, to avoid injury to that individual or his/her property.

Duty of care is said to be greater when working with vulnerable adults. A vulnerable adult is defined by the UK government as "a person aged 18 years or over, who is in receipt of or may be in need of community care services by reason of 'mental or other disability, age or illness and who is or may be unable to take care of him or herself, or unable to protect him or herself against significant harm or exploitation."

Instructors have a duty of care to vulnerable clients and any client undergoing a 'special' physiological lifespan process that puts them at greater risk, these include:

- Children
- Older Adults
- Pre/Post Natal
- Disabilities

Many Instructors do not have a specialised qualification in working with special populations. Working with special population groups when not qualified can put the client at risk. Instructors can offer basic advice as qualified but should inform clients they don't specialise in this field. There are many advanced level 3 and 4 qualifications which once qualified will allow an instructor to:

- Market as a specialist instructor in the area
- Instruct special population clients 1:1
- Plan a progressive, long-term special populations physical activity programme



## FITNESS INSTRUCTORS DUTY OF CARE

Below are some key things a fitness professional is able to do to ensure a safer working environment:

| Exercise Risk | Exercise Precautions |
|---|---|
| **Medical Status** | Avoid any exercises that could aggravate the condition, for example, avoid isometric exercises if the client has high blood pressure |
| **Past Surgery** | A PAR-Q should highlight past surgeries and when these occurred, ensure the exercise prescribed does not put these at risk, For example, avoid plyometric exercises and deep squats with an ACL knee reconstruction |
| **Current Injuries** | The PAR-Q should again highlight these. The instructor will need to adapt the exercise choice to ensure the injury is not exacerbated. For example, if the client has an ankle injury avoid weight bearing exercise. A recumbent bike may be more suitable than a treadmill |
| **Weight/ Resistance** | To perform exercises with a high weight, the instructor must be sure the client has the correct technique/flexibility to enable safe form. For example, the clean and press, if too much weight is added poor form can result, thus increasing the risk of injury |
| **Speed of Movement** | The quicker an exercise speed the more technique awareness and skill required. A beginner will find the co-ordination of fast movement hard which in turn can increase the risk of injury. For example, weighted ladder work at speed should only be completed by experienced gym users |
| **Proprioception** | There are many activities that require greater proprioception. For example, TRX, VIPR and kettlebell work. For novices, these pose a great challenge as they require greater body awareness and technique and if performed incorrectly could result in a high injury risk |
| **Nutrition** | Correct pre exercise nutrition is essential, as low blood sugar levels (hypoglycemia) could occur if a client was to train early morning and missed breakfast |

**Table 3.1** outlines the instructor's duty of care responsibilities

## KEY INDIVIDUALS RESPONSIBLE FOR HEALTH AND SAFETY IN THE FITNESS ENVIRONMENT

In the health and fitness environment there are various people and job roles that are responsible for maintaining and ensuring health and safety.

| Role | Responsibility |
|---|---|
| **General Manager (GM)** | Has responsibility for the facility and ensuring that policies and procedures are in place and being followed |
| **Duty Manager (DM)** | Will have overall responsibility in the absence of the general manager during shifts, ensuring health and safety is maintained |
| **First Aid at Work Qualified Staff** | Deliver first aid within their limitations and competence |
| **Defibrillator Qualified Staff** | Normally are first aid trained as well as qualified to use a defibrillator within their limitations and competence |
| **All Staff** | Have a responsibility to adhere to and implement all health and safety procedures relevant to their job role and the members of the public using the facility |
| **Health & Safety Officer** | They have responsibility for all health and safety matters, including risk assessments and putting together health and safety policies and procedures (sometimes this is done by DM's and GM's) |

**Table 3.2** outlines the key individuals in relation to health and safety in the workplace

# SECURITY PROCEDURES WITHIN THE FITNESS ENVIRONMENT

## TYPES OF SECURITY PROCEDURES

In the fitness environment there are a variety of security procedures in place to help protect participants and staff.

### External Security Systems

It is not all about the security of participants whilst within a facility, but also a responsibility of a facility to monitor the outside of a building. The majority of health clubs and fitness centres will have car parking, driveway and walkway access. Facilities will consider the security systems they put in place for these areas.

### Video Monitoring System (CCTV)

It is good practice to have a video monitoring system external to the facility, to record and act as a deterant to criminal damage and unauthorised access. Typically, facilities will have cameras monitoring doors i.e. main entrance/fire escapes, as well as on car park entrances, footpath gates or within the car park. The monitors should be behind reception, in a security or managers office for monitoring or recording purposes.

### Security Lighting

Sufficient lighting should be in place, whether set up on motion sensors or on a timer, especially for car parks, driveways and secluded exits/entrances. This acts as a deterant but also to ensure health and safety to avoid trips, slips and falls, as a majority of leisure facilities and health clubs are open late night or early in the morning.

### Security Signage and Stickers

These should be located on signs around the car parks, and placed on doors and windows. This acts as a deterant and sends out a clear warning that security procedures are in place and have been activated.

### Internal Security Systems/Alarms

Intruder alarms are fitted to protect against breaking and entering into facilities, generally out of hours. Normally these are linked to a manned control centre or security firm to raise the alarm. There should be sensors located throughout the facility to alert a forced entrance or break in.

### Barrier/Access Control

To protect staff, participants and property, most facilities have some kind of entrance control at reception of a health club or leisure facility. This could be swipe card access or as simple as coded locks on entrance doors. The size of the facility will normally dictate the type of entrance, either manned by a receptionist or swipe card barriers.

All staff should have panic/personal alarms and/or communication devices such as walkie talkies or phones, so the alarm can be raised if any security issues arise. Staff should also have regular training updates and evaluation of the security procedures that are in place at the facility.

The level of the security will vary site to site, and may depend on the environment. Investing in security procedures and deterants in crime is worth the expense and effort made.



# KEY HEALTH AND SAFETY DOCUMENTS WITHIN THE FITNESS ENVIRONMENT

## PAR-Q FORM (PHYSICAL ACTIVITY READINESS QUESTIONNAIRE)

The physical activity readiness questionnaire (PAR-Q) was created by The Canadian Society for Exercise Physiology and is a self-screening tool that can be used by anyone who is planning to start an exercise programme. It should draw attention to any potential risks for the client when exercising and should highlight when exercise is appropriate or highlight those who should seek medical advice before commencing an exercise programme.

A PAR-Q form is a yes and no questionnaire that is completed prior to exercise. This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if the client's condition changes (if they answered YES to any of the seven questions).

A written PAR-Q form should be completed by everyone that enrols onto an exercise programme. A verbal PAR-Q should be completed prior to every session even if a written form has already been completed. An example PAR-Q is outlined below:



| | | | |
|---|---|---|---|
| 1. | Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor? | Yes | No |
| 2. | Do you feel pain in your chest when you do physical activity? | Yes | No |
| 3. | In the past month, have you had chest pain when you were not doing physical activity? | Yes | No |
| 4. | Do you lose your balance because of dizziness or do you ever lose consciousness? | Yes | No |
| 5. | Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity? | Yes | No |
| 6. | Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart conditions? | Yes | No |
| 7. | Do you know of any other reason why you should not do physical activity? | Yes | No |

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity programme or a fitness appraisal, this section may be used for legal or administrative purposes.

**I have read, understood and completed this questionnaire.**
**Any questions I had were answered to my full satisfaction.**

Name .....

Signature ..... Date .....

Signature of Parent/ Guardian ..... Witness .....

**If you answered YES to one or more questions:**

Talk with your doctor by phone or in person **BEFORE** you start becoming much more physically active or **BEFORE** you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered **YES** to.

- You may be able to do any activity you want as long as you start slowly and build up gradually
- You may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.

**If you answered NO to all questions:**

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- Start becoming much more physically active – begin slowly and build up gradually
- Take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively

## INFORMED CONSENT

Another important process in exercise screening is the informed consent. This consent document is so that the client agrees to participate in the exercises prescribed and that they fully understand what is going to happen. Informed consent should include:

- The purpose of the consent form
- The degree of exercise supervision
- The benefits and risks of exercise participation
- The responsibilities of the client
- A statement covering confidentiality and freedom of consent to participate in the programme

## HEALTH COMMITMENT STATEMENT (HCS)

The Health Commitment Statement sets the standards that health & fitness centres and users can reasonably expect from each other in regards to the health of the user.

## BACKGROUND

The HCS is the evolution of the PARQ, which has existed for the past 15 years. The HCS reflects government policy and legal trends, which aims to shift responsibility for personal health from the operator to the user. The Fitness Industry Association is taking the lead in allowing operators to be more accessible while facilitating a better working relationship between fitness and medical sectors in the community.

This has also provided an opportunity to align the HCS to the skills and expertise of fitness professionals established through REP's.

The HCS has been developed by Fitness Industry operators, medico-legal professionals and health providers to support the evolving requirements of users and operators.

## HCS PURPOSE

- Develop the current PAR-Q to simplify access to activity facilities for users
- Assist the Health, Medical and Fitness industries to work in harmony while supporting initiatives to encourage the nation to become more active
- Bring health and fitness clubs in line with virtually all other sports and active leisure facilities in relation to health matters
- Demonstrate respect for members by placing responsibility where it belongs, with the individual member
- Be consistent with current Government policies in encouraging every individual to take responsibility for his or her own health
- Offer the opportunity to clubs to maximise their membership
- Be in keeping with current trends in legislation and case law
- Be consistent with a more modern approach to individual responsibility in medicine and the law
- Provide the opportunity for a uniform approach across the health and fitness industry, producing greater clarity and reducing costs
- Offer a simple solution which is accessible to fitness instructors, staff and members
- Remove stress and anxiety from staff in relation to health of members



# OTHER DOCUMENTS RELEVANT TO THE FITNESS ENVIRONMENT AND INSTRUCTOR

## FIRST AID BOOK

This contains topics covered on the first aid courses such as how to deal with incidents and accidents such as asthma, bleeds, burns, choking, broken bones and a variety of other common first aid incidents.

## ACCIDENT REPORT FORMS/BOOK

This is a requirement under UK legislation, so organisations have to keep an accident book and/or accident reporting forms. These have to be completed whether an incident/accident actually occurs or a near miss happens.

It is a way of recording accident/incident information and will be part of the organisations policies of accident and incident handling. It is a legal requirement that any workplace must keep records of a reportable injury, disease or dangerous occurrence. When reporting an incident, you need to update the accident book/form with the following details:

- Date and method of the reporting
- Date, time and place of the incident
- Personal details of all persons involved i.e. casualty, member of staff, witnesses
- A description of the event and the outcome i.e. type of first aid administered, were the emergency services contacted etc.
- Signed and dated, stored safely and following data protection act

# CONTROLLING HAZARDS

### Risks

A risk is the chance, high or low, that any hazard will actually cause somebody harm.

### Hazards

A hazard is something that can cause harm.

Within the health and fitness environment there are a variety of hazards which you may come across, and can be categorised into the following:

- Facilities – wet floor in the showers/pool side
- Equipment – frayed cables (resistance machines/cable cross over), worn treadmill belts
- Working Practices – manual handling/lifting, gym induction
- Client Behaviour – misuse of equipment, unsafe behaviour i.e. running on poolside
- Security – signing in, signing out, membership cards, CCTV
- Hygiene – cleaning i.e. shower areas, sweat on machines, pool chlorine

# RISK ASSESSMENTS

A risk assessment is an important document which helps protect both workers and customers in the workplace.

A risk assessment is an examination of what can cause harm and the likelihood of an accident occurring in the workplace. From this assessment suitable precautions can be introduced and monitored to ensure a safe environment that is 'reasonably practicable'.

Within the fitness environment there are many hazards. All of the equipment poses its own hazard. However, when joining the gym an induction should be carried out to reduce these to a certain extent. A risk assessment should be completed on all equipment and all classes to ensure best practices.

**Below is a basic way of completing a risk assessment with 5 steps:**

## 1. IDENTIFY THE HAZARDS

- Walk around your workplace and look at what could reasonably be expected to cause harm
- Ask your colleagues if they have noticed anything that could cause problems
- Check manufacturers' instructions for possible technical hazards
- Check accident report to identify the hazards that have caused harm previously

## 2. DECIDE WHO MIGHT BE HARMED AND HOW

For each hazard you need to be clear about who might be harmed and how. This will help you identify the best way of managing the risk.

## 3. EVALUATE THE RISKS AND DECIDE ON PRECAUTION

Having spotted the hazards, you then have to decide what method to choose to reduce the risk of injury. The law requires you to do everything 'reasonably practicable' to protect people from harm.

## 4. RECORD YOUR FINDINGS AND IMPLEMENT THEM

Record what you have decided to do to control the risks from the previous steps, and implement the changes.

## 5. REVIEW YOUR ASSESSMENT AND UPDATE IF NECESSARY

Constant reviews and modifications to the risk assessment need to be carried out to include:

- Whether there have been any changes
- Are there improvements you still need to make
- Have your colleagues spotted a potential problem
- Evaluate accident report forms and RIDDOR forms

## A BASIC RISK ASSESSMENT FORMAT

Risk assessments can be rated according to the risk severity and the likelihood of it occurring. The risk is rated using a numbered system from 1 to 5 (with 5 being the most severe and likely and 1 being the least severe and unlikely).

The two numbers are then multiplied together to give a risk rating. Depending on the result, action may need to be taken.

| | Likelyhood | | Severity of injury/ disease | Risk |
|---|---|---|---|---|
| 5 | 50% (likely) | 5 | Death | **11-25 Danger** HIGH (Stop) |
| 4 | 25% | 4 | Major Injury/Disease | **3-10 Tolerable** MEDIUM (Maintain controls) |
| 3 | 10% | 3 | Off work for >3 days | **1-2 Acceptable** LOW (No further action) |
| 2 | 5% (possible) | 2 | First Aid – back to work | |
| 1 | 2% (unlikely) | 1 | Minor injury/Near miss | |

**Table 3.3** shows a ranking system regarding risk assessment in the workplace

If a score of greater than 11 is recorded the associated risk is considered to be high. High risk situations need immediate action. If on the other hand the score falls between 3 and 10 the risk is said to be moderate and risk controls must be maintained.

## CONTROL MEASURES

All of the risks that are identified need to have control measures in place to reduce the chances (likelihood) of them happening. The higher the severity means the more control measures would be required.

For example, hygiene in the gym is controlled firstly by users using paper towels and spray provided to wipe down equipment after use and secondly by the gym manager having a structured cleaning rota in place. This ensures the risk to user's health is minimised.

If the risk cannot be viably controlled then the activity or risk must be removed. For example, a frayed cable on a lat pulldown machine would be put out of use until repaired, as the likelihood of injury is high.



## WHO TO CONTACT

If there are hazards or risks that you cannot control as they are out of your competency as a fitness professional, you should be referring them to one of the following people:

**Fitness Manager**
In overall charge of the fitness environment, including equipment and surroundings.

**Duty Manager**
In charge of the leisure facility when on shift, including first aid and staff.

**General Manager**
Has overall say in emergency and normal operating procedures as well as the day to day logistics of the facility.

**Maintenance Manager**
Is in charge of repairing and maintaining the facility, may be involved in implementing items to reduce risks.

**Security Manager**
Is in charge of the security within the environment.

# SAFEGUARDING INTRODUCTION

All children and vulnerable adults have the right to protection from all forms of abuse and neglect, and every employee has a responsibility to protect children and vulnerable adults from abuse and harm wherever possible, whilst protecting themselves from allegations of abuse

## SAFEGUARDING CHILDREN

People who work with children and young people in a leisure, sports or fitness setting on a regular basis are able to help in identifying those who have been, or are at risk of, being harmed. Staff who work with children have a responsibility to:

- Review their practice to ensure they are adhering to codes of conduct
- Be able to recognise the signs, symptoms and indicators of abuse and the impact this has on children
- Identify their own feelings towards child abuse and how it may impact on them if they respond
- Deal and respond in the correct way to a child who discloses information to them
- Follow the correct procedures and action if concerns are raised

The government has set up 2 bodies to help employers make informed decisions about the staff they recruit when working with children and young people. It makes it easier and quicker for employers to access the criminal backgrounds of applicants. These bodies are:

- Criminal Records Unit (CRB)
- Disclosure Scotland and the Wales Council for Voluntary Action Criminal Records Unit (CRU)

The employer is able to use the disclosure to identify whether an applicant has a recorded background that might make them unstable for the position or job vacancy. Most sports and leisure facilities have a requirement for disclosers to be completed by all staff and in particular those who are in contact with children or young people. They will also update these discloser records yearly or bi-yearly.

The checks provided can be completed in different levels (standard or enhanced disclosure), which include:

- All convictions, reprimands or formal warnings held on the police database
- Information from the Protection of Children Act list
- Information held by the department for education and skills (DfES) that are considered unsuitable for, and banned from, working with children

If an employer knowingly appoints a person who is banned from working with children or young adults they are committing a criminal offence, as is the applicant.

## ROLES AND RESPONSIBILITIES OF AN INSTRUCTOR WHEN WORKING WITH CHILDREN

When working with young people and children, it is essential that a culture of honesty, integrity and competence exists. This means:

- Understanding and acting upon individuals' responsibilities
- Recognising the need to protect the rights of participation, for fun, enjoyment and achievement for all
- Reporting any suspected abuse to the child protection officer or manager

There are also some essential factors when working with children that you should be promoting and displaying:

- **Acting as a role model** – children will emulate and copy behaviour they witness, so by setting a good example, using correct language and being positive will encourage good behaviour from children
- **Adopting best practice** – this is as simple as wearing correct uniform so you are easily identifiable and professional, not only to those in your care but also to parents and guardians. Name badges should also be worn in addition to uniform for identification purposes
- **Demonstrating safeguarding behaviour at all times** – following codes of practice, policies or procedures

When working with vulnerable adults and special population groups it is important to display a duty of care and work within your limitations. As a Level 2 instructor you have a basic knowledge in working with special population groups and young people, so you need to make your clients aware of this. If you are working with these groups regularly you may need to obtain the relevant qualifications to work with them. For example, health related exercise for children or pre-post natal.

As an instructor you need to be aware of the limitations of working with vulnerable adults, young people and special population groups. You should only be working within your skill remit, delivering what you are qualified to do and informing your clients of this.

## TYPES OF ABUSE

Even for experienced child care staff it is not easy to recognise situations of abuse. As instructors you will not be experts but need to be aware of the signs and symptoms of possible abuse. The term child abuse describes the ways in which children may be harmed. Child abuse can affect children both mentally and physically, and effect their behaviour and development. Abuse can vary widely, there are 5 main categories:

**Physical** – this is when physical harm/injury is sustained by an individual

**Emotional** – this is when the individual is emotionally affected, this could be through threats of making the individual feel worthless

**Sexual** – this is when the individual is used to fill the abusers sexual needs

**Neglect** – this occurs when the individual is subject to depravation of basic needs

**Bullying/Harassment** – this is deliberate hurtful behaviour which can be verbal, physical or written

## SIGNS AND SYMPTOMS OF ABUSE

| Physical | Emotional | Sexual | Neglect | Bullying/ Harassment |
|---|---|---|---|---|
| Hitting/shaking | Shouting, taunting or threatening | Inappropriate touching | Failing to provide shelter, food, clothing | Name calling/racist taunts |
| Scalding or burning | Making them feel frightened | Sexual intercourse | Giving inappropriate medical care | Being ignored |
| Causing physical harm | Making them feel worthless/unvalued | Involving children in or showing pornographic material | Refusing attention | Physical assaults |
| **Indicators/signs** | **Indicators/signs** | **Indicators/signs** | **Indicators/signs** | **Indicators/signs** |
| Fear of parent being contacted/going home | Neurotic behaviour | Sexual drawings/ advanced sexual knowledge | Truancy and lateness | Shyness |
| Scalds, bite marks or visible injuries | Feeling unable to take part | Sudden changes in behaviour | Regularly alone or unsupervised | Insecurity |
| Aggressive outbursts | Fear of making mistakes | Apparent fear of one person | Constant hunger | Seeming over sensitive |
| Withdrawn behaviour | Sudden speech disorders | Self-harm/suicidal | Unkempt state | |
| Depression | Self-harm | Sexually transmitted diseases/pregnancy | Weight loss | |
| Bruises that reflect hand marks | Developmentally delayed | Bed wetting | Inappropriate dress | |
| Keeping arms and legs covered | | Discomfort when walking and sitting | | |

**Table 3.4** outlines the types of abuse and the associated signs and symptoms

## SAFEGUARDING VULNERABLE ADULTS

A vulnerable adult is:

- A person "who is or may be in need of community care services by reason of mental or other disability, age or illness"
- Someone who is or may be unable to take care of him or herself
- Someone who is unable to protect him or herself against significant harm or exploitation

Abuse occurs when a vulnerable adult is mistreated, neglected or harmed by another person who holds a position of trust. Everyone has a right to feel safe and to live without fear of abuse, neglect or exploitation.

## TYPES OF ABUSE

### Physical Abuse

- Hurting or injuring someone
- Administering medication incorrectly
- Authorising changes to a person's life without their consent

### Sexual Abuse

- Rape, sexual assault and pressurising someone into sexual acts they don't understand or feel powerless to refuse

### Psychological Abuse

- Verbal abuse, including insults, threats, harassment and intimidation
- Blaming, controlling or embarrassing
- Isolating, taking away privacy or threatening to abandon

### Financial Abuse

- Theft, fraud and misuse of property, possessions or benefits

### Neglect

- Withholding food, drink and adequate heating
- Failing to provide access to health, social and education services

### Discriminatory Abuse

- Slurs, harassment and maltreatment because of someone's race, impairment or illness

### Institutional Abuse

- Neglect and poor standards of care in hospitals, day centres and care homes

## RESPONDING AND REPORTING SUSPECTED ABUSE

Dealing with child and vulnerable adult abuse or an allegation of abuse is not straight forward or simple. Adults may be shocked and disturbed by what they hear or see, but they should always act upon it. Children who are being abused will only speak to people who they trust and feel safe with, so it is important that they act upon it as they may be the only one they speak to. They do want the abuse to stop, so by listening to what they say will already be helping to protect them.

Follow the organisations child protection guidelines, or know who to refer to. This would normally be a child protection officer or senior manager.

In the event of a child approaching you with their experiences, here are guidelines on how to respond:

- Stay calm, try not to display shock or disbelief and accept what is being said, listen carefully and allow the child to talk
- Reassure him/her that they have done the right thing by telling you
- Tell the child that you take seriously what he/she is saying
- Don't panic
- Don't judge e.g. "why didn't you tell me before?"
- Don't promise to keep secrets
- Don't make the child repeat the story
- Don't tell people who do not need to know
- Don't interrogate or ask leading questions e.g. "did he touch you?"
- Do not approach the alleged abuser, or the parents of the child
- Record in writing the details of the child, what has been said, heard or seen, include dates, times and a description of any visual bruising or injury, and details of who has been informed and what action was taken, in an incident report book
- Be honest and explain that you have to tell someone else to protect the child

It is not the job of the adult who the child has disclosed information to to investigate the matter, but they have the responsibility of passing information on to the Child Protection Officer or senior manager for further investigation.

Children may also talk to an instructor about bullying or harassment, which they need to listen to, record, report and reassure the child. They may need to involve parents and the other children to change behaviour and improve the situation. If it is serious bullying and an assault has taken place they should follow the safeguarding guidelines above.

It may not be only through a child talking to an instructor making them aware of a situation, but it may be apparent through other ways such as:

- Conversation with another adult
- Direct observation of an incident
- Signs, symptoms or actions that children or vulnerable adults present

Again, these should be reported in the same way as safeguarding and should not be ignored as they may also be a cry for help. You should not question the child involved or contact parents/adults involved, just report to the appropriate individual.

## STATUTORY AGENCIES

- Child welfare agencies
- Child welfare officers
- Social services
- Police
- Childline
- Child protection officer

It is not down to the person reporting to justify or investigate whether the person is being abused. It is their responsibility to act on what they've been told, heard or seen. Once they have informed the child protection officer or manager, following workplace procedures, it will then be down to the suitable statutory agency to follow up.

## CONFIDENTIALITY OF INFORMATION REGARDING ABUSE

Standard data protection should be followed (so reports locked away safely and securely). Whoever the instructor talks to should only be on a 'need to know' basis. They must also maintain confidentiality, but may not take full responsibility i.e. child protection officer/senior manager as they may pass the information on to the correct statutory agency to investigate.

The people contacted should be limited to who is essential as the child or vulnerable adult will be the centre of the process and their safety, security and wellbeing must be assured!



# KNOW HOW TO SUPPORT CLIENTS WHO TAKE IN EXERCISE & PHYSICAL ACTIVITY SUMMARY OUTCOMES

## CAN YOU NOW...

- Understand the emergency procedures within a fitness environment ☐
- Outline the health and safety requirements in a fitness environment ☐
- Know how to control risks within a fitness environment ☐
- Safeguard children and vulnerable adults in the fitness environment ☐

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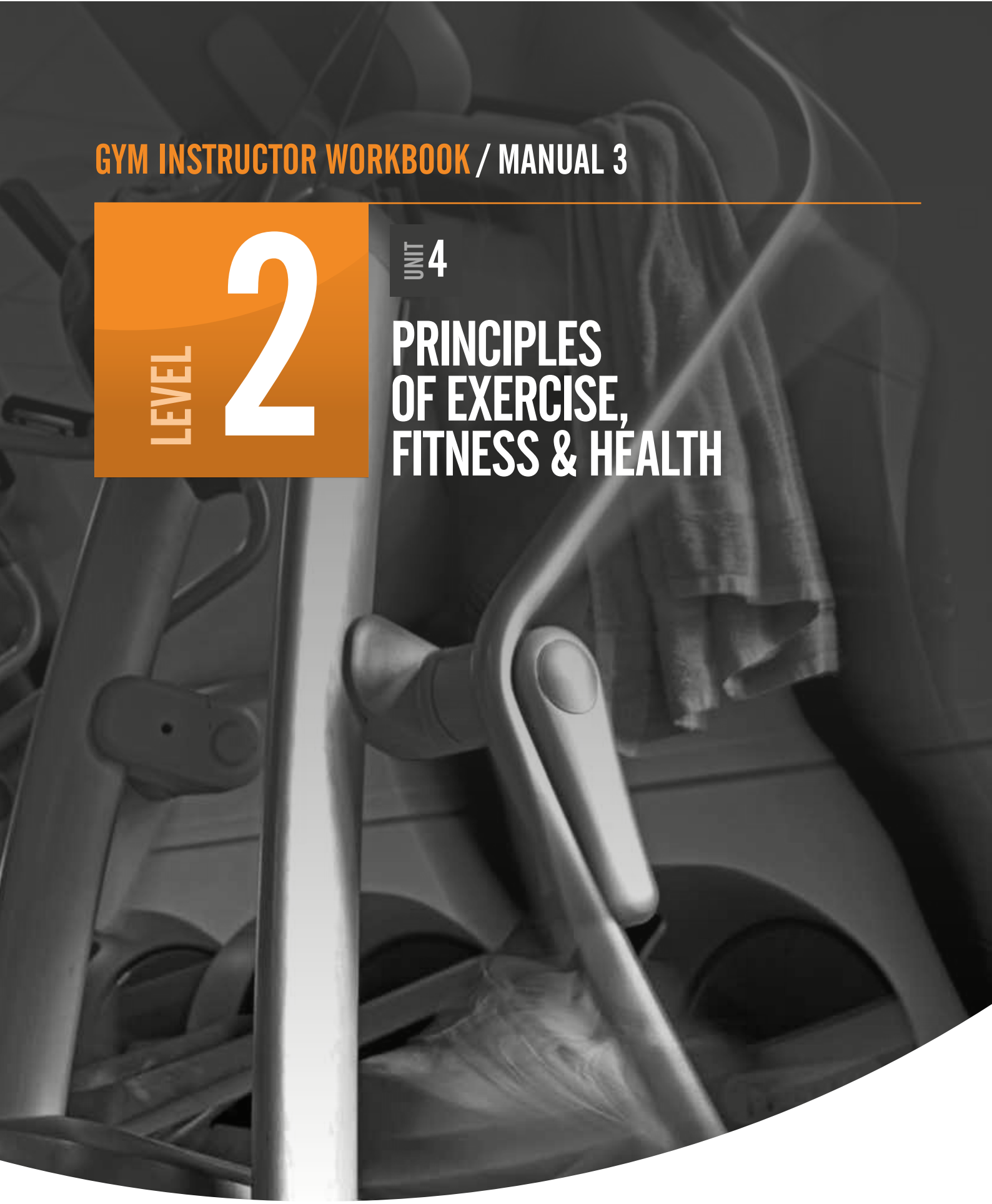
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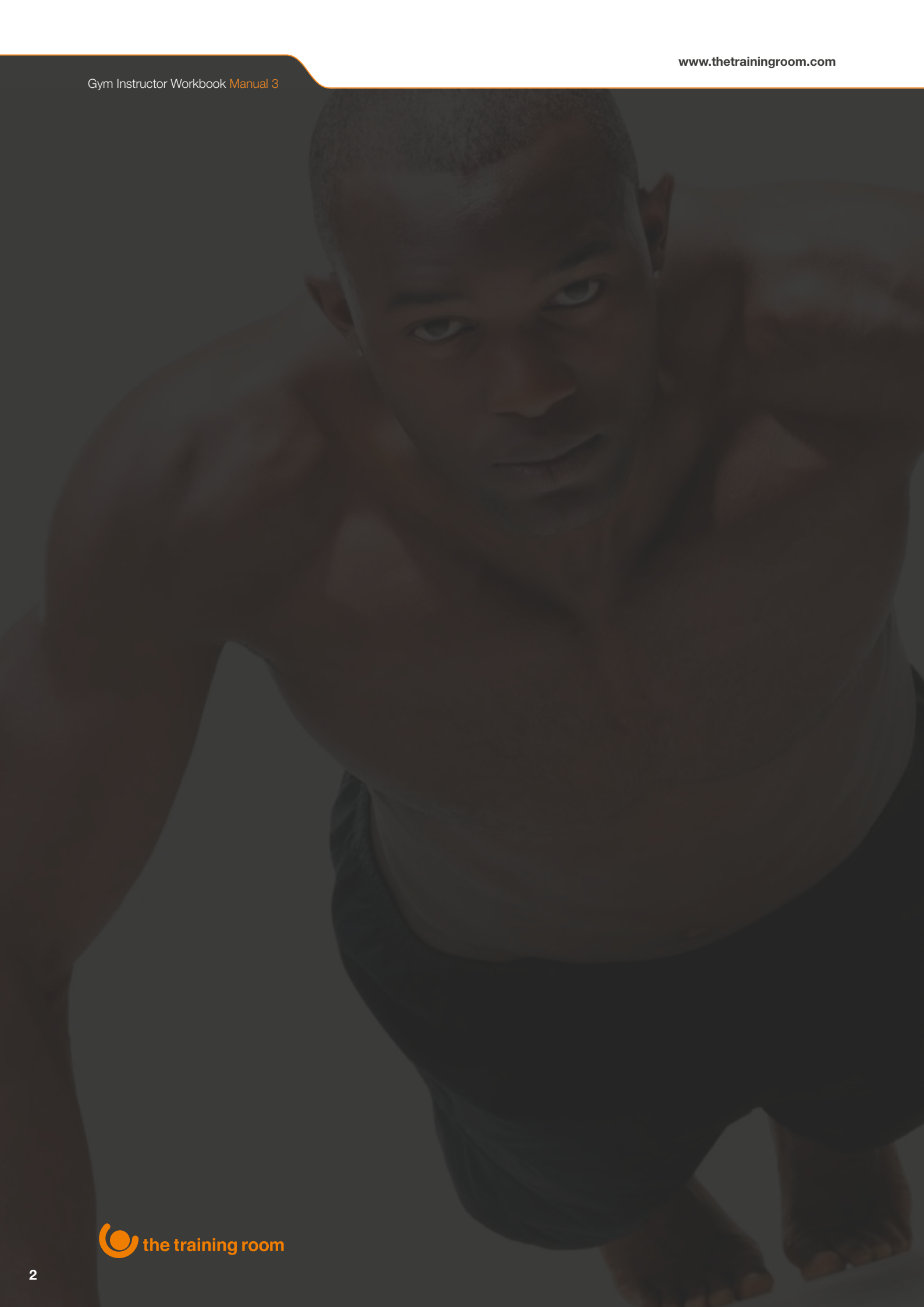
GYM INSTRUCTOR WORKBOOK / MANUAL 3

LEVEL 2

UNIT 4

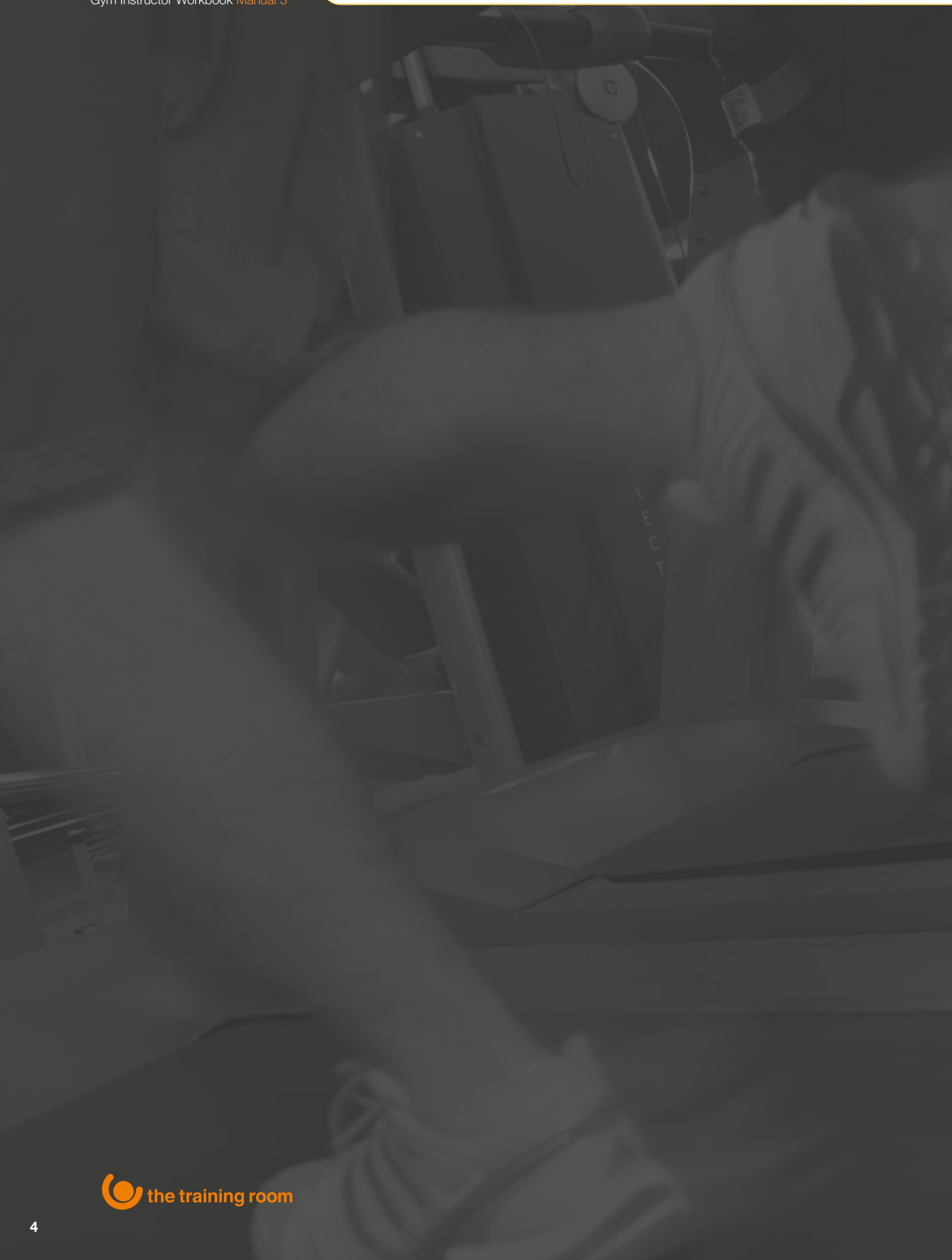
# PRINCIPLES OF EXERCISE, FITNESS & HEALTH

the training room



# UNIT CONTENTS


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UNIT 4

1

# THE COMPONENTS OF FITNESS

**By the end of this section you should be able to...**

Outline the components of health related fitness

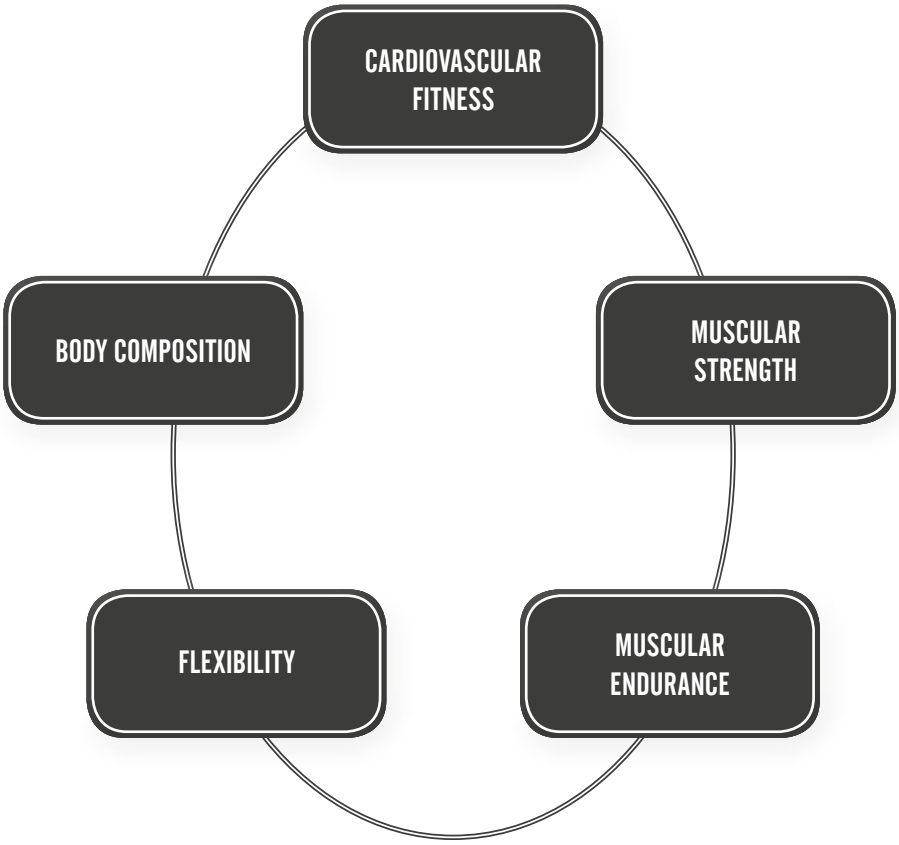
Outline the components of skill related fitness

Identify the factors that affect health and skill related fitness

# COMPONENTS OF FITNESS

## HEALTH RELATED FITNESS

There are 5 components of health related fitness:




**Cardiovascular Fitness** – This is also sometimes known as stamina and is the ability of your body to continuously provide enough energy to sustain submaximal levels of exercise (the ability to take on and utilise oxygen through efficient heart and lung actions).

**Muscular Strength** – This is the ability of a muscle or muscles to exert maximal force to overcome a resistance.

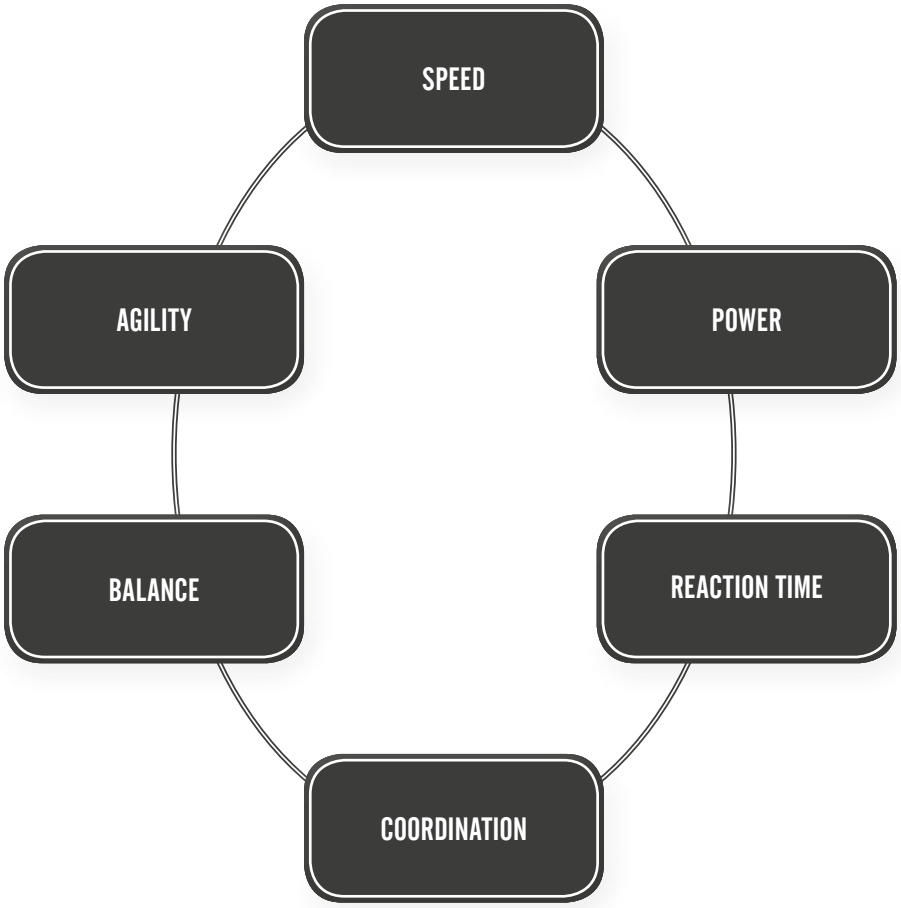
**Muscular Endurance** – Muscular endurance is the ability of a muscle to make continuous contractions over a set period of time whilst resisting fatigue.

**Flexibility** – This is the range of movement possible at joints within the body.

**Body Composition** – Amount of muscle, fat, bone, cartilage etc. that makes up our body.

## SKILL RELATED FITNESS

There are 6 components of skill related fitness:




**Speed** – Is the ability to move one or more body parts quickly.

**Power** – Is the product of strength and speed. It is when we move as quickly and as forcefully as we can.

**Reaction Time** – Is how quickly the brain can respond to a stimulus and initiate a response.

**Coordination** – Is the ability to use the body parts and senses together to produce smooth efficient movements.

**Balance** – Is the ability to maintain equilibrium whilst moving or stationary.

**Agility** – Is the ability to change the direction and the speed at which you are travelling, quickly and efficiently.

### KEY TERMS

**SKILL**

Is the learnt ability to carry out tasks or activities with the minimum outlay of time, energy, or both.

NOW TEST YOUR SELF...
Go to page 10

## HELPFUL HINT

**REMEMBER**

M for Mesomorph
= Muscular body type

## FACTORS THAT AFFECT HEALTH AND SKILL RELATED FITNESS

**Age** – Physical fitness generally declines with the ageing process. However, the speed at which the effects of ageing occur can be offset by regular physical activity.

**Gender** – Due to hormonal deviations (testosterone/oestrogen) males tend to have a larger muscle mass, larger lungs and a larger aerobic ability than females, who often have better flexibility and a higher body fat percentage.

**Physique/Body Type** – Body type will have a significant impact on a person's ability to perform various physical tasks. We classify individuals into 3 body types (somatotypes) ectomorphs, endomorphs and mesomorphs. It is important to note that individuals can have a combination of two or more somatotypes.

- Ectomorphs have a slim build, low body fat percentage and are suited to endurance events
- Mesomorphs have an athletic build and are suited to sprint events and swimming
- Endomorphs have a rounded shape and are suited to strength/power events such as wrestling and throwing events

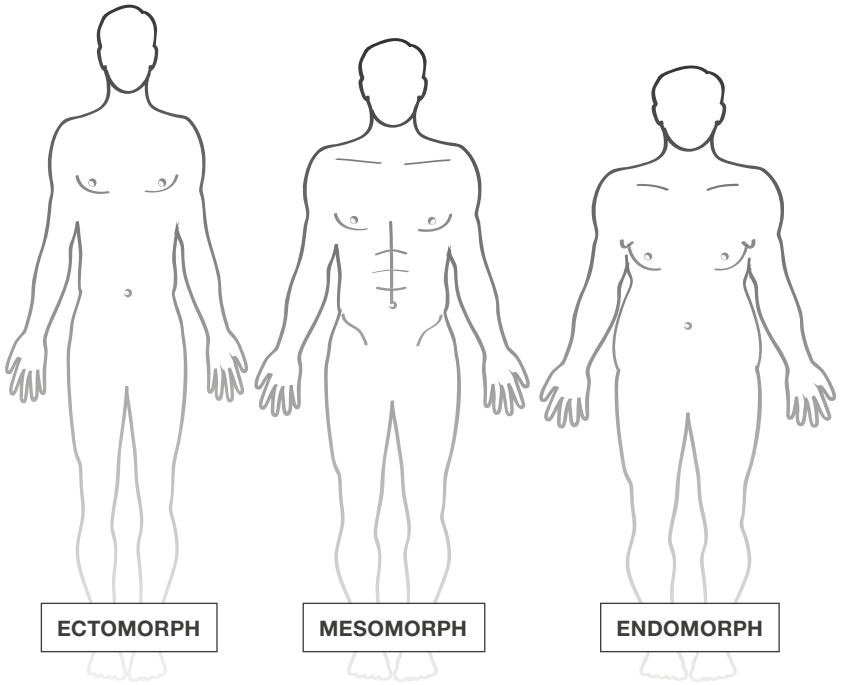



**Figure 4.1** somatotypes

**Diet** – When exercising, the body requires sufficient quantities of substances for energy, growth and repair. A diet that lacks in quality can lead to fatigue, increased levels of adipose tissue, poor bone growth and slow results in a training programme.

**Activity level/type** – The frequency, intensity, type and time of activities will be a large factor as to the physiological progressions to the human body.

**Physical disabilities** – There are many disabilities that can cause physical impairment, however exercise adaptations can help correct/enhance body functioning with targeted exercises.

**Illness and fatigue** – Illness will affect training directly. Depending on the illness this can be both short and long term. Fatigue will hamper progress. Rest is an essential part of an exercise programme.

**Drugs** – These can be both social and medical. These should be picked up in pre-exercise screening. If medical drugs are prescribed, exercise clearance may need to be sought from the clients GP. If social drugs are taken this will affect the body in a variety of ways. Training should never take place if you suspect a client has taken recreational drugs.

# THE COMPONENTS OF FITNESS SUMMARY OUTCOMES

## CAN YOU NOW...

Outline the components of health related fitness ☐

Outline the components of skill related fitness ☐

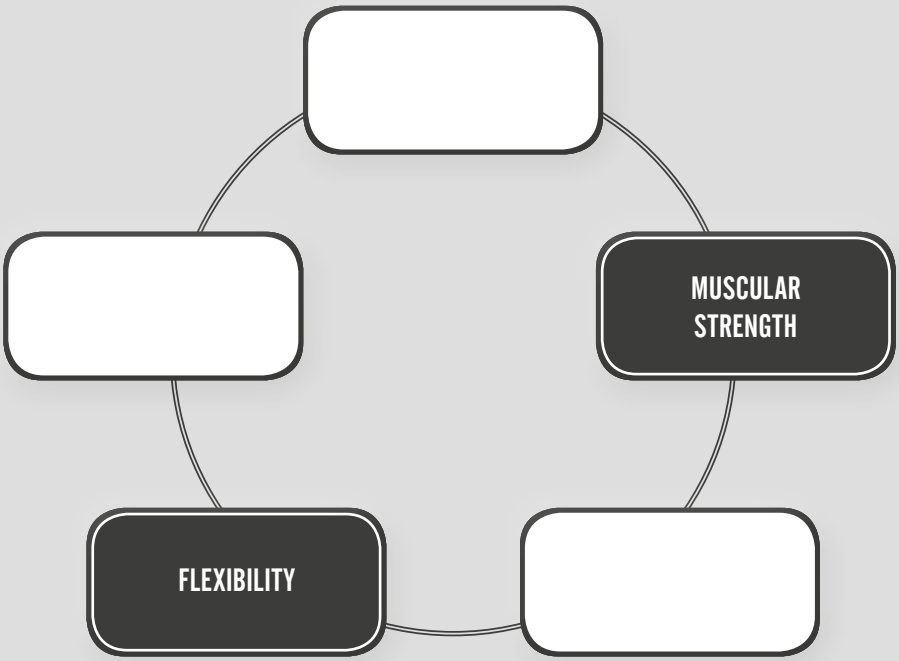
Identify the factors that affect health and skill related fitness ☐

NOW TEST YOUR SELF...



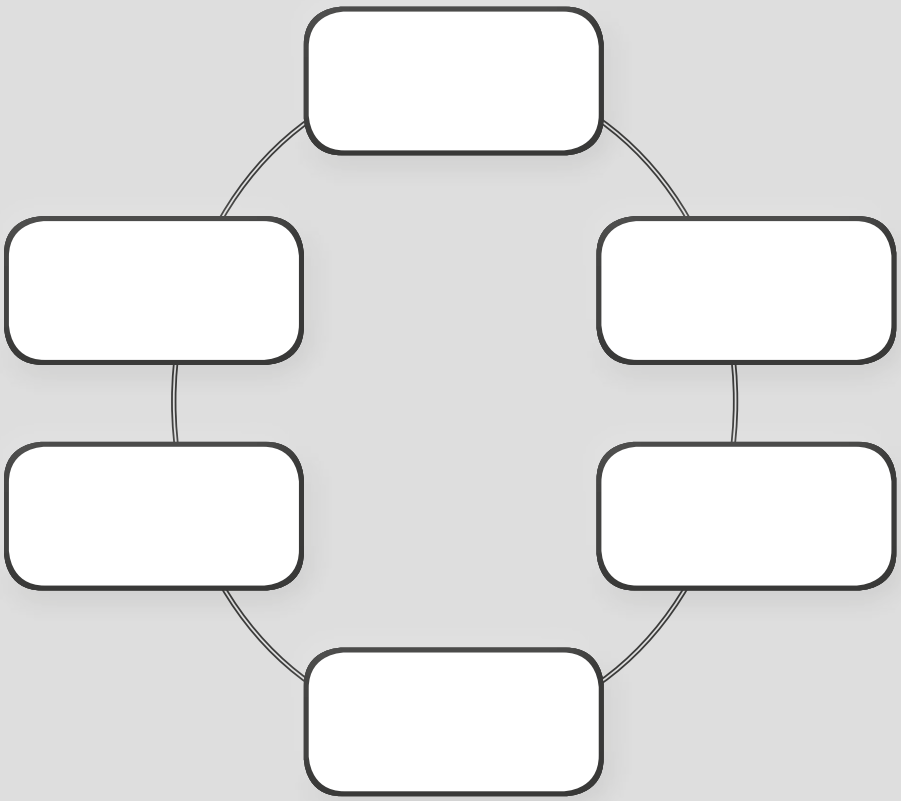
## TASK 1.1

Fill in the blank components of fitness:




## TASK 1.2

The 6 components of skill related fitness are:



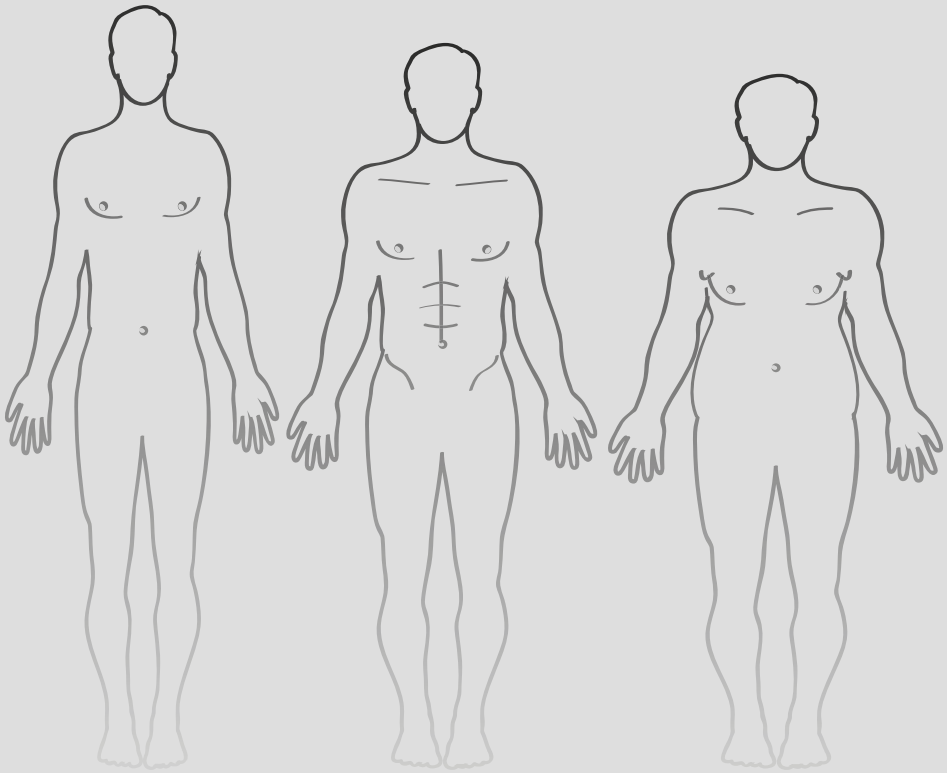
## TASK 1.3

List 8 factors that can affect health and skill related fitness:

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |

## TASK 1.4

Label the following somatotypes:





UNIT 4 2

# THE EFFECTS AND HEALTH BENEFITS OF EXERCISE

**By the end of this section you should be able to…**

Describe cardiovascular and respiratory adaptations to endurance/aerobic training

Identify the short and long term effects of exercise on blood pressure

Explain the "blood pooling" effect following exercise

Identify the affects of exercise on bones and joints including the significance of weight bearing exercise

Describe delayed onset of muscle soreness (DOMS) and identify exercises or techniques likely to increase its risk

Explain the short and long term effects of different types of exercise on muscle

Identify different exercises that can improve posture

VITAL FACTS

**HYPOKINETIC**

Hypo - lack of

Kinetic - movement

Hypokinetic diseases are conditions related to inactivity or low levels of movement.

# WHY EXERCISE?

The term hypokinetic describes many of the diseases and conditions associated with inactivity and poor fitness and first originated in the book Hypokinetic Disease (Kraus & Raab,1961).

Hypokinetic Diseases include:

**Obesity**

**High blood pressure**

**High cholesterol**

**Osteoporosis**

**Osteoarthritis**

**Lower back pain**

**Type 2 diabetes mellitus**

## THE HEALTH BENEFITS OF EXERCISE

- Physically active people have a 33-50% lower risk of developing type 2 diabetes compared with inactive people. The preventative effect is particularly strong for those at high risk of developing type 2 diabetes, as it can reduce their risk of developing the disease by up to 64%
- Physical activity programmes can help reduce the risk of falling, and therefore fractures, among older people
- Physical activity is effective in the treatment of clinical depression and can be as successful as psychotherapy or medication, particularly in the longer term.
- Physical activity is associated with a reduction in overall risk of cancer. In colon cancer the most active individuals have, on average, a 40-50% lower risk than the least active. Women with higher levels of physical activity have about a 30% lower risk of breast cancer than the least active
- Physical activity is a major independent protective factor against coronary heart disease in men and women. Inactive and unfit people have almost double the risk of dying from coronary heart disease compared with more active and fit people. People at high risk of coronary heart disease may benefit even more from physical activity compared with people at lower risk. Physical activity also significantly reduces the risk of a stroke and provides effective treatment of peripheral vascular disease

(The Department of Health, 2004)

Exercises can be categorised into 2 areas:

1. Aerobic/Cardiovascular
2. Anaerobic

The key differences between these two types of exercises are the duration and the exercise intensity.

## CARDIOVASCULAR EXERCISE

These types of exercises are low to moderate in intensity using slow twitch muscle fibres, these primarily utilise energy created from the aerobic energy system and typically use large muscle groups in a rhythmical movement for extended periods of time. For example cycling, swimming and running

Cardiovascular exercise improves the efficiency of oxygen transfer between the heart and lungs, this can be measured using VO2 max. VO2 max is the maximum capacity of an individual's body to transport and use oxygen during exercise.

"Maximal oxygen uptake (VO2 max) is widely accepted as the single best measure of cardiovascular fitness and maximal aerobic power. Absolute values of VO2 max are typically 40-60% higher in men than in women." (Hyde & Gengenbach 2007)

Standard VO2 max tests include:

- Cooper VO2 max test (12 minute maximum run)
- The multi stage fitness test (bleep test)
- Queens college step test
- Rockport Fitness walking test

**HELPFUL HINT**

**'C' FOR CONCENTRIC**

**=**

**'C' FOR CONTRACT + SHORTEN**

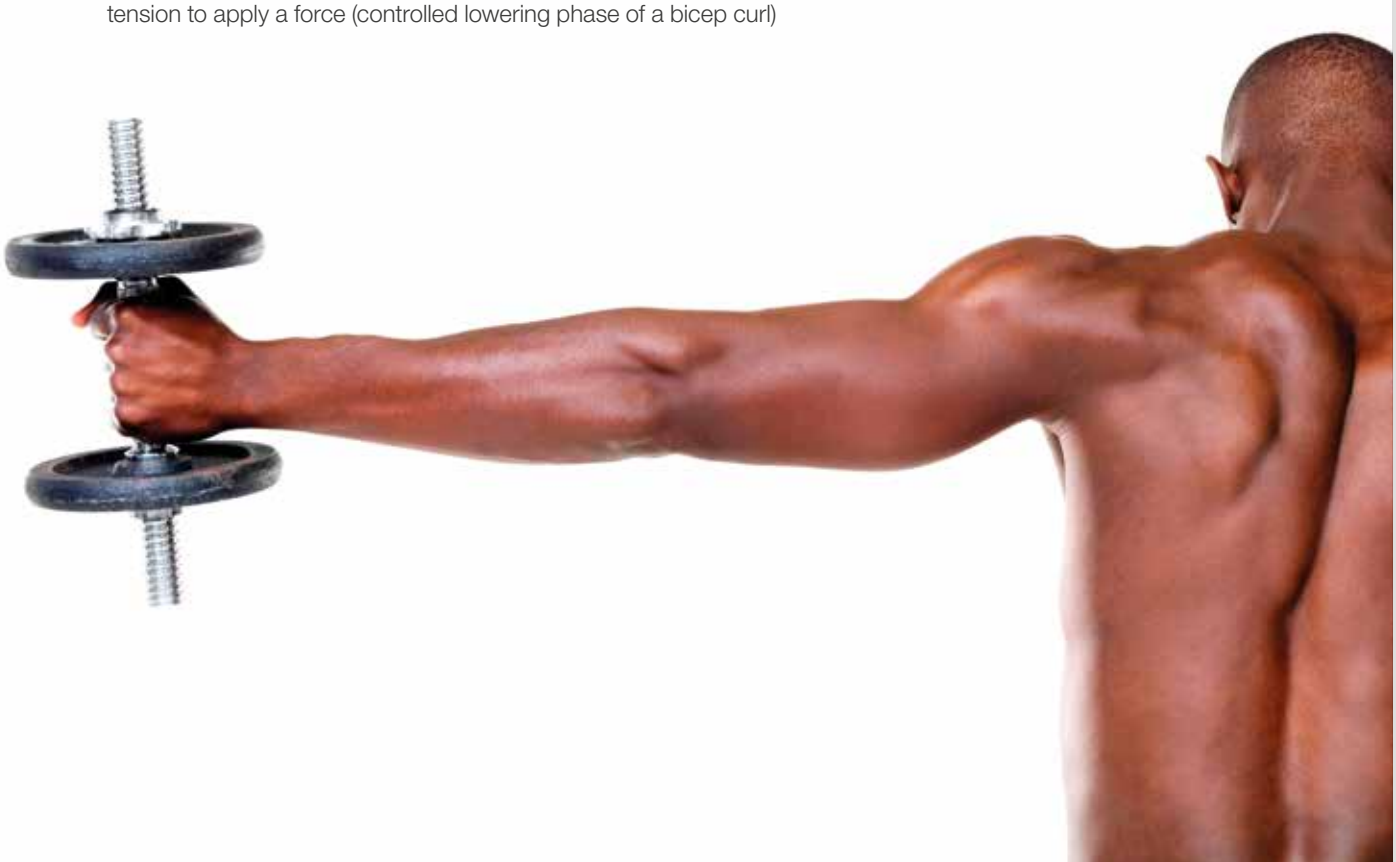
## RESISTANCE EXERCISE

Resistance exercises are a form of strength training at a moderate to high intensity using fast twitch muscle fibres to apply effort or force to overcome a specific load. Energy for resistance training is primarily anaerobic (without oxygen) in both the ATP-PC and lactate systems.

If the individual wishes to measure the development to fast twitch muscle fibres then 1 repetition max tests could be completed to measure the maximal force chosen muscles can generate in a single repetition.

There are a variety of ways in which muscles can be worked during resistance training, these include:

- **Isometric** – are movements in which contracting muscles stay the same length whilst applying a force (the plank)
- **Concentric** – causes muscles to shorten as they contract under tension to apply force (upward phase of a bicep curl)
- **Eccentric** – are the opposite to concentric contractions, muscles lengthen under tension to apply a force (controlled lowering phase of a bicep curl)



# EFFECTS OF EXERCISE ON THE BODY

The body will adapt to the pressures put upon it if the overload principle is used. When this is applied, the body will develop so that it is better suited to these pressures. The type of training undertaken will promote different adaptations.

## THE LONG TERM PHYSIOLOGICAL BENEFITS OF RESISTANCE TRAINING

- Increased bone density
- Increased resting metabolic rate
- Decreased body fat percentage
- Increased creatine phosphate and adenosine triphosphate stores
- Decreased blood pressure
- Decreased blood cholesterol markers
- Muscular hypertrophy
- Improved posture
- Improved core stability
- Decreased risk of injury
- Increased range of movement
- Improved power
- Improved strength
- Increase in number and size of mitochondria
- Improved motor unit firing and ability to recruit motor units



## THE LONG TERM PHYSIOLOGICAL BENEFITS OF CARDIOVASCULAR TRAINING

- Increased lung capacity/increase in VO2 max
- Hypertrophy of cardiac tissue
- Increased blood volume and red blood cell count
- Increased cardiac output and stroke volume
- Increased number of capillaries (capillarisation)
- Reduction in blood pressure
- Increased number of mitochondria
- Increase in bone density
- Lower blood cholesterol markers (reduction in HDL count)
- Reduction in body fat

# EFFECTS OF EXERCISE ON BLOOD PRESSURE

## SHORT TERM

Heavy weight training and isometric exercise will significantly increase both systolic and diastolic blood pressure. As a fitness instructor you should always get your client to complete a pre exercise questionnaire which will highlight any known hypertension, you may also complete static health tests including blood pressure. If the client is hypertensive, explosive movements such as plyometric training and static movements such as the plank or bridge should be avoided, to ensure the condition is not exacerbated. A gradual warm up/pulse raiser should always be completed to increase blood pressure steadily at the start of every exercise programme.

However during light/moderate aerobic activity, blood pressure can drop and remain lower than usual for up to 22 hours, according to the American College of Sports Medicine (ACSM). This is due to blood vessels responding to exercise (vasodilation) which increases blood vessel size and reduces the pressure exerted on the artery walls.

## LONG TERM

Aerobic exercise is very effective in reducing both systolic and diastolic blood pressure over a long term exercise programme.

About 30% of patients were estimated to achieve a reduction in systolic blood pressure of 10 mmHg or more in the short term, up to 1 year.

(NICE (June 2006). Management of hypertension in adults in primary care)

## BLOOD POOLING

Whilst exercising there is an increased demand for blood flow to the working muscles to provide oxygen and nutrients. The action of skeletal muscle contraction helps return deoxygenated blood back to the heart as part of the venous return process. However, when the exercise stops so does this muscular contraction, this leads to blood and other waste products staying within the muscle. This process is known as blood pooling. Blood located in muscles below the heart, especially the legs, is also subject to gravity, which increases the likelihood of blood pooling.

During exercise the requirements of venous return is increased due to a higher build-up of blood and waste products within muscle tissue. Increased muscular pump of skeletal muscle, peristalsis of smooth muscle and non-return valves found in veins help return blood, if the exercise stops suddenly then waste products will not be removed effectively which can cause fainting, dizziness and nausea.

Blood pooling can be reduced by gradually lowering the exercise intensity. This will slowly reduce heart rate, help in lactic acid removal and aid in venous return. A cool down should be completed at the end of a workout to help in reducing blood pooling.

### HELPFUL HINT

**MMHG**

- Millimetres of mercury



VITAL FACTS

**REMEMBER**

Dilation - is to open up, get bigger, increase in size.

Constriction - is to close up, get smaller, decrease in size.

# EFFECTS OF EXERCISE ON BONES AND JOINTS

## SHORT TERM

- An increased production and secretion of synovial fluid. This will lubricate the joints and reduce friction between the articular cartilages of each bone

## LONG TERM

- Stronger ligaments and tendons increase the number of collagen fibres creating better joint stability
- Increase in bone density due to the increased activity of osteoblasts (bone building cells). Physical activity can increase bone mineral density in adolescents, maintain it in young adults, and slow its decline in old age

# EFFECTS OF EXERCISE ON SKELETAL MUSCLES

## SHORT TERM

- Vasodilation of blood vessels diverts blood to working muscles

## LONG TERM

Muscular endurance/aerobic training will cause an increase in number and size of mitochondria (sometimes referred to as the battery cells, as this is where energy is produced in the form of ATP) as well as capillarisation (increase in capillaries surrounding muscles).

Muscular hypertrophy and strength training will cause an Increase in muscle size (hypertrophy) and can cause a reduction in reciprocal inhibition (muscles on one side of a joint relaxing to allow the contraction of muscles on the opposite side of that joint). This in turn can maximise the force generated by that agonist.



# EFFECTS OF EXERCISE ON THE RESPIRATORY SYSTEM

## SHORT TERM

- Increased breathing rate and amount of oxygen breathed in and out of the lungs (Tidal Volume)

## LONG TERM

- Increased strength of respiratory muscles, these include the diaphragm and intercostals
- Increased alveolar surface area
- An increase in vital capacity, the amount of air that can be expired from the lungs once they are filled

# EFFECTS OF DIFFERENT TYPES OF RESISTANCE EXERCISE ON MUSCLES

## AEROBIC EXERCISE AND MUSCULAR ENDURANCE RESISTANCE TRAINING

Endurance training programs use low resistance, high repetition exercises such as running or cycling to increase VO2 max.

Low intensity, long duration exercise can bring about the following changes on Type I fibres:

- An increase in the number and size of mitochondria in the muscle fibres
- An increase in the number of capillaries surrounding these fibres
- An increase in the number of aerobic enzymes, stored glycogen and triglycerides in the muscle fibres

## HYPERTROPHY AND STRENGTH RESISTANCE TRAINING

Typically, strength training programs involve large muscle group activation of high-resistance low repetition exercises to increase the force output ability of skeletal muscle (Sale et al 1990).

Short duration, high intensity exercise affects mainly Type II fibres:

- A decrease in reciprocal inhibition
- An increase in the diameter of the recruited fibres (hypertrophy) due to an increase in the myofilaments within the fibres
- An increase in the glycolytic activity (the process in which carbohydrates and sugars, especially glucose, are broken down, producing ATP) of the muscle allowing more work to be performed under anaerobic conditions or high stress conditions

Delayed onset of muscle soreness – The delayed onset muscle soreness (DOMS) is the pain and stiffness felt in muscles 24 to 72 hours after the exercise. DOMS often occurs when an individual changes/increases the workload/workout intensity. The eccentric phases of training are the main reason for muscle soreness.

VITAL FACTS

**POSTURE**

Is the position in which you hold your body in relation to gravity.

# EFFECTS OF EXERCISE ON POSTURE

Poor posture is common in both children and adults, which is usually caused by muscular imbalance. There are many causes of poor posture within a modern lifestyle. These include work such as desk jobs (which can cause a shortening of the pectorals) and driving (which can lead to a shortening of the hip flexors), these in turn can affect spinal posture.

Through a combination of stretching and strengthening specific muscle groups postural abnormalities can be improved. Below are a few exercises that can be completed to improve some spinal abnormalities, for more detail on these abnormalities refer to the anatomy and physiology section.

## LORDOSIS EXERCISE REQUIREMENTS

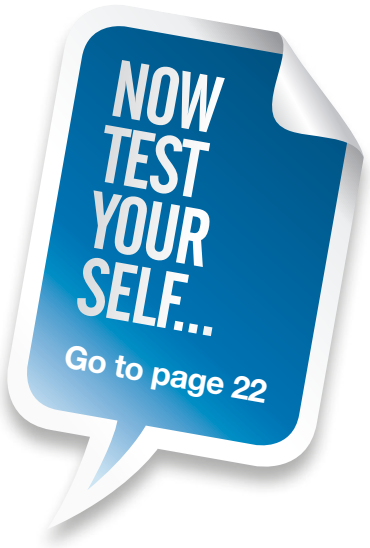
- Strengthen Abdominals
- Strengthen Gluteals
- Strengthen Hamstrings
- Stretch Hip Flexors
- Stretch Quadriceps
- Stretch Erector Spinae

## KYPHOSIS EXERCISE REQUIREMENTS

- Strengthen Posterior Deltoid
- Strengthen Trapezius
- Strengthen Rhomboid
- Strengthen Infraspinatus and Teres Minor
- Stretch Latissimus Dorsi
- Stretch Pectorals
- Stretch Anterior Deltoid

## POSTERIOR PELVIC TILT (FLAT BACK) EXERCISE REQUIREMENTS

- Strengthen Posterior Deltoids
- Strengthen Trapezius
- Strengthen Rhomboids
- Strengthen Infraspinatus and Teres Minor
- Strengthen Hip Flexors
- Strengthen Quadriceps
- Stretch Gluteals
- Stretch Hamstrings
- Stretch Pectorals
- Stretch Abdominals



# THE EFFECTS AND HEALTH BENEFITS OF EXERCISE SUMMARY OUTCOMES

## CAN YOU NOW...

- Describe cardiovascular and respiratory adaptations to endurance/aerobic training ☐
- Identify the short and long term effects of exercise on blood pressure ☐
- Explain the "blood pooling" effect following exercise ☐
- Identify the effects of exercise on bones and joints including the significance of weight bearing exercise ☐
- Describe delayed onset of muscle soreness (DOMS) and identify exercises or techniques likely to increase its risk ☐
- Explain the short and long term effects of different types of exercise on muscle ☐
- Identify different exercises that can improve posture ☐




## TASK 2.1

List 6 Hypokinetic Diseases:

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |

## TASK 2.2

List 7 physiological benefits of the following types of training on the body:

| Cardiovascular | Resistance |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |



## TASK 2.3

Match the correct statements, each system has a short and long term adaption to exercise:

| | | |
|---|---|---|
| Bones and Joints | Long Term Adaption | An increase in vital capacity, the amount of air that can be expired from the lungs once they are filled. |
| | Short Term Adaption | Increase in bone density due to the increased activity of Osteoblasts (bone building cells). Physical activity can increase bone mineral density in adolescents, maintain it in young adults, and slow its decline in old age. |
| Respiratory System | Long Term Adaption | Muscular Endurance/Aerobic Training will cause an increase in number and size of mitochondria (sometimes referred to as the battery cells, as this is where energy is produced in the form of ATP) as well as capillarisation (increase in capillaries surrounding muscles). |
| | Short Term Adaption | Vasodilation of blood vessels diverts blood to working muscles. |
| Skeletal Muscles | Long Term Adaption | Increased breathing rate and amount of oxygen breathed into and out of the lungs (Tidal Volume) |
| | Short Term Adaption | An increased production and secretion of synovial fluid. This will lubricate the joints and reduce friction between the articular cartilages of each bone. |



UNIT 4

3

# APPLYING THE PRINCIPLES AND VARIABLES OF FITNESS TO AN EXERCISE PROGRAMME

**By the end of this section you should be able to…**

Describe the importance of and reasons for a warm up and cool down

Identify the implications of specificity, overload, reversibility, adaptability, individuality and recovery

Explain the principles of FITT, with modifications and progressions for each component

Explain how to recognise when and how to regress a training programme

Describe the effect speed and intensity has on posture

Describe the effect of levers, gravity and resistance on exercise

Describe the differences between programming exercise for physical fitness and for health benefits

VITAL FACTS

**WARM UP -**

Pulse Raiser (CV)
Stretches prior to exercise

**COOL DOWN -**

Pulse Lower (CV)
Post stretches (flexibility) after exercise

# THE PURPOSE OF A WARM UP AND COOL DOWN

When designing an exercise programme it is essential that a specific warm up and cool down are included. These are often neglected by gym users but have an important role in preparing and returning the body to a pre exercise state to reduce the risk of injury.

# WARM UP

A warm up is an exercise that gradually builds in intensity at the beginning of a workout. This prepares muscles, heart rate, blood pressure and body temperature for the forthcoming exercises.

A typical warm up may include cardiovascular exercise with a gradual increase in intensity. This is often referred to as a pulse raiser. Mobilisation exercises to promote joint movement and pre exercise stretching (static, dynamic or ballistic) may also be included.

A warm up is prescribed to raise the body temperature to 39/40 degrees. This small increase in temperature has many benefits to exercise performance.

1. This heating effect will allow the muscles and tendons to become more extensible. This in turn will create more supple muscle fibres and enhance stretching.
2. An increase in oxygen and essential nutrients to muscle tissue, which occurs due to an increase in blood flow through vasodilation.
3. Specific warm ups that mirror the activity about to take place will enhance neural pathways, which speeds up reaction time.
4. Secretion of synovial fluid helps lubricate joints.
5. Psychological preparation for physical activity/exercise.

The risk of injury can be reduced by about one third and the risk of severe injuries by as much as a half. (Soligard T, Myklebust G, Steffen K, et al. 2008).

## TYPES OF WARM UP

There are 3 main categories of warm up:

**Passive Warm Up** – increases body temperature by some external means, for example a bath or massage, this however is not the most appropriate method to prepare muscles for exercise.

**General Warm Up** – increases body temperature by using general rhythmical body movements which use large muscle groups, examples of movements include jogging, cycling and rowing.

**Exercise Specific Warm Up** – increases body temperature whilst using specific muscle groups that are going to be used within the exercise following the warm up. For example in football a warm up would include drills and exercises (turns, jumps and lunges) which replicate the players movement patterns within a game.

Although there are no general rules to the best warm up type, an exercise specific warm-up is seen to be the most appropriate as this method provides a rehearsal of the activity or event.

Depending on the client, warms ups should consist of a pulse raiser lasting between 5 and 20 minutes, gradually increasing intensity until the participant is working to around 40-60% of maximal heart rate (4-6 RPE), as explained by the ASCM 2010.

Pre exercise stretching should then be completed on muscle groups that are going to be worked during the session.

# COOL DOWN

The purpose of a cool down is to return the body to a pre exercise state. This may involve a cardiovascular cool down lasting 5-10 minutes in which the working intensity is gradually reduced by reducing the speed and resistance allowing a gradual decrease in temperature, heart rate and blood pressure, back to resting levels. By gently working the major muscle groups blood pooling is reduced and the removal of waste products such as lactic acid. A good indication of when the cool down is complete would be when the participant's heart rate is reduced to just above the individuals resting heart rate figure.

Stretching after the cardiovascular cool down could also reduce the effects of DOMS following exercise. It can help improve flexibility, which will have a positive effect on performance in physical activities, or decrease risk of injuries by helping joints move through their full range of motion more effectively.

## KEY TERMS

**WARM UP**

Preparing muscles, increasing heart rate and body temperature for exercise.

**COOL DOWN**

Returning the body gradually to a pre exercise state.

# TYPES OF STRETCHING

There are a variety of ways to stretch before and after exercise.

**Active** – Active stretching is accomplished using antagonist muscles without assistance from an external force or object (Alter, 1998) For example contracting the hamstrings to stretch the quadriceps.

**Passive** – Passive stretching is a form of stretching in which an external object or person is used to help enhance the stretch. For example using a wall to stretch the pectorals.

## WARM UP

**Static** – This from of stretching is when the client holds the stretch to the end of the muscles movement. There is no movement during this type of stretch. Correct posture should be maintained during stretches, which are normally held for 8-10 seconds.

For example a static quadricep stretch.



**Figure 4.2** static quadriceps stretch

**Dynamic** – These types of stretches are seen to be the best way of preparing for exercise. They are controlled movements that reflect the exercise about to be performed. 8-10 repetitions of each movement are normally completed.

For example a lunge rotation movement helps stretch the quadriceps and obliques.



**Figure 4.3** examples of dynamic stretches

## HELPFUL HINT

There are 2 types of cool down stretches:

Maintenance & Developmental

**Ballistic** – These types of stretches involve rapid bouncing movements, which lengthen the muscle to beyond its normal range with the use of momentum. These are not suitable for exercise beginners as they can cause muscle damage and muscle soreness. An example of this would be bouncing to touch your toes in a standing hamstring stretch.

For tasks requiring power and agility, results suggest that a dynamic warm up might offer performance benefits not found with static stretching.

For tasks demanding a high degree of flexibility, power, and agility, warm up activities should be sequenced so that static-stretching (if it is deemed necessary) is followed by dynamic, progressive movements that mimic the goal activity without inducing fatigue.

(Samson et al 2012)

## COOL DOWN

**Static (Maintenance)** – cool down stretches are generally static and are held for 15-30 seconds.

**Static (Developmental)** – these stretches are held for 15 second intervals and are repeated as required, these are used to develop the range of movement at a joint. Firstly the stretch would be held for 15 seconds maintaining correct posture, once the tension has reduced within the muscle the stretch will be passively increased and held for a further 15 seconds, repeat as necessary.

# TRAINING PRINCIPLES

When designing an exercise programme a fitness professional has six main training principles to apply as applicable to the clients' goals. These principles can be applied to both health and fitness related goals. However, fitness goals are usually more specific and focus on improving or maintaining one or more of the five components of physical fitness.

## THE 6 TRAINING PRINCIPLES ARE:

### Individuality

Each training programme that is written will differ slightly and be very specific to the client it is intended for. The reason for this is because no two clients will be the same. Final goals of clients may be similar but other factors such as previous exercise history, exercise likes and dislikes, current exercise participation and underlying medical problems will need to be adapted for.

### Specificity

This principle outlines the need for the programme to be tailored to the client's goals. The training will need to be specific to the final outcomes desired, for example if a client wishes to improve on their 10km run time then training should include exercises that meet the physical requirements. Cycling for example will help improve Vo2 max but ideally the client should train to run that specific distance.

### Progressive Overload

Progressive overload is essential when designing a programme, this is the gradual increase of stress placed upon the body during exercise training. This is important as the body will adapt to the stresses placed upon it, and continual progression will lead to better results. For example if a client feels the intensity level has dropped during the bench press set, there are a number of variables a fitness professional can use to increase the working intensity. These could be:

1. Increasing the weight used whilst decreasing repetitions
2. Slowing repetitions down during the set
3. Adding another set to the end of the section
4. Decrease the rest periods used

### Adaptability

The adaptability principle suggests that the body will react to the training stimuli endured whilst training, by increasing its ability to cope with those loads. Physiological adaptations occur during the recovery period after the training session is completed.

### Recovery

As outlined in the adaptability principle, rest is a vital part of an exercise programme and is not always adhered to by the client. Rest periods both during and after training allow the body to adapt to the pressures being placed upon it.

### Reversibility

Once the client has reached the intended goal they will enter the maintenance phase of training. This is when exercise is undertaken to maintain current fitness levels. It will ensure that a training stimulus is still present, therefore reducing the risk of a decline in fitness levels.

When training ceases the training effect will also stop. It gradually reduces at approximately one third of the rate of acquisition (Jenson and Fisher, 1972)

### VITAL FACTS

There are 6 principles of training:

- Individuality
- Specificity
- Progressive Overload
- Adaptability
- Recovery
- Reversibility

# THE FITT PRINCIPLE

This principle can be used to evaluate previous and current exercise sessions, as well as give guidance to future sessions within an exercise programme.




**F**

**I**

**T**

**T**

**F**requency – The number of exercise sessions in a set period i.e. 3 sessions per week

**I**ntensity – The level of work performed during an activity session i.e. moderate intensity

**T**ime – The duration of a given session i.e. 45 minutes

**T**ype – The choice of activity i.e. cardiovascular, resistance training, or activity specific (football, rugby etc)

# KEY GUIDELINES FOR ADULTS

The general exercise recommendations for healthy adults, as prescribed by the ACSM 2010 are:

| Frequency | Advised Exercise Type |
|---|---|
| At least 5 days per week | Moderate Intensity 40-60% Max Heart Rate (4-6 RPE) aerobic (CV endurance) activities, weight-bearing exercise, flexibility exercise |
| At least 3 days per week | Vigorous Intensity > 60% Max Heart Rate (>6 RPE) cardiovascular activities, weight-bearing exercise, flexibility exercise |
| 3-5 days per week | A combination of moderate and vigorous intensity aerobic activities, weight-bearing exercise, flexibility exercise |
| 2-3 days per week | Muscular strength and endurance resistance exercise, motor skills (balance and agility) |

**Table 4.1** ACSM 2010 prescribing exercise guidelines for healthy adults

(NHS Statistics on obesity, physical activity and diet: England, 2011)

- In 2009, almost a quarter of adults (22% of men and 24% of women aged 16 or over) in England were classified as obese

- In 2009, 16% of boys aged 2 to 15, and 15% of girls were classed as obese, an increase from 11% and 12% respectively in 1995
- In 2009, the number of prescription items dispensed for the treatment of obesity was 1.45 million; this is more than eleven times the number in 1999

When looking at prescribing exercise and programme design it is important to work on the correct training stimulus. Shown below are the ACSM 2010 exercise guidelines adapted for healthy adults when prescribing exercise, specifying FITT principles and guidelines for resistance and cardiovascular exercise.

| Training Goal | Strength | Hypertrophy | Endurance | Health | Cardiovascular |
|---|---|---|---|---|---|
| Intensity | High | Moderate | Low | Low (aerobic) | 60-90 % MHR Moderate - High |
| Load as % of 1RM | > 85% | 67%-85% | < 67% | N/A | N/A |
| Reps/Duration | 1-5 | 6-12 | 12+ | 30 mins + | 20-60 mins |
| Recover between Sets | 3-5 mins | 1-2 mins | 30-60 seconds | N/A | N/A |
| Sets per Exercise | 2-6 | 3-6 | 2-3 | 1 | 1 |
| Frequency per Muscle Group | 1-2 x per week | 1-2 x per week | 2-3 x per week | 5-7 sessions per week | 3-5 sessions per week |

**Table 4.2** programming guidelines and principles (Adapted from Earle and Baechle 2000)

# METHODS OF EXERCISE PROGRAMME PROGRESSION

**Frequency** – The frequency of training can be adjusted according to the fitness of the client. The starting point for the number of sessions in a programme can be judged from the completion. The number of sessions should increase as the client becomes more advanced, however barriers may limit training session availability.

| Training Status | Frequency guidelines (sessions / week) |
|---|---|
| Beginner | 2-3 |
| Intermediate | 3-4 |
| Advanced | 4-5 |

**Table 4.3** exercise programme progression – frequency (Baechle and Earle, 2000)

**Intensity** – Increasing the exercise intensity is essential to a progressive exercise programme. There are a number of ways in which to increase working intensity in chosen exercises. For example:

**Speed of repetitions** – The tempo at which an exercise is completed will affect the intensity and can help specify the exercise for a set goal. An example of this would be increasing the speeds during a cardiovascular workout (RPM on a bike, SPM on a rowing machine and speed on a treadmill). Explosive movements such as the clean and press or plyometric squats are completed at high speed and are more intense than a normal tempo of 2 seconds concentric, pause, 2 seconds eccentric.

Slowing resistance exercises from the normal tempo will also increase the exercise as the muscles are under tension for a longer period of time. This method of training can be referred to a super slows and will emphasise the eccentric phase (lowering against gravity) which is often neglected during exercise. A side effect of this training is an increase in DOMS.

**Exercise Stability** – Exercise stability has been a large area of development within the last decade, latest gadgets include Swiss balls, air discs, wobble boards and suspension trainers.

Unstable exercises require large amounts of work by muscles other than the prime mover to control the movement (synergists and fixators). This leads to an increase in muscles used but can reduce the workload on prime movers.

An example of making an exercise unstable would be a development with a client from a chest press machine to a barbell bench press, to a dumb bell bench press as the client becomes more familiar with movement patterns. This can then be progressed by using a Swiss ball as the platform to create an unstable bench to lay on.

It may be more suitable for a beginner to used fixed path resistance machines at the start of an exercise programme to reduce the risk of injury and to increase proprioception on new exercise movements.

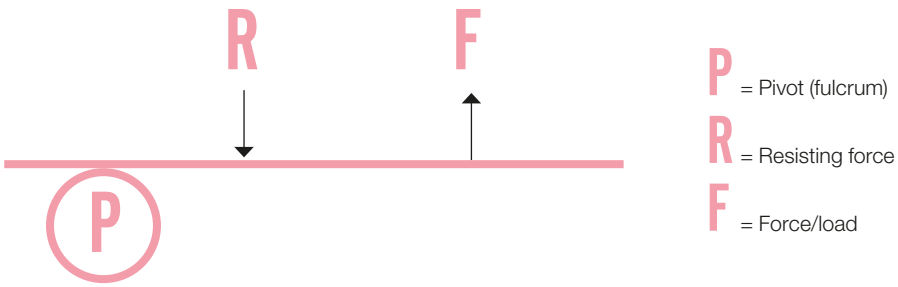


Reduction in stability

**Figure 4.4** exercise progressions through reduction in exercise stability

**Lever Length** – A lever is a rigid rod or bar to which a force may be applied to overcome a resistance. The lever is free to turn about a fixed support called the fulcrum.

Below is an example of a second class lever:




**HELPFUL HINT**

In a press up the lever length can be increased by lengthening the distance between the fulcrum and the main force. As a beginner a box press up would be the easiest regression followed by a ¾ press up and finally a full press up.



Box press up | 3/4 press up | Full press up

Progression of a press up

**Figure 4.5** exercise progressions through increased lever length

**Range of movement** – Training through a full range of movement allows the client to work muscles to their full length. This promotes flexibility and as discussed in the speed of repetition section, increases muscle time under tension. Training through a partial range of movement cuts time under tension and will allow the client to use more weight in a specific section of an exercise. This can lead to a client using a weight that can create poor form. The only time training through a full range of motion may be detrimental is if you are training around an injury.

**Gravity** – Is a force applied to us at all times. This can be increased by adding weight to a movement, which could be through a resistance machine, free weight or by changing the body angle.

**Time** – To progress an exercise programme using time, cardiovascular elements and isometric contractions could be completed for a longer duration. Resistance training would involve completing more repetitions or sets to increase the muscles time under tension.

**Type** – Types of exercises can be used to increase muscle stimulation and to add a variety of training for the participant. For example you may use body weight dips rather than tricep extensions or use a cross trainer rather than a treadmill.

**HELPFUL HINT**

It is important for the instructor to understand that by increasing the speed of movement, lengthening the lever and increasing the resistance, any postural abnormalities will be exaggerated. For some clients progression will be a slow process but is essential to reduce the risk of injury!

# PROGRESSION AND PERIODISATION

Progression will occur when the overload principle is applied to an exercise programme. This will ensure that the body continues to adapt to the stress placed upon it.

Periodisation allows us to make informed decisions regarding our successes and how to make direct improvements for future development.

From evaluations made on training progress (fitness testing) it will be clear to see whether a new cycle of training or stimulus is needed to progress with the bodies adaptations. If the client remains within a stage or cycle of training then they are likely to plateau. This can lead to a reduction of results and a client that is unmotivated. Once a new training stimulus is introduced, adaptations will continue.

**Plateau/New Training Stimulus Chart**

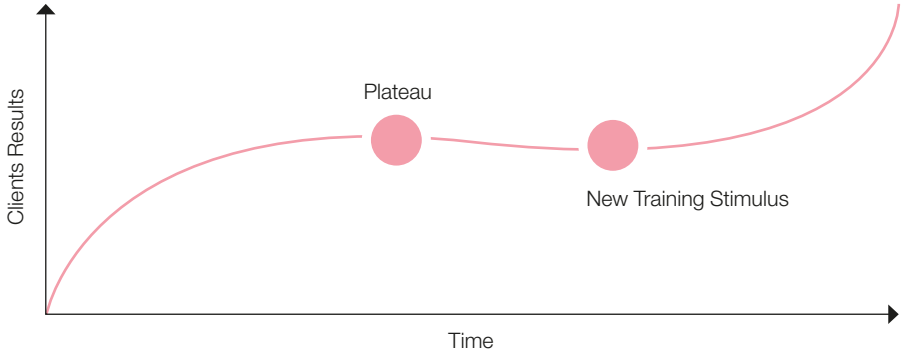



**Figure 4.6** exercise plateau continuum

## OVERTRAINING

An exercise programme requires a balance between overload and recovery. Too much overload and/or too little recovery may result in symptoms of overtraining syndrome. It is important that rest and recovery are planned within an exercise programme.

If the fitness professional recognises these symptoms with the client, the programme should be immediately regressed to allow the client to recover fully.

| Symptoms of Over Training | | |
|---|---|---|
| **Training** | **Physiological** | **Psychological** |
| Decreased speed | Continual DOMS | Increase irritability |
| Decreased strength | Increased resting heart rate | Anger |
| Reduced co-ordination | Increased weight loss | Loss of concentration |
| Increased fatigue | Feeling fatigue | Lack of enthusiasm |
| Elevated heart rates | Increased injury rate | Increase in stress |
| Delayed recovery | Frequent illness i.e. colds | Can lead to depression |

**Table 4.4** symptoms of overtraining

# APPLYING THE PRINCIPLES AND VARIABLES OF FITNESS TO AN EXERCISE PROGRAMME SUMMARY OUTCOMES

## CAN YOU NOW...

- [ ] Describe the importance and reasons for a warm up and cool down
- [ ] Identify the implications of specificity, overload, reversibility, adaptability, individuality and recovery
- [ ] Explain the principles of FITT, modification and progression for each component
- [ ] Explain how to recognise when and how to regress a training programme
- [ ] Describe the effect speed and intensity has on posture
- [ ] Describe the effect of levers, gravity and resistance on exercise
- [ ] Describe the differences between programming exercise for physical fitness and for health benefits




## TASK 3.1

List the principles of training:

| | |
|---|---|
| 1 | 4 |
| 2 | 5 |
| 3 | 6 |

## TASK 3.2

Match the FITT principles to the correct statements:

| | |
|---|---|
| **Frequency** | The duration of a given session |
| **Type** | The choice of activity |
| **Time** | The level of work performed during an activity session |
| **Intensity** | The number of exercise sessions in a set period |



## TASK 3.3

Complete the following table with the cardiovascular training guidelines for a healthy adult:

| Training Goal | Cardiovascular |
|---|---|
| Intensity | |
| Load as % of 1 RM | N/A |
| Reps / Duration | |
| Recover between Sets | N/A |
| Sets per Exercise | 1 |
| Frequency per Muscle Group | |

## TASK 3.4

List 8 methods of exercise programme progressions:

| | |
|---|---|
| 1 | 5 |
| 2 | 6 |
| 3 | 7 |
| 4 | 8 |



UNIT 4

4

# MONITORING EXERCISE INTENSITY

**By the end of this section you should be able to…**

Describe the benefits of monitoring exercise intensity

Identify the limitations of the methods of monitoring intensity

VITAL FACTS

RPE = Rate of Perceived Exertion

# METHODS TO MONITOR EXERCISE INTENSITY

As an exercise professional it is key that you have the ability to monitor your clients working intensity and make adaptations as necessary. Having the ability to judge working intensities will ensure that you as an instructor are working in the correct way with your client to reach targets and goals. Working intensities apply to both cardiovascular and resistance training methods. There are a variety of methods in which an instructor can monitor intensity.

**RPE** – Stands for the rate of perceived exertion and is measured on a scale of 6 (No exertion at all) to 20 (Maximal exertion) with the client indicating a figure according to exercise intensity.

Although this is a subjective measure, a high correlation exists between a person's perceived exertion rating and the actual heart rate during physical activity; so a person's exertion rating may provide a fairly good estimate of the actual heart rate during activity (Borg, 1998).

| Number on Borg Scale | HR Estimation | Intensity Suggestion |
|---|---|---|
| 6 | 60 BPM | No exertion |
| 7 | 70 BPM | Extremely light |
| 8 | 80 BPM | Very Light |
| 9 | 90 BPM | |
| 10 | 100 BPM | |
| 11 | 110 BPM | Light |
| 12 | 120 BPM | |
| 13 | 130 BPM | Somewhat hard |
| 14 | 140 BPM | |
| 15 | 150 BPM | Hard (Heavy) |
| 16 | 160 BPM | |
| 17 | 170 BPM | Very hard |
| 18 | 180 BPM | |
| 19 | 190 BPM | Extremely hard |
| 20 | 200 BPM | Maximal exertion |

**Table 4.5** Borg 6-20 RPE Scale



A more commonly used version of the this scale has been developed, and is called the Borg CR10 Scale, which runs from 1-10, and relates to a 'how do you feel' scale. This scale can be seen below:

| Borg CR10 Scale | Intensity Suggestion |
|---|---|
| 1 | Very Light Activity – Anything other than sleeping. Watching TV, riding in a car etc. |
| 2 | Light Activity – Feels like you can maintain for hours. Easy to breathe and hold a conversation |
| 3 | |
| 4 | Moderate Activity – Feels like you can exercise for prolonged periods. Increased breathing rate and can hold a short conversation |
| 5 | |
| 6 | |
| 7 | Vigorous Activity – On the verge of becoming uncomfortable. Short of breath, can speak a sentence |
| 8 | |
| 9 | Very Hard Activity – very difficult to maintain exercise intensity. Heavy breathing and can speak a single word |
| 10 | Max Effort Activity – feels almost impossible to keep going. Completely out of breathe, unable to talk |

**Table 4.6** Borg CR10 RPE Scale

### HELPFUL HINT

There are 2 main methods we used to moniter exercise intensity:

Borg Scale - 6-20

Borg CR10 Scale - 1-10

## HEART RATE/KARVONEN METHOD

The Target Heart Rate or Training Heart Rate (THR) is a desired range of heart rate reached during aerobic exercise which enables the heart and lungs to receive the most benefit from a workout. The THR can be calculated as a range of 65%-85% intensity.

Heart rate (HR) – Is the number of heart beats per minute, resting heart rate (RHR) is the amount of beats at rest. Maximum HR is calculated by taking your age from 220 (HRmax = 220 - age). Although this is not completely accurate, it can be used as a basic guideline by fitness professionals to find the percentage of maximal heart rate and enable training in the clients THR.

However the Karvonen method of calculating target heart rates (THR) is one of the most effective methods as long as the maximum heart rate is accurate as it takes into account resting heart rate. The formula is:

$$THR = (HRmax - HRrest) \times \%\ intensity\ (0.65\ to\ 0.85) + HRrest$$

## HEART RATE TRAINING ZONES

| | | Exercise Zones | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Age | | | | | | | | | |
| | | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 65 | 70 |
| Beats per minute | 100% | 200 | 195 | 190 | 185 | 180 | 175 | 170 | 165 | 155 | 150 |
| | | VO2 Max (Maximum effort) | | | | | | | | | |
| | 90% | 180 | 176 | 171 | 167 | 162 | 158 | 153 | 149 | 140 | 135 |
| | 80% | Anaerobic (Hardcore training) | | | | | | | | | |
| | | 160 | 156 | 152 | 148 | 144 | 140 | 136 | 132 | 124 | 120 |
| | 70% | Aerobic (Cardio training/endurance) | | | | | | | | | |
| | | 140 | 137 | 133 | 130 | 126 | 123 | 119 | 116 | 109 | 105 |
| | 60% | Weight control (fitness/fat burn) | | | | | | | | | |
| | | 120 | 117 | 114 | 111 | 108 | 105 | 102 | 99 | 93 | 90 |
| | 50% | Moderate activity (maintenance/warm up) | | | | | | | | | |
| | | 100 | 98 | 95 | 93 | 90 | 88 | 85 | 83 | 78 | 75 |

**Figure 4.7** heart rate training zones

### VITAL FACTS

Pro-active instructors use a combination of 3 ways to monitor their clients:

- RPE check
- Talk test
- Observation

## TALK TEST

This is a simple test that does not require any equipment or client knowledge, this simply involves the client responding/communicating to the trainer. As the activity increases, the clients breathing will become deeper and there will be larger pauses between words/sentences. The talk test can be used along with observations on both technique and colour to the face, but should not be used as a sole method of checking exercise intensity due to its subjective nature.

1. Light breathing and able to talk easily – light activity
2. Deeper breathing with small pauses within sentences – moderate activity
3. Deep breathing with large pauses within sentences – vigorous activity

## OBSERVATION

This is another simple method in which the trainer uses basic observation on the client. Technique will be a key indicator on the exercise intensity. If the clients form becomes poor this can indicate the working intensity is too hard or becoming difficult. The second observation can be on the client's appearance, have they changed colour, are they sweaty? However this does vary from client to client and is not always an accurate measure on working intensity.

# MONITORING EXERCISE INTENSITY SUMMARY OUTCOMES

## CAN YOU NOW...

Describe the benefits of monitoring exercise intensity ☐

Identify the limitations of the methods of monitoring intensity ☐




## TASK 4.1

List 4 methods of monitoring clients:

| | |
|---|---|
| 1 | 3 |
| 2 | 4 |

## TASK 4.2

Complete the following Borg Table, by filling in the blanks:

| Number on Borg Scale | HR Estimation | Intensity Suggestion |
|---|---|---|
| 6 | 60 BPM | No exertion |
| 7 | 70 BPM | Extremely light |
| | 80 BPM | Very Light |
| 9 | 90 BPM | |
| | 100 BPM | |
| 11 | 110 BPM | |
| 12 | 120 BPM | |
| | 130 BPM | Somewhat hard |
| 14 | 140 BPM | |
| 15 | 150 BPM | Hard (Heavy) |
| 16 | 160 BPM | |
| | 170 BPM | |
| 18 | 180 BPM | |
| 19 | 190 BPM | Extremely hard |
| 20 | 200 BPM | |

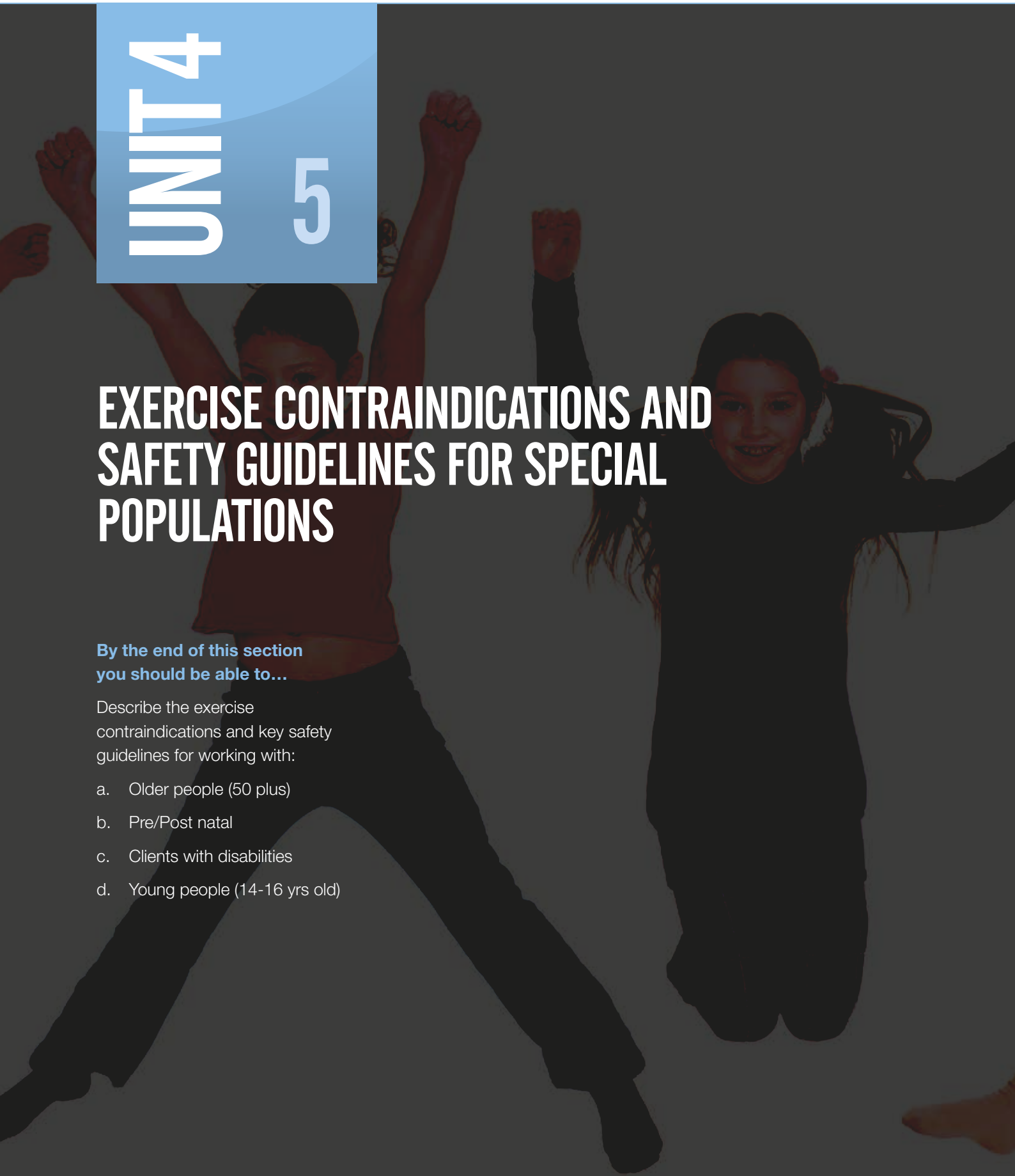




UNIT 4

5

# EXERCISE CONTRAINDICATIONS AND SAFETY GUIDELINES FOR SPECIAL POPULATIONS



**By the end of this section you should be able to…**

Describe the exercise contraindications and key safety guidelines for working with:

a. Older people (50 plus)

b. Pre/Post natal

c. Clients with disabilities

d. Young people (14-16 yrs old)




# EXERCISE CONTRAINDICATIONS FOR SPECIAL POPULATIONS

Special populations is a term used to describe participants that require expertise and supervision to overcome their situation and allow safe/effective exercise. There are 4 main population groups:

1. Older people (50 plus)
2. Pre/Post natal
3. Clients with disabilities
4. Young people (14-16 yrs old)

Contraindications are in place wherever there is an increased risk of harm or injury in any given exercise or activity, regardless of age, skill level or ability. They should be identified at the consultation phase through either interview or questionnaire (via the PAR-Q). Contraindications will exclude participants from exercise or activity until they have clearance to commence or continue, which usually requires GP referral.

Adaptations and special considerations may need to be applied to programmes when working with special population groups within the exercise environment.

# OLDER ADULTS

This relates to clients aged 50 or above. 50 is the recognised age when there is a reduction in the safety margins relating to exercise and a thorough pre-exercise screen is essential prior to activity. Regarding clients over 50 it has been noted that 4 out of 10 older adults have a chronic disorder that results in a functional limitation (Blocker, 1992).

40 is the approximate age that the ageing process begins and at 50 is when it starts to progressively affect the musculoskeletal, cardiovascular and neuromuscular systems, meaning that adaptation of exercise needs to be considered. Relaxation of these guidelines for highly trained or active individuals needs to be taken at the clients own risk, as regardless of appearance and fitness levels the life course and ageing process is already underway.

## PHYSICAL ADAPTIONS

From the age of 40 there is a reduction in physical capacity, around 1-2% loss per year, which effects:

- **Muscular Strength** – fewer, smaller and weaker muscle fibres
- **Power** – fewer fast twitch muscle fibres, smaller, weaker and slower
- **Bone Density** – thinner, more brittle bones, with less ability to withstand high impact/fracture
- **Aerobic Capacity** – fewer capillaries, less elastic vessels and reduced intake, uptake and utilisation of oxygen, increased heart rate and blood pressure
- **Balance and Co-ordination** – less sensory input, less postural stability, resulting in less co-ordination
- **Flexibility & Motor Skills** – stiffer joints, reduced range of movement and a reduction in daily activities i.e. getting up and down from the floor and seated positions

## SENSORY & COGNITIVE DECLINES

There are declines in performance of sensory function including:

- **Sight and Hearing** – reduced visual and aural ability
- **Motor Learning** – reduced ability to learn new skills
- **Reduction in Short Term Memory**

## EXERCISE GUIDELINES

As an instructor working with older adults there are some key guidelines to ensure the safe participation in exercise and physical activity.

- Clients should complete a detailed pre-screen, medical questionnaire and lifestyle analysis (and if over the age of 69 should have clearance to exercise). Completing this process will establish whether they are ready to participate or whether they should seek further medical assessment and referral prior to commencing an exercise programme
- It is important to complete a longer and more gradual warm up (approximately 15 minutes) and carry out more joint mobility exercises, especially if they have joint issues i.e. osteoarthritis
- When planning the main components of the programme the instructor should keep the intensity challenging but work within the guidelines for health related fitness. Regularly using and checking intensity, via the RPE scale and talk tests
- At the end of the session build in a longer and gradually tapered cool down, in order to assist in reducing heart rate and to avoid adverse cardiovascular events

In addition to these adaptions and changes, instructors should also be aware of, and encourage older adult clients to:

- Take more time during change of positions and exercises, especially floor to standing or vice versa
- Use correct technique and maintain good form to prevent injury or risk to themselves
- Adapt exercises to simplify, especially if they are new to the client, so that they can learn them from the easy position, lightest resistance and slowly progress from there
- Avoid motor skill exercises to avoid falls and injury risk as well as those exercises where there is a quick transfer of weight, high impact or long periods spent on one leg
- Avoid exercises that directly load the spine and exercises that require rotation/ flexion of the spine

### HELPFUL HINT

Warm up time should be increased.

Main components should be focused on health/endrance benefits

Cool down time should be longer and taper off slowly





# PRE AND POST NATAL

The following guidance relates to normal, adult women who are, or have experienced a normal and healthy pregnancy or birth. In the majority of cases exercise is safe for both the mother and baby, and at the correct intensity is not associated with complications or an adverse pregnancy outcome.

## A BRIEF OVERVIEW OF PREGNANCY

Pregnancy is divided into three periods (called Trimesters):

**1st Trimester (first 3 months) 1 - 12 weeks** – this is the phase with the highest risk of miscarriage, and often the time when women suffer from morning sickness, but experience of this varies greatly.

**2nd Trimester (second 3 months) 13 - 25 weeks** – this is the phase when most women feel pretty good. Morning sickness has normally stopped but the 'bump' isn't large or heavy enough to cause postural problems and back pain yet.

**3rd Trimester (third 3 months) 26 - 40/42 weeks** – the final phase of pregnancy when the foetus does the majority of its growing and a woman's energy requirements can increase by as much as 200-300 Kcal per day. Exercise intensity will need to decrease at this time and may not be possible due to sciatica or low back pain caused by postural changes.

The postnatal period is divided into two phases:

The immediate post natal period is 0 - 6 weeks. After 6 weeks women will have a post natal check with their GP, to ensure they have recovered from the birth and are able to return to exercise after this period with the GP clearance.

The extended post natal period is 7 weeks to 1 year.

## PRE AND POST NATAL EXERCISE CONSIDERATIONS

Women who have not previously exercised before pregnancy should be cautious, and begin exercise with only 15 minutes continuous low to moderate aerobic exercise, gradually building up to 30 minutes continuous low to moderate aerobic exercise, which should be monitored closely.

It is important for pregnant women to remain hydrated and avoid exercising in hot or humid conditions. They must ensure they have consumed sufficient calories, and not to exercise for longer than 45 minutes.

Women should be advised to monitor exercise according to 'how they feel' and using the talk test, rather than heart rate. Women during pregnancy and exercise should also avoid:

- Exercising in the supine position after 16 weeks of pregnancy
  The inclined position is likely to be a successful alternative to flat supine
- Exercising prone
- Prolonged, motionless standing
- Heavy, uncontrolled, isometric or prolonged resistance work above the head
- Leg adduction and abduction against a resistance
- Isometric exercises
- Loaded forward flexion
- Rapid changes of direction or position
- Uncontrolled twisting
- Exercise with a risk of falling or abdominal trauma
- Excessive and uncontrolled de-stabilisation techniques

### VITAL FACTS

Women should be cautious when exercising when pregnant and especially if new to exercise, but can exercise with correct supervision

Pregnant women should immediately stop exercising if they experience:

- Dizziness, faintness or nausea
- Bleeding or leakage of amniotic fluid
- Abdominal or contraction type pain
- Unexplained pain in the back, pelvis, groin, buttocks or legs
- Excessive shortness of breath, chest pain or palpitations

Hormonal and postural changes make pregnant women vulnerable to injury, joint misalignment, muscle imbalance and motor skills decline, especially if they are genetically hypermobile. These changes may start from very early on in pregnancy and gradually become more significant as pregnancy progresses.

A woman should be referred to a health professional if she is experiencing any of the following symptoms post-birth:

- Stress incontinence or pelvic floor muscle weakness
- "Dragging" pain or a feeling of heaviness in the lower abdominal or pelvic floor area
- Groin, low back pain or difficulty walking, even if mild and intermittent
- Abdominal muscle weakness, excessive abdominal doming, abdominal muscle separation or softness/sinking at the umbilical mid-line, umbilical hernia

As an instructor it is also important to understand that there are benefits to exercising safely and regularly during pregnancy:

- Helps to promote healthy lifestyle habits
- Can alleviate many symptoms of pregnancy
- Can increase self-esteem & feelings of well-being
- Increases endurance levels, which may help during labour
- May decrease the time spent in active phase of labour
- Can help reduce stress and pain in labour
- Is associated with an improved recovery from labour
- Can help with maintaining good posture and therefore reduce back pain
- May improve sleeping patterns
- Can prevent stress incontinence
- Facilitates a quicker return to pre-pregnancy weight, strength & flexibility levels

### MYTH BUSTER

There is no such thing as eating for 2

Energy intake may increase by around 150-300 kcals per day

# CLIENTS WITH DISABILITIES

## AN INTRODUCTION TO DISABILITIES

The World Health Organisation – WHO (2012) explains that 'disabilities' is an umbrella term covering impairments, activity limitations, and participation restrictions.

"An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations. Thus disability is a complex phenomenon, reflecting an interaction between features of a person's body and features of the society in which he or she lives." (WHO, 2012)

It is important as an instructor to understand that many disabled people find they experience barriers to accessing sufficient physical exercise for psychological, physical or social reasons.

It is widely recognised that regular and planned physical activity in a safe and supportive environment may not only help disabled clients in the same range of ways as for non-disabled clients, but it may also reduce the risk of gaining additional disabling conditions, improve the ability to perform activities of daily living that might previously have been difficult, and maintain or even improve independence.

## VITAL FACTS

Exercise may help with disabilities to improve daily activities, maintain/improve independence, reduce the risk of further disabling conditions

## LEGISLATION

### The Disability Discrimination Act (DDA) 1995

It is unlawful to refuse to serve a disabled person, provide a lower standard of service, or offer a less favourable service to a disabled person. Service providers must make "reasonable adjustments" to their facilities and services so that they are accessible to disabled people. Adjustments to buildings and services must be made in anticipation of attendance of disabled people, it is not reasonable for disabled people to be asked to wait until adjustments have been made. This may include providing extra help when required, but does not include automatically providing an additional service that is not required.

Exemption from the DDA is justified for the following reasons:

- If by meeting the needs of the disabled person the health and safety of any person, including the disabled person, is endangered
- If by serving the disabled person the service provider is unable to serve others (not including a delay or inconvenience to others)
- If the disabled person is unable to enter into a legally enforceable agreement, or give informed consent
- If providing a service to disabled people on the same terms as to other people means that it would not be possible to offer the service at all, or if a higher charge would have to be made to others

## DISABILITY CONSIDERATIONS

The benefits of exercise for people with disabilities generally outweigh the concerns, and with the correct guidance and advice these concerns can be overcome. It is important you focus on what clients can do rather than what they cannot do. To programme a safe and effective session it is important to recognise the following issues:

### Physical Disabilities

There are a wide range of physical disabilities that can effect the safety and effectiveness of the session. It is therefore important when prescribing exercise programmes that the instructor adapts and selects exercises specific to the clients' needs and capability.

Some physical disabilities are classified as progressive, this means that the condition develops and worsens over time. An example of this is multiple sclerosis. Progressive disorders require careful monitoring, to ensure that the exercise and activities prescribed are not causing the condition to worsen or develop more quickly.

There are other physical disabilities which present asymmetrical weakness, which means that there is a difference in strength or control between the left and right sides of the body. An example of this includes a stroke or cerebral palsy. The instructor should aim to improve the affected side of the body as much as possible whilst working the unaffected side. Be aware that improvement in the affected muscles is greatly reduced if the nerves controlling the affected side have been partially or completely damaged.

### Spasticity

The majority of individuals with physical disabilities will have some degree of spasticity, spastic muscles being very tight or rigid, which means that flexibility training is essential in their programmes. It is important though for the instructor, before including any flexibility training, to gain authorisation and further advice from a suitable trained medical authority on the best practice to stretch a spastic muscle without causing further trauma or injury.

## Neurological Conditions

Neurological disorders are diseases of the central and peripheral nervous system. They can affect the brain, spinal cord, cranial nerves, peripheral nerves, nerve roots, autonomic nervous system, neuromuscular junction and muscles.

| Condition | How It Affects the Client |
|---|---|
| Arthritis | A degenerative joint disease characterised by the progressive loss of joint cartilage<br>Symptoms can include pain and stiffness, restricted movement, joint swelling, tenderness, crepitus (crackling noise on movement) or swelling of structures surrounding the joint |
| Asthma | Chronic inflammatory disorder of the airways<br>Symptoms can include chest tightness, shortness of breath and wheezing |
| Diabetes | Can be present in both type 1 and type 2 forms, and occurs when there is an increased resistance or deficiency in insulin<br>Symptoms can include, increased requirement for hydration, increased sweating from the upper body and hyperglycaemia |
| Depression | 'Depression is a psychiatric disorder that ranges from episodes of unhappiness that affect most people from time to time, to persistent low mood and inability to find enjoyment' (Biddle and Mutrie, 2001)<br>Symptoms can include low energy levels, weight loss and a loss of interest in activity |
| Multiple Sclerosis | A chronic and unpredictable progressive disease that affects the nerves in the brain and spinal cord<br>Symptoms can include fatigue, muscle weakness/stiffness, altered sensation/sensory difficulties e.g. tingling, numbness, burning, balance and co-ordination difficulties |
| Osteoporosis | A loss in bone mass resulting in porous bone<br>Symptoms include a higher chance of bone fractures. If present in the spine abnormalities to posture and breathing may result |
| Parkinson Disease | Parkinson's Disease (PD) is a long term, progressive neurological disorder affecting motor control<br>Symptoms can include a slowing of movements, balance problems, tremors or muscle stiffness |
| Strokes | A stroke occurs when the blood supply to part of the brain is suddenly stopped, which can cause motor/sensory impairments, speech, language and visual problems |
| Obesity | The fundamental cause of obesity is consuming more calories than are expended in everyday life (National Audit Office, 2001)<br>Symptoms can include high blood pressure, increased joint pain and breathlessness |

**Table 4.7** outlines of a variety of disability conditions



A result of this is that muscles become progressively weaker as a result of the decline in the central nervous system functioning. Examples of neurological conditions are muscular dystrophy, Parkinson's disease, epilepsy and Alzheimer's disease. Exercise can help to offset this and programmes should focus to work on general fitness levels, but if there is any rapid decline in function the client should be referred to their GP for guidance.

### Damage to Sensory Nerves

This occurs with many types of physical disabilities. Since this may result in an inability to detect pressure against the skin, left untreated, it can result in a pressure sore. It is generally recognised that the use of a wheelchair increases the risk of developing pressure sores, and so the client will already be aware of the importance of frequent checks. However, the instructor should make the client aware that the use of gym equipment may bring similar associated risks and so extra checks should be made.

### Depression

Depression is a common secondary condition resulting from an individual's physical and psychological challenges of living with a disability. Occasionally, depression can cause a person to drop out of the programme.

These are some of the common conditions that the fitness instructor may come across. Table 4.7 (previous page) details some more conditions, but if they are in doubt of their ability to work safely and effectively with anyone they should refer to a medical professional for advice and further guidance.

# YOUNG PEOPLE

When training young people it is important to consider physiological and psychological maturity levels, which include:

## CARDIO-RESPIRATORY SYSTEM IN RELATION TO CHILDREN

During childhood the cardio respiratory system is developing, and therefore instructors need to be aware of the risk factors of training children at high intensities.

Lung volume and peak flow rates will steadily increase until fully grown. Children have an inferior pulmonary function. This means there is reduced ventilation rate (air in and out of the lungs) compared to adults, resulting in a higher breathing rate around 60 breaths per min compared to 40 breaths per min in adults for the equivalent level of exercise.

Children have a reduced cardiovascular function due to having a reduced size in the chambers of the heart. This in turn reduces stroke volume and to compensate they have an increased heart rate. This means their heart has to work harder to sustain cardiac output compared to an adult.

These two factors combined have a direct effect on children's ability to sustain long periods of vigorous activity, due to their reduced aerobic capacity. As an instructor, long periods of vigorous aerobic activity should be avoided or regular rest periods should be factored in.

Anaerobic exercise capacity is reduced due to lack of muscle mass and liver capacity to store and produce glycogen and creatine phosphate. Therefore they are unable to generate as much anaerobic work.

## BODY TEMPERATURE AND DEHYDRATION

Children have inferior cooling mechanisms due to lower blood volume and a higher skin temperature. They are sensitive to heat stress because they expend more energy per kilogram of bodyweight than an adult during exercises.

### VITAL FACTS

Children are not small adults!!

Their anatomy and physiology is different from mature adults.



Adolescents are at risk of dehydration when exercising due to overheating. In the cold, they lose heat more quickly due to their relatively large surface area compared to their mass.

The implications for the instructor are:

- give regular water breaks
- the warm up component may need to be less intense and shorter than an adults
- the cool down component may need to be shorter than an adults
- active rests may have to be given in between bouts of vigorous activity

## MUSCULOSKELETAL SYSTEM

A major concern with the development of a child's musculoskeletal system, is damage and trauma to the growth cartilage and epiphyseal growth plate fractures. These fractures are more common in boys than girls, and occur around the age of 14-16. These types of fractures and damage occur between the shaft and head of the bone around the growth area.

The instructor should understand that when prescribing exercise to young people:

- it is extremely important to avoid excessive training. This includes playing too much of one sport, playing the wrong sport for their body type or using too heavy a weight in weight training
- it is important to remember the gender differences and the differing stages of development within the same sex
- inappropriate size matching in pairs should be avoided
- avoid too many high impact moves on the spot
- always teach an appropriate warm up and cool down
- always provide appropriate equipment for the activity e.g. correct size, weight

Children's muscles do not grow at the same rate as bones, so caution should be taken when planning and prescribing flexibility and resistance training with younger people. In relation to flexibility, children have not gained enough motor skills to develop their flexibility with good technique. Therefore, there is an increased risk of injury due to lack of understanding of stretching tension. Resistance training should focus on endurance, with a consistent tempo ensuring good technique and full range of movement. Any maximal or near maximal lifting or training should be avoided until full musculoskeletal maturity. It is therefore important as an instructor not to build unrealistic expectations of hypertrophy.

## VITAL FACTS

Growth plate fractures are most common between the ages of 14-16.

## TRAINING YOUNG PEOPLE OVERVIEW

Although infrequent, it is important to be aware of the risk of injury for younger people when taking part in physical activity. Potential injuries during activity fall into one of two categories, impact and non-impact.

Impact injuries (most common as a result of contact sports or falls)

- There is little we can do to prevent impact injuries as they are usually accidental. However, if safety equipment is available this should be used at all times along with careful planning of activities

Non-impact injuries (often affect young adults who participate in large amounts of physical activity)

- These could include sprains, strains, or traction injuries like Osgood Schlatters or Sever's disease
- A well structured training programme that avoids excessive, long duration or repetitive loading of the same body part will help to reduce the risk of these types of injuries

The moderate risks of injury are normally outweighed by the enormous health, fitness, psychological and social benefits younger adults gain by taking part in physical activity.

Please note that the Level 2 Certificate in Fitness Instructing qualification does not qualify you to work on a regular basis with individuals or groups of special population clients. This unit is intended to equip you with a basic understanding of the needs of these population groups in the event that you are confronted by them as part of your role as a fitness instructor.



# EXERCISE CONTRAINDICATIONS AND SAFETY GUIDELINES FOR SPECIAL POPULATIONS SUMMARY OUTCOMES

## CAN YOU NOW...

Describe the exercise contraindications and key safety guidelines for working with:

a. Older people (50 plus)

b. Pre/Post natal

c. Clients with disabilities

d. Young people (14-16 yrs old)






## TASK 5.1

Using the information in this section; identify suitable adaptions for each of the following special population groups. For each exercise category select an exercise of your choice to adapt:

**Think about the factors that affect safe participation and how you could adapt the exercise to maintain an effective workout?**

| | **Cardiovascular Machine** |
|---|---|
| 14-16 Year Olds | |
| Older Adults | |
| Pre/Post Natal Client | |
| Disability Group | |

| | **Resistance Machine** |
|---|---|
| 14-16 Year Olds | |
| Older Adults | |
| Pre/Post Natal Client | |
| Disability Group | |

| | Free Weight Exercise |
|---|---|
| 14-16 Year Olds | |
| Older Adults | |
| Pre/Post Natal Client | |
| Disability Group | |

| | Body Weight Exercise |
|---|---|
| 14-16 Year Olds | |
| Older Adults | |
| Pre/Post Natal Client | |
| Disability Group | |



UNIT 4

6

# THE IMPORTANCE OF HEALTHY EATING

**By the end of this section you should be able to…**

Identify the common dietary sources of the key nutrients

Explain the dietary role of the key nutrients

Explain the importance of adequate hydration

Describe the national food model/guide

Describe key healthy eating advice that underpins a healthy diet

Describe the energy balance equation

Explain the health risks of poor nutrition

Explain professional role boundaries in relation to offering nutritional advice

KEY TERMS

**HEALTHY EATING**

Is the intake of food that promotes optimal function of the structures and systems of the human body.

# HEALTHY EATING

As a fitness professional it is important that the benefits of healthy eating are understood. Healthy eating not only supplements an exercise programme to achieve results, but also benefits in general health. Eating a well-balanced diet can aid in weight loss, increase energy levels and help repair muscle tissue following exercise.

Poor diet can progress and develop diseases such as obesity, osteoarthritis, coronary heart disease (CHD), strokes, type 2 diabetes and some forms of cancer such as colorectal cancer and post-menopausal breast cancer. It can also contribute to a variety of other risk factors such as high blood pressure and high cholesterol.

Poor diet and nutrition are recognised as major contributory risk factors for ill health and premature death (NHS Statistics on obesity, physical activity and diet: England, 2011)

## PROFESSIONAL ROLE BOUNDARIES IN OFFERING NUTRITIONAL ADVICE

As part of a fitness instructor role, the instructor should not recommend diets but will be able to give generalised advice on healthy eating for a 'normal healthy individual' to improve their current nutritional intake. However for clients with more serious diseases and nutritional deficiencies, an instructor must refer the client to registered dieticians or nutritional therapists as appropriate, as they have the ability to further analyse the client and offer supplements if required.

**Registered Dieticians (RDs)** – Dieticians are the only qualified health professionals that assess, diagnose and treat diet/nutrition problems. The job role of a dietician is protected by law, the regulator is the Health Professions Council (HPC).

**Nutritionists** – A Nutritionist is not a protected term and can be used by anyone, however by registering with the UK Voluntary Register of Nutritionists (UKVRN) the term 'Registered Nutritionist' can be used. To be able to work with high risk patients they are supervised by a dietician.

**Nutritional Therapists** – Nutritional therapy is again not a protected term, they do however, have a voluntary register which is the Complementary and Natural Healthcare Council (CNHC). Nutritional therapists tend to work privately with clients on alternative/ complementary medicine.

## NUTRIENT GROUPS

The body requires a variety of fuels to provide energy to all cells, to allow organs to function and to help repair body tissues. We eat to provide this fuel and food contents can be classified into 2 main categories: Macronutrients which we need a higher quantity of and micronutrients which we require a smaller quantity of.

### MACRONUTRIENTS

Carbohydrates
Fats
Protein

### MICRONUTRIENTS

Vitamins
Minerals

# MACRO-NUTRIENTS

## Carbohydrates

There are 3 types of carbohydrate within the food we eat:

| Classification of Carbohydrate | Structure | Example of foods | Purpose in the body |
|---|---|---|---|
| Sugars | Simple structure easily broken down to provide energy quickly (glucose) | Fruit, sweets, jam and sugar | To provide quick release energy to the body, the brain is dependent on glucose to function |
| Starches | Complex build up releasing energy slowly | Vegetables, rice, pasta and potatoes | To provide a slow release of energy to fuel the body |
| Fibre | Indigestible and does not provide energy | Whole grains, beans and the skin of fruit and vegetables | Provides bulk in the digestive system pushing waste products through the digestive tract |

**Table 4.8** classification of carbohydrates

## Fats

There are 2 main classifications of fats within food:

| Classification of Fat | Types | Example of foods | Purpose in the body |
|---|---|---|---|
| Saturated | | Generally solid at room temperature except palm and coconut oil, includes butter, lard, fat from meat, eggs and dairy products | Helps cell and nervous system function, insulation under the skin, protection of vital organs and provide energy, as well as storage of vitamins A, D, E and K |
| Un-saturated | Poly-unsaturated<br>Mono-unsaturated | Nuts, seeds, fish and oils | Helps protect from heart disease (CHD) and aid in cell and brain function |

**Table 4.9** classification of fats

## Proteins

Amino acids are small structural units that make up proteins, there are 20 standard amino acids, 9 are called essential as the human body cannot synthesize them (create from other compounds) so they must be obtained from food we eat. The ll non essential can not be created within the body

We ingest protein from 2 sources:

| Classification of protein | Example of foods | Purpose in the body |
|---|---|---|
| Animal sources | Meat, poultry, fish, eggs and dairy products | The other 11 amino acids are non-essential which means that they can be synthesized by the body, providing sufficient amounts of the 9 essential amino acids are consumed |
| Plant sources | Nuts, seeds, beans and grains | |

**Table 4.10** classification of proteins

## MICRO- NUTRIENTS

Micro-nutrients are made up of a combination of many vitamins and minerals:

| Classification of micro-nutrient | Types | Example of foods | Basic purpose in the body |
|---|---|---|---|
| Vitamins | **A, B, C, D, E, K**<br>**B6, B12** | **A** – Dairy products and fish<br>**C** – Fruits and vegetables<br>**D** – Oily fish and eggs<br>**E** – Plant oils i.e. soya and olive oil<br>**K** – Green leafy vegetables<br>**B6** – Meat and wholegrain products<br>**B12** – Meat, fish and dairy products | **A** – Helps the immune system<br>**C** – Helps in cell protection<br>**D** – Helps regulate calcium to aid in bone and teeth growth<br>**E** – Helps in cell protection<br>**K** – Helps with blood clotting<br>**B6** – Helps form haemoglobin and helps energy release and store energy<br>**B12** – Helps red blood cell production and nervous system function |
| Minerals | **Calcium, phosphorus, iron, sodium, zinc, iodine and potassium** | **Calcium** – Green leafy vegetables and dairy products<br>**Phosphorus** – meat, fish and dairy products<br>**Iron** – Most dark-green leafy vegetables, meat and liver<br>**Sodium** – Salt<br>**Zinc** – Meat, milk and bread<br>**Iodine** – Fish and shell fish<br>**Potassium** – Meat, milk, nuts and seeds | **Calcium** – Hardening of bones / teeth<br>**Phosphorus** – Hardens bones and teeth/filters waste in the kidneys<br>**Iron** – Creates red blood cells<br>**Sodium** – Controls fluid levels in the body and helps nerve transmission<br>**Zinc** – Helps wounds heal and cell growth<br>**Iodine** – Helps create thyroid hormones, controls metabolism<br>**Potassium** – Controls fluid levels in the body |

**Table 4.11** classification of vitamins and minerals

### HELPFUL HINT

**MACRO-NUTRIENTS:**
Gives us our calories

**MICRO-NUTRIENTS:**
Allow us to efficiently digest the marco-nutrients

## WATER

Water is very important for both health and performance. As babies, we are made up of approximately 75 to 80% water and as we age this decreases to approximately 60 to 65% for men and 50 to 60% for women. We lose water every day through evaporation from the skin as sweat, expiration and in faeces/urine. The amount we lose can be dependent on the external environment, body temperature and physical activity.

The Department of Health recommends that we should drink about 1-2 litres of fluid every day. This is about six 200ml or eight 150ml glasses.

Dehydration occurs when the body loses more water than is taken in, and is measured in percentage of body weight lost. A loss of 10% can be fatal with as little as 1% affecting exercise performance.

## THE EATWELL PLATE

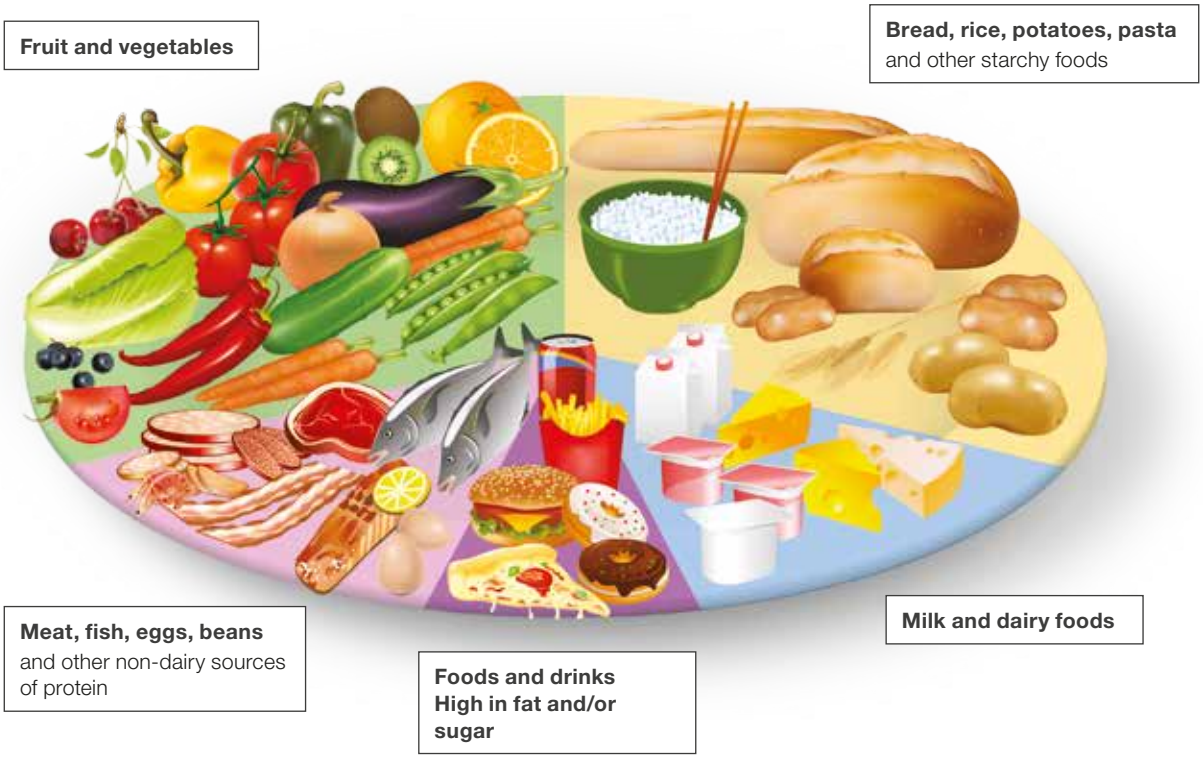



**Figure 4.9** FSA – Eatwell plate

The Eatwell plate provides basic, easy to understand guidelines as to what the general public should consume to ensure they have a healthy and well balanced diet. This simple guidance model was introduced in 2007 and is also supported by 8 specific healthy eating statements:

1. Base your meals on starchy food
2. Eat lots of fruit and vegetables (5 portions per day)
3. Eat more fish (2 portions a week, 1 oily)
4. Cut down on saturated fat and sugar
5. Try to eat less salt, no more than 6g a day
6. Get active and try to be a healthy weight
7. Drink plenty of water (6-8 glasses per day)
8. Don't skip breakfast

NOW TEST YOUR SELF...
Go to page 71

## MACRONUTRIENTS CALORIE CONTENT

| | |
|---|---|
| Carbohydrates | 4 calories per gram |
| Proteins | 4 calories per gram |
| Fats | 9 calories per gram |

Although not a macro nutrient it is important to know that:

| | |
|---|---|
| Alcohol | 7 calories per gram |

## GUIDELINES ON PORTION SIZES

As a fitness professional you may ask your client to fill out a food diary. It is important to explain how much food is equivalent to a portion size, as this will help both gauging current diet and advising what could be added. Generally a portion size is 80g for an adult or fist size if that's easier to measure for your client.

- Fruit – adult portion size is 80g
- Dried fruit – adult portion size is 30g
- Fruit/vegetable juice – adult portion size 150ml
- Vegetables – adult portion size is 80g

Below are some examples of fruit and vegetable portion sizes:

| Fruit Portions | | Vegetable Portions | |
|---|---|---|---|
| Apple | 1 medium apple | Beans | 3 heaped tablespoons |
| Apricot | 3 apricots | Cabbage | 3 heaped tablespoons |
| Avocado | Half an avocado | Carrots | 3 heaped tablespoons |
| Banana | 1 medium banana | Cucumber | 2 inch slice |
| Blackberries | 1 handful (9 to 10 blackberries) | Mushrooms | 13 button mushrooms |
| Blackcurrants | 4 heaped tablespoons | Onion | 1 medium onion |
| Cherries | 14 cherries | Parsnips | 1 large parsnip |
| Grapes | 1 handful | Peas | 3 heaped table spoons |
| Kiwi fruit | 2 kiwi fruit | Pepper | Half a pepper |
| Pineapple | 1 large slice | Radish | 10 radishes |
| Plum | 2 medium plums | Sweetcorn | 1 cob |
| Strawberry | 7 strawberries | Tomato | 1 medium or 7 plum tomatoes |

**Table 4.12** examples of fruit and vegetable portion sizes



## THE ENERGY BALANCE EQUATION

In its simplest form, the energy balance equation is meant to represent what does (or at least should) happen to the body, by looking at the difference between energy intake (from food) and energy output (physical activity). This highlights the importance of both diet and physical activity in the role of weight gain/loss.

Energy Input is greater than Energy Output = Weight gain

Energy Input is less than Energy Output = Weight loss

Energy Input is the same as Energy Output = Weight maintenance

Estimated Calorie Requirements (in kilocalories) for each gender and age group at three levels of physical activity.

| Gender | Age (years) | Activity Level | | |
|---|---|---|---|---|
| | | Sedentary | Moderately Active | Active |
| Child | 2-3 | 1,000 | 1,000 - 1,400 | 1,000 - 1,400 |
| Female | 4 - 8 | 1,200 | 1,400 - 1,600 | 1,400 - 1,800 |
| Female | 9-13 | 1,600 | 1,600 - 2,000 | 1,800 - 2,000 |
| Female | 14-18 | 1,800 | 2,000 | 2,400 |
| Female | 19-30 | 2,000 | 2,000 - 2,200 | 2,400 |
| Female | 31-50 | 1,800 | 2,000 | 2,200 |
| Female | 51+ | 1,600 | 1,800 | 2,000 - 2,200 |
| Male | 4-8 | 1,400 | 1,400 - 1,600 | 1,600 - 2,000 |
| Male | 9-13 | 1,800 | 1,800 - 2,200 | 2,000 - 2,600 |
| Male | 14-18 | 2,200 | 2,400 - 2,800 | 2,800 - 3,200 |
| Male | 19-30 | 2,400 | 2,600 - 2,800 | 3,000 |
| Male | 31-50 | 2,200 | 2,400 - 2,600 | 2,800 - 3,000 |
| Male | 51+ | 2,000 | 2,200 - 2,400 | 2,400 - 2,800 |

**Table 4.13** HHS/USDA dietary guidelines for Americans: 2010

### VITAL FACTS

**WEIGHT GAIN:**
Energy in ↑ Energy out ↓

**WEIGHT LOSS:**
Energy in ↓ Energy out ↑

**WEIGHT MAINTENANCE:**
Energy in = Energy out

# THE IMPORTANCE OF HEALTHY EATING

## CAN YOU NOW...

- Identify the common dietary sources of the key nutrients ☐
- Explain the dietary role of the key nutrients ☐
- Explain the importance of adequate hydration ☐
- Describe the national food model/guide ☐
- Describe key healthy eating advice that underpins a healthy diet ☐
- Describe the energy balance equation ☐
- Explain the health risks of poor nutrition ☐
- Explain professional role boundaries in relation to offering nutritional advice ☐




## TASK 6.1

Match the macronutrients to their role in the body:

| | |
|---|---|
| **Protein** | Provide us with Glucose for energy production in the body |
| **Carbohydrates** | Cell and nervous function, provide insulation, protection of vital organs, storage of vitamins A,D,E and K, energy production |
| **Fats** | Made up of amino acids, major role is to aid with growth and repair of body tissue |

## TASK 6.2

Identify good food sources for the following macronutrients:

| Carbohydrates | Fats | Proteins |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |



## TASK 6.2

Label the sections on the Eatwell Plate:



## TASK 6.4

The energy balance equation states (match the equations):

| | |
|---|---|
| **Weight Gain** | Energy input is greater than energy output |
| **Weight Maintenance** | Energy input is less than energy output |
| **Weight Loss** | Energy input is the same as energy output |

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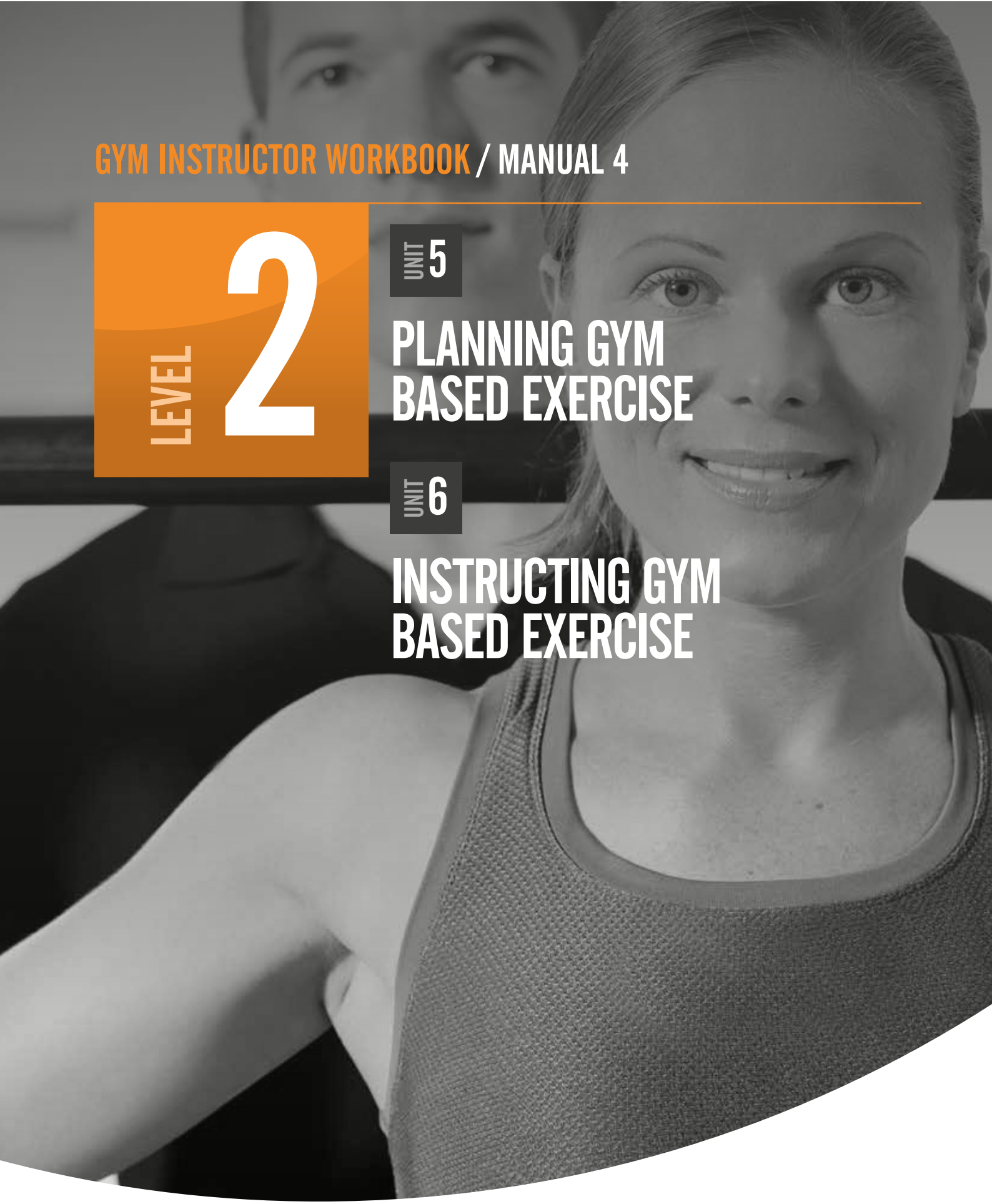


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GYM INSTRUCTOR WORKBOOK / MANUAL 4

LEVEL 2

UNIT 5

# PLANNING GYM BASED EXERCISE

UNIT 6

# INSTRUCTING GYM BASED EXERCISE

the training room



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UNIT 5

# PLANNING GYM BASED EXERCISE

**By the end of this section you will be able to...**

Understand how to collect client information to plan gym based exercise

Understand how to plan gym based exercise

Use client information to plan a safe & effective gym based programme with clients

# GATHERING INFORMATION TO PLAN GYM BASED EXERCISE

Planning prior to delivery of a gym-based session is essential to ensure a safe and effective session is carried out. Planning will enable the gym instructor to obtain the client's goals and will, therefore provide a reference for the development of programmes suitable to their needs and levels of fitness.

This plan may include young people in the 14-16 age range, provided they are part of a larger adult group, as well as working with individual older adults, ante/post-natal and disabled clients, provided the relevant contraindications and key safety guidelines are observed (as discussed in Unit 4).

The ACSM guidelines (2010) explain that most newcomers to exercise are apparently healthy individuals seeking to become fitter and lose weight. Furthermore, individuals who remain physically active are less likely to develop major chronic diseases such as heart disease, obesity and diabetes.

However, for some individuals exercise can actually have the opposite effect. Clients with chronic conditions, such as hypertension or CHD, will be at a higher risk during physical activity. The aim of gathering client's information and screening is to check the level of risk and know when to refer clients to other health care professionals.

For every client an instructor works with, a health and fitness profile should be obtained using techniques such as questionnaires, diaries and oral questioning. Decisions can then be made of the client's readiness for exercise, so that the most appropriate action can be taken. If a client is deemed unsuitable to undertake an exercise programme they can then be referred to the appropriate health care professional, such as a GP, to give medical clearance prior to starting.

It is stressed that instructors are not qualified to diagnose any medical conditions or rehabilitate clients from injury (unless they have a relevant professional qualification). This is beyond the gym instructor's scope of practice.

When planning exercise with clients there are four main stages to follow:

| STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 |
|---|---|---|---|
| Pre-Screen | Information Gathering | Fitness Tests | Programme Design |

# STAGE 1

## PRE-SCREENING

Once the client has decided to embark on a fitness programme it is the fitness professional's duty to pre-screen the client and gather any information required, i.e:

- To check the client does not have an obvious health risk
- To fully brief the client as to what is required in the programme and clarify that they are fully aware of what they are participating in and that they understand it is voluntary
- To gain further information on the clients exercise likes/dislikes, current fitness levels, previous fitness levels and goals

When collecting and pre-screening clients, the instructor should be aware of some important factors:

- All of the information gained should be relevant and up to date, and any changes to this information would be updated throughout the programme
- All client information and data collected should be stored safely and securely in line with the Data Protection Act 1998, and not be available or passed on to any third parties

## PAR-Q FORM

A physical activity readiness questionnaire or PAR-Q form is a common pre-exercise screening tool. There are many varieties of this form and they can vary from establishment to establishment. The main purpose of a PAR-Q form is to highlight any associated medical risks that could affect the client while taking part in an exercise programme. If any areas are highlighted, then the client should be referred to their GP.

## PAR-Q FORM (PHYSICAL ACTIVITY READINESS QUESTIONNAIRE)

The physical activity readiness questionnaire (PAR-Q) was created by the the Canadian Society for Exercise Physiology and is a self-screening tool that can be used by anyone who is planning to start an exercise programme. It should highlight any potential risks for the client when exercising and highlight when exercise is appropriate or those who should seek medical advice before commencing an exercise programme.

A PAR-Q form is a yes and no questionnaire. This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if the clients' condition changes so that they would answer YES to any of the seven questions.

A written PAR-Q form should be completed by everyone that enrols onto an exercise programme, a verbal PAR-Q should be completed prior to every session even if a written form has already been completed.

An example PAR-Q is outlined below:

| | | | |
|---|---|---|---|
| 1. | Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor? | Yes | No |
| 2. | Do you feel pain in your chest when you do physical activity? | Yes | No |
| 3. | In the past month, have you had chest pain when you were not doing physical activity? | Yes | No |
| 4. | Do you lose your balance because of dizziness or do you ever lose consciousness? | Yes | No |
| 5. | Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity? | Yes | No |
| 6. | Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart conditions? | Yes | No |
| 7. | Do you know of any other reason why you should not do physical activity? | Yes | No |

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity programme or a fitness appraisal, this section may be used for legal or administrative purposes.

**I have read, understood and completed this questionnaire.**
**Any questions I had were answered to my full satisfaction.**

Name .....

Signature ..... Date .....

Signature of Parent/Guardian ..... Witness .....

**If you answered YES to one or more questions:**

Talk with your doctor by phone or in person **BEFORE** you start becoming much more physically active or **BEFORE** you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered **YES** to.

- You may be able to do any activity you want – as long as you start slowly and build up gradually
- You may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice

**If you answered NO to all questions:**

If you answered **NO** honestly to all PAR-Q questions, you can be reasonably sure that you can:

- Start becoming more physically active – begin slowly and build up gradually
- Take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively

## INFORMED CONSENT FORM

An informed consent form is a tool used to ensure the client is fully briefed by the fitness professional as to what their exercise programme entails. The informed consent should contain:

- Clients name, signature and date undertaken
- Purpose and explanation of procedures
- Risks associated with participation
- Benefits to be expected, along with alternatives to exercise
- Confidentiality and use of information

Informed consent should be discussed verbally with the client and recorded In a written format, stored in line with the data protection act.

# EVALUATING RESULTS FROM PRE-SCREENING

## INCLUSION TO AN EXERCISE PROGRAMME

On completion of the pre-screen it is the responsibility of the instructor to evaluate the client's responses and information gathered. They can then identify the suitability of inclusion to an exercise programme. Inclusion would be suitable for clients who have responded 'no' to all PAR-Q questions, have completed health screening tests, and fall within accepted limits (such as heart rate, blood pressure and BMI), and have agreed and completed informed consent.

## TEMPORARY DEFERRAL OF EXERCISE

There may be times when the pre-screen highlights factors which could defer clients from starting an exercise programme. These include:

- 'Yes' responses to PAR-Q questions
- Medical Referral - any diagnosed metabolic, pulmonary or cardiovascular disease, any signs and symptoms of pulmonary or cardiovascular disease
- Any doubt or uncertainty regarding the client's health, including prescribed medication, recent operations and current injury or illness
- Health testing results which fall above or below recommended 'safe' levels, such as heart rate, blood pressure and BMI

Once the referral route has been decided the fitness professional will need to decide the appropriate person depending on the issue. Referrals could be to:

**A GP** – If there are any medical issues that may affect exercise

**Physiotherapist** – If the client has recently had a serious injury or operation

**Dietician** – If there are specific nutritional/supplementation requirements

**Psychologist** – If the client has suffered eating disorders or depression

When referring clients to any of the above professionals it is best practice to pass on the relevant information, such as: the reason for exercise deferral i.e. previous medical history (CHD, dizzy spells etc.), health screening results (heart rate, blood pressure, BMI) or injury and illness. The whole process of client screening is to reduce risk and provide safe participation for all clientele.

# STAGE 2

## INFORMATION GATHERING

### Questionnaires

Questionnaires are a useful tool when gathering data. They come in many forms, they are cheap and simple to produce, and can be given to a large audience easily. The fitness professional can use this method on a face to face basis, or the questions can be given to the client to complete away from the fitness environment. The downsides to questionnaires include the necessity for the client to be literate to complete these, they can seem impersonal and can lend themselves to less detailed data.

### One to One interviews

Interviews are very personal as they collect detailed information on a wide range of topics. Face to face meetings can build rapport and trust with the client, which can lead to more honest answers. The downside to interviews include having a suitable environment to complete them in, they can be time consuming and clients may feel nervous or embarrassed.

### Direct/Live Observations

Use of direct observation by the fitness professional can be used for a variety of reasons specific to the client, which in turn will enable more effective planning of an exercise programme. For example, it may be necessary to look at the client's posture, how they have adapted an exercise due to a disability or to check their technique during exercise. This is a very accurate form of information gathering as the data is live. However, the client may feel intimidated or embarrassed of making mistakes especially if they are new to exercise.

### Knowledge Required During Pre-Questioning

During the information gathering process, the fitness professional will need to obtain a number of key pieces of information, these include:

### Lifestyle Information

Questioning the client on their lifestyle may highlight potential barriers to exercise adherence and goal achievement. For example:

| | |
|---|---|
| **Occupation**<br>Working hours, location, postural adaptions, physicality | May affect client's posture, physical activity levels, rest required. location may depend on time available to train and how long |
| **Hobbies**<br>Physicality/sport related, sedentary, time consuming | Types of hobbies may affect time available to train, type of training, days of training, rest required. if physical or sporting may need to develop into the programme |
| **Nutritional habits**<br>Completion of a food diary will highlight nutritional habits | Nutritional intake is an important factor of physical activity and may affect their goals |
| **Smoking**<br>If they smoke, how often and how many | Could affect cardiovascular and respiratory fitness |
| **Alcohol consumption**<br>If they drink, how often and how much | May affect hydration, co-ordination levels. it may impact their nutrition and their achievement of goals |
| **Travel consideration**<br>Do they drive, how they commute/travel | Affect physical activity levels i.e. non driver may walk or cycle. high levels of commuting in a seated position may affect posture/ lower back |

**Table 5.1** shows impact of lifestyle habits on an exercise programme

## Time Available

The client will need to decide how much time they are going to spend on the exercise programme; this will include training around work, family and hobbies. Cost of training may also have an effect on the amount of time they are able to spend within the gym environment.

When designing a programme it is important to understand the client's time available to train as it will have a direct impact on the goal setting time frames. The time they can commit to each session will also have a direct impact on their adherence to the exercise guidelines and outcome.

### Training Status (FITT)

A simple way of overviewing current and previous exercise programmes is to use the FITT principle. This will indicate the starting fitness levels and the experience of the client, however intensity of training is subjective and sometimes can be over exaggerated by the client.




F – Frequency of exercise (number of times in a set period)

I – Intensity (% of max HR, RPE levels, % of 1RM, range of movement and rest)

T – Time (how long was each session)

T – Type (type of activity completed)

### Exercise Likes and Dislikes

It is important to find out which exercises your client enjoys as these will be important when planning exercises during the exercise programme. If the client has exercise dislikes it is important to clarify why and give options on progressions, regressions and adaptations.

As an instructor it is important to maximise clients 'likes' as there is more chance of increased adherence and client enjoyment of the exercise programme.

### Objectives/Training Goals

To enable the fitness professional to set **SMART** goals, the client must be in agreement with the goals and requirements of the exercise programme. Clients may not be able to make the goals **SMART**, they will however have an Idea as to why they are training and when they would like to see results by. Some of the goals may be:

| Client Goal Example | Specific Adaption Example |
|---|---|
| To increase CV ability for an event | To run 5km in 25 minutes |
| To increase muscular hypertrophy | To increase upper arm size by 3 cms of lean tissue |
| To increase muscular strength | Increase leg press 1 rep max by 10kg |
| To reduce lose weight | Reduce body fat percentage by 5% |
| To improve flexibility | Develop hamstring range of movement by 20 degrees |
| To improve core strength | Increase plank hold to 1 minute |

**Table 5.2** shows specific goal adaptions

When setting goals with a client it is important that you target their reasons for exercising. Involving them in the goal setting process will help with motivation, adherence and ensure that both the instructor and client are working towards the same 'end product'. As an instructor it is important that you are able to develop client's goals into the **SMART** format, making them specific, so they are tangible and can be measured and reviewed throughout the programme.

# STAGE 3

## FITNESS TESTING

### Physical Measurements

After the client has completed pre-exercise questions it is important that physical measurements are taken. This will give a better insight into the current fitness levels of the client, as well as providing a platform that can referenced against with future fitness testing results. The results of the tests may indicate additional goals that the client had previously overseen, for example reducing BMI to recommended guidelines.

Physical measurements can make some clients feel uncomfortable. It is important to stress that if the client is not comfortable with any tests then they do not have to participate in them, for example, skin fold tests can be intrusive, so an alternative can be used. Where the tests are carried out is important, they should be completed in a private area in which other gym users will be unable to disturb the process, this could be a specific fitness testing room or a gym office.

## PHYSICAL TEST CHOICE

### Specificity

When choosing a physical test with a client it is important that they are specific to the goals or outcome of the exercise programme.

### Validity

Once **SMART** goals have been decided, the way in which results are going to be measured is very important. For example, if the client wanted to reduce body fat, the instructor could complete skin fold tests or bio electrical impedance tests. However if the client wanted to lose a specific amount from their waist, circumference tests of waist may be more applicable.

### Objectivity

Fitness tests should be made objective. This will enable that test to be completed by another fitness professional if the original tester is unavailable whilst producing the same results for the same individual. For example, the multistage fitness test, BMI tests or bio electrical impedance.

### Reliability

A reliable fitness test should produce the same results if repeated. To ensure this the instructor should make a list of specific requirements for that test. For example, when measuring skin fold it is important that specific areas are targeted to ensure the consistency of the test results.

Fitness tests are affected by a number of factors which may affect the outcome. When completing a subsequent fitness test after the initial test, it is important to try to limit as many variables as possible. The instructor must try to replicate the first test as closely as possible. Factors to consider include:

- The time of day the test is completed
- Weather conditions if outdoor tests are completed
- Is the assessor the same, if not, are they using the same test protocol
- Time since the athletes last meal, are they suitably hydrated
- Is the client suffering from illness, and are they taking medication
- Has the testing equipment changed

## WHEN TO STOP TESTING

Some physical/dynamic tests can place the client under high intensity. The instructor must therefore ensure the safety of the client and tests should stop immediately if the client experiences any of the following symptoms:

- Onset of angina-like symptoms
- Significant drop (20mmHg) in systolic blood pressure or a failure of the systolic blood pressure to rise with an increase in activity
- Excessive rise in blood pressure: systolic pressure >260 mmHg or diastolic pressure >115 mmHg
- Signs of poor perfusion: light-headedness, confusion, ataxia, pallor, cyanosis, nausea, or cold, clammy skin
- Failure of the heart rate to increase with increased exercise intensity
- Noticeable change in heart rhythm
- Client requests to stop
- Physical or verbal manifestations of severe fatigue
- Failure of the testing equipment

(General indications for stopping exercise testing low-risk adults (ACSM, 2001)

# STATIC FITNESS TESTS (ANTHROPOMETRICS)

## ANTHROPOMETRIC TESTS

Before starting the programme, static or anthropometric testing should completed to assess the client's current fitness levels. There are a number of tests that can be performed according to the client's goals:

### Height

To measure the client's height correctly, they must firstly remove any footwear, stand against a flat surface or stand tall then measure to the highest point on the head.

### Weight

To weigh the client the scales will firstly need to be calibrated, place the scales on a hard surface and ensure the client has removed any heavy clothing. Weight can be taken in pounds, stones or kilograms depending on the instructor preference.

### BMI (Body Mass Index)

BMI is used to judge whether the client is overweight. It is a unit of measure in which body weight is related to height. However, this method does not necessarily identify a healthy individual, neither does it identify the cause of the weight. Many athletes and body builders will find themselves in the overweight or obese categories due to high levels of muscle mass.

| Category | BMI Range |
|---|---|
| Very Obese | from 35 and above |
| Obese | from 30 to 34.9 |
| Overweight | from 25 to 29.9 |
| Normal | from 18.5 to 24.9 |
| Underweight | from 16 to 18.4 |
| Very Underweight | from 15 and below |

**English BMI Formula**

$$\text{BMI} = \frac{\text{Weight in Pounds}}{\text{Height in inches} \times \text{Height in inches} \times 703}$$

**Metric BMI Formula**

$$\text{BMI} = \frac{\text{Weight in Kilograms}}{\text{Height in metres} \times \text{Height in metres}}$$

**Table 5.3** classification of BMI from the National Institute of Health 1998



## Circumference Measurements

In many goals set it is essential to measure the circumferences of the body, these sites will vary depending on the goal. One of the main sites of measurement is the waist, however there are 5 sites for circumferential measurement.

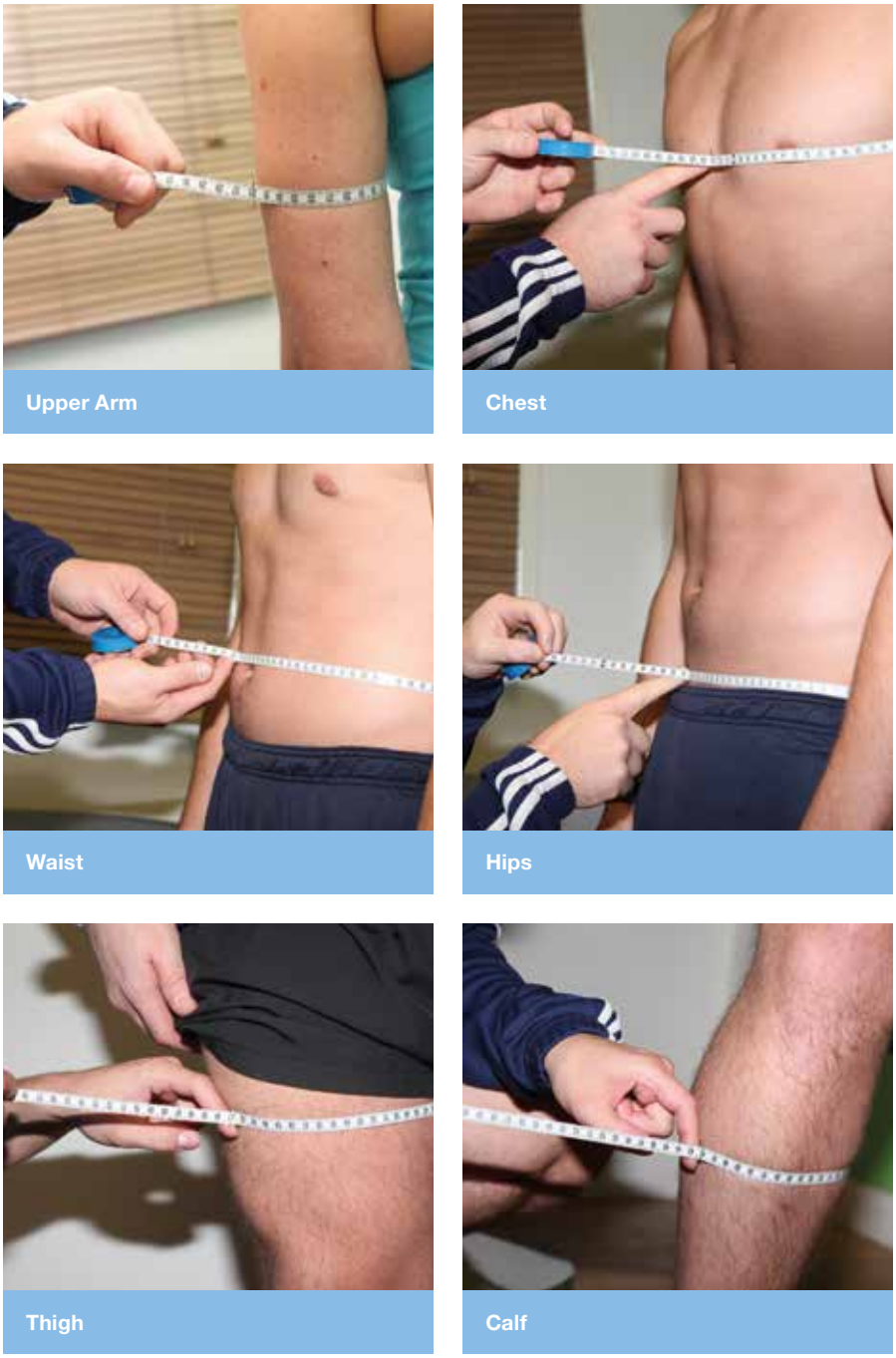



**Figure 5.1** sites of circumference measurements

When taking measurements it is essential that the client is relaxed (unless specifically measuring tensed size) and breathing normally otherwise the results will be inaccurate.

1. The instructor should measure these areas at their widest point
2. Take an average reading
3. Measure under clothing where possible

## Waist to Hip Ratio

Once the circumference measurements are complete, waist to hip ratios can be analysed.

| Waist to Hip Ratio Formula |
|---|
| $\frac{\text{Waist (inches)}}{\text{Hips (inches)}}$ = Waist to Hip Ratio |

Once you have calculated the waist to hip ratio, use the table below to identify client's classification of risk of morbidity (disease):

| | Ideal | High Risk | Very High Risk |
|---|---|---|---|
| **Men** | < 94 cms (< 37 inches) | 94-102 cms (37-40 inches) | > 102 cms (> 40 inches) |
| **Women** | < 80 cms (< 32 inches) | 80-88 cms (32-35 inches) | > 88 cms (> 35 inches) |

**Table 5.4** waist to hip ratio classification

## Resting Heart Rate

Resting heart rate (RHR) is the amount of times the heart beats every minute at rest, it is measured in beats per minute (bpm). Heyward (2002) states that resting heart rate averages between 60-80 bpm, with men averaging 70 bpm and women around 75 bpm. Generally the lower the reading the greater the levels of aerobic fitness, but hereditary factors can also affect RHR, so do not rely solely on RHR as a reliable indicator of fitness.

To obtain heart rate there are two main sites where pulse can be taken:



**Carotid:**

The common carotid artery sites are located on both sides of the front of the neck. Each are in the groove formed by the larynx (Adam's apple) and the sternocleidomastoid muscles (muscles on the side of the neck) just below the mandible (lower jawbone).



**Radial:**

The radial artery runs deeply on the anterolateral (thumb side) aspect of the forearm and becomes superficial near the distal head of the radius (directly in line with the base of the thumb).

**Figure 5.2** main sites where heart rate can be taken

Once you have found the pulse at one of these sites, count the number of beats in 60 seconds (minute), which will give the clients resting heart rate in beats per minute.

### Client Information Storage

On completion of the initial consultation (pre-screen, PAR-Q and fitness testing) it is the responsibility of instructor to store and handle all client information confidentially and securely following the data protection act 1998. This means using the information for reasons collected i.e. in the safe programming and instructing of the client and not disclosing any of the information to other parties, unless required and consented to by the client i.e. medical referral, physio or sports therapists.

# STAGE 4

## PROGRAMME DESIGN

Once the pre-screening questions, medical questionnaire and physical tests are complete, the exercise professional will need to decide how to approach programme design. There are many variables that will affect an exercise programme, for example:

1. Current fitness levels
2. Exercise likes and dislikes
3. Client injuries
4. Time available per week/session to train
5. Clients total programme time
6. Client's goals - It is important to revisit the clients original objective and agree SMART goals based on the needs and potential of the client.

Once the SMART goals have been agreed by both parties, the instructor should now be armed with the necessary information to plan a safe and effective training programme following industry good practice and level of competency.

## PROGRAMME GUIDELINES

When looking at the programme design it is important to work on the correct training stimulus. Shown below are the suggested repetitions and sets for strength, hypertrophy and muscular endurance. During an exercise programme the client could solely stay within one set of guidelines or combine approaches as the fitness professional sees as appropriate.

| Training Goal | Strength | Hypertrophy | Endurance | Health | Cardiovascular |
|---|---|---|---|---|---|
| **Intensity** | High | Moderate | Low | Low (aerobic) | 60-90% MHR |
| **Load as % of 1RM** | > 85% | 67%-85% | < 67% | N/A | N/A |
| **Reps/duration** | 1-5 | 6-12 | 12+ | 30 mins + | 20 mins + |
| **Recover between sets** | 3-5 mins | 1-2 mins | 30-60 seconds | N/A | N/A |
| **Sets per exercise** | 2-6 | 3-6 | 2-3 | 1 | 1 |
| **Frequency per muscle group** | 1-2 x per week | 1-2 x per week | 2-3 x per week | 5+ sessions weekly | 3+ sessions weekly |

**Table 5.5** programming guidelines and principles (Adapted from Earle and Baechle 2000)

## PROGRAMMING AEROBIC TRAINING

There is no definitive guide to designing aerobic training programmes; but targeted training should be applied to ensure the adaptations to the training type are specific to the client's goals. The frequency, intensity and duration of the exercise will affect the work rate in all types of aerobic training.

When prescribing aerobic exercise, the ACSM have outlined guidelines for both maintaining health and improving fitness:

| | Maintaining Health | Improving Fitness |
|---|---|---|
| **Frequency** | 5 x per week | 3 x per week |
| **Intensity** | Low to Moderate | Vigorous |
| **Time** | > 30 minutes | > 20 minutes |
| **Type** | Rhythmical Exercise Using Large Muscles Groups | |

**Table 5.6** cardiovascular programming guidelines (Adapted from ACSM 2010)

There are 3 main cardiovascular training systems which target a variety of muscle fibre types and energy sources within the body.

### Long Slow Duration (LSD) Training

Long slow duration training was first introduced in the 1920's by Dr Ernst Van Auken and involves prolonged training with no rest periods. LSD training is typically completed at low to moderate intensity (60-80% MHR) for periods longer than 30 minutes. It is therefore good for clients that are new to aerobic exercise or those who wish to maintain a base level of cardiovascular fitness. Another type of duration training is continuous training. The difference from LSD training is that it is often performed as high intensity continuous training and typically works the client to 85-95% MHR.

### Interval or Tempo Training

Interval training was formalised in the 1930's by German coach Woldemar Gerschler and involves 2 phases, one of high intensity and one of lower intensity or active recovery. Active recovery interval training is more commonly used within the fitness environment. There are a number of ways to vary the intensity of interval training:

- Intensity of the exercise interval
- Distance of the exercise interval
- Exercises used in both the exercise and rest intervals
- The duration of rest or active recovery
- The time of training/number of sets of intervals

These variables can be changed according to the client's goals and fitness levels; interval training is often used to train sports athletes.

### Fartlek

Fartlek is Swedish for speed play and was developed in Sweden in the 1930s, this form of training is a combination of continuous and intervals. Fartlek training is often associated with running but can also be applied to other continuous sports such as cycling and swimming. It involves working at a variety of working intensities and is good for cross training as it can work all muscle fibre types and energy sources. It is also good for those clients who get bored easily.

| Description | Beginner (very low to low fitness) | Intermediate (average fitness) | Advanced (above average fitness) |
|---|---|---|---|
| Programme focus | • Improved health profile<br>• Increased energy<br>• Daily activities made easier<br>• Weight reduction | • Weight reduction<br>• Programme variety | • Increase $VO_2$ max<br>• Weight maintenance<br>• Sport training<br>• Competition |
| Frequency | 1-3 times per week | 3-5 times per week | 4-6 times per week |
| Intensity | 55-64% MHR<br>RPE 9-12 | 65-74% MHR<br>RPE 12-15 | 75-90% MHR<br>RPE 13-16 |
| Time | 15-30 Minutes | 20-45 Minutes | 40-60 Minutes |
| Type | • Walking<br>• Stationary cycling<br>• Swimming<br>• Water aerobics<br>• Basic fitness classes | • Stair climbing<br>• Treadmill<br>• Fitness classes<br>• Cycling classes<br>• Cross-training | • Complex movements<br>• Sports<br>• Cross training<br>• Interval training |




**Table 5.7** cardiovascular programme progression (Adapted from Anderson and Bates 2007)

As the client progresses within the exercise programme the overload principle should be applied to avoid plateau and promote adaptions. The fitness professional should combine a variety of cardiovascular exercises and training types to increase the intensity of the workout whilst ensuring the client does not get bored.

An example of progression for treadmill running would be to work towards 30 minutes of LSD at 70% MHR. Once this is done, work on completing 30 minutes of interval training with long periods of active recovery whilst gradually reducing rest. This could be a reduction from a 2-1 to a 1-1 active recovery to work ratio. Finally work on 30 minutes of fartlek training, introducing both speeds and gradients into the session whilst continually working above 60% MHR.

# PROGRAMMING FOR BEGINNERS AND MUSCULAR ENDURANCE FITNESS

When planning resistance exercise for beginners it requires a logical and structured introduction into resistance training. They need to develop a solid foundation that they can build upon as they progress.

The ACSM 2008, state that the guidelines for endurance are as follows:

| Training Goal | Endurance |
|---|---|
| Intensity | Low |
| Load as % of 1RM | < 67% |
| Reps/duration | 12+ |
| Recover between sets | 30-60 seconds |
| Sets per exercise | 2-3 |
| Frequency per muscle group | 2-3 x per week |

**Table 5.8** programming muscular endurance guidelines (Adapted in Earle and Baechle 2000)

As an instructor you need to be aware of some of the common issues a beginner to resistance training may display:

### Poor Technique

Practicing new exercise moves with teaching points will improve new techniques.

### Poor Proprioception

This is normally apparent when a client carries out less stable exercises, for example free weights.

### Postural Abnormalities

Depending on work, hobbies and injuries, it may be necessary to strengthen and stretch areas to help reduce injury risks from poor posture.

### Weak Muscular Strength

Dynamic fitness tests should indicate current muscular strength. It is important not to overestimate resistance required as it can increase injury risk. Instead use the intensity variables to gradually increase the clients strength.

When a beginner embarks on a resistance programme it is important to incorporate the following:

- Start within the muscular endurance section of the pyramid as the weights/ resistance used are less intense, and will enable the client to increase proprioception
- Use a mixture of basic compound and bodyweight exercises
- Ensure correct technique through verbal and visual teaching points
- Train with a whole body approach

When planning to progress a client over a prolonged period of time, from a novice to more advanced and intensive forms of resistance training, It is important that the instructor develops a long term training plan, following the basic progression pyramid:

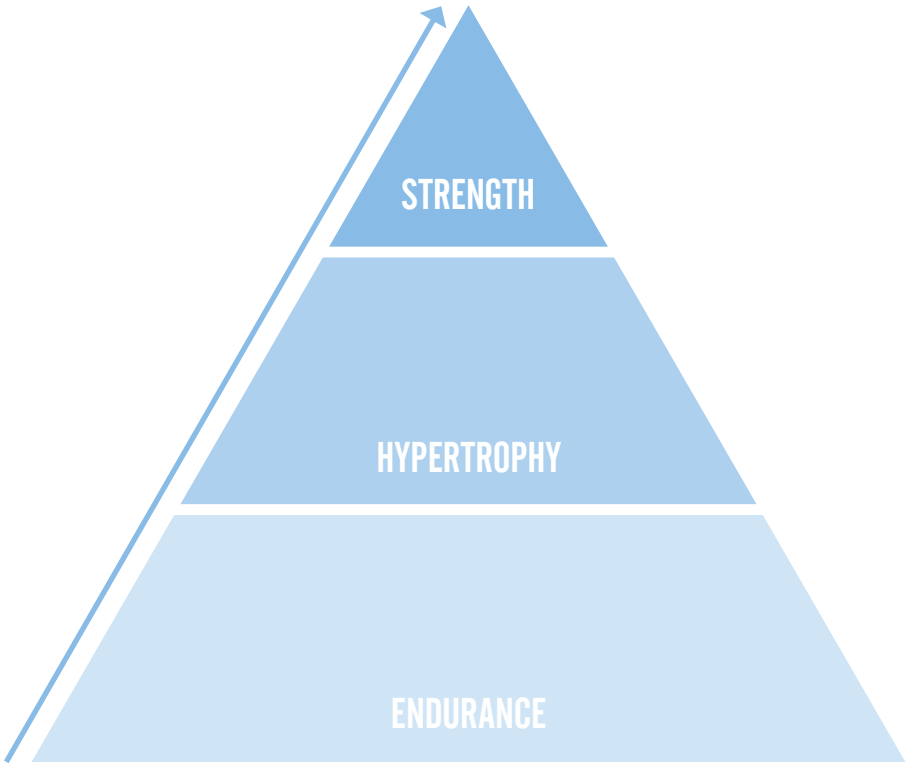



**Figure 5.3** resistance training progression pyramid

When planning and programming resistance sessions, there are some basic rules to follow as an instructor:

1. **Promote Muscular Balance** – ensure that the programme works all major muscle groups equally. This should ensure that individual muscles don't get overworked resulting in postural deviations. For example over working chest and biceps and neglecting upper back muscle can induce a kyphotic posture.
2. **Train Large Muscle Groups First** – ensure the programme works large muscle groups first, as this is when they have the most energy to train effectively, maximising correct technique and posture.
3. **Complete Compound/High Skill Exercises First** – exercises should be planned from compound to isolation. Compound exercises use two or more joint movements and work the larger muscle groups, as they require more energy and motor skills. For example, completing squats and lunges before isolating the quadriceps with a leg extension.
4. **Train Synergist and Fixators Last** – assisting muscles in compound movements should be trained last, as this provides exercise stability and assistance in the compound movements. If these muscles are fatigued first, then risk of injury from the compound exercise could be increased due to lack of co-ordination, strength and ultimately technique. For example, fatiguing the triceps brachii prior to a chest press.

## PROGRAMME VARIABLES

When the time comes to progress or adapt a resistance training programme, the instructor has a variety of factors or variables they can adjust:

1. **Number/variation of exercises**
2. **Stability of exercises**
3. **Number of repetitions**
4. **Number of sets**
5. **Rest time**
6. **Repetition tempo**
7. **Split routines**
8. **Weight increase**

By manipulating one, or a combination of these variables, the instructor is able to progress the programme and start the overload principle of training again.

# TRAINING WITH INTERMEDIATE/ ADVANCED CLIENTS

As the client progresses, the training stimulus will need to be advanced specifically towards their goals. This may mean that the client progresses through the training pyramid from endurance to hypertrophy to strength; this would involve reducing repetitions and increasing the weight and therefore working intensity.

| Training Goal | Strength | Hypertrophy |
|---|---|---|
| Intensity | High | Moderate |
| Load as % of 1RM | > 85% | 67% - 85% |
| Reps/duration | 1-5 | 6-12 |
| Recover between sets | 3-5 mins | 1-2 mins |
| Sets per exercise | 2-6 | 3-6 |
| Frequency per muscle group | 2-3 x per week | 1-2 x per week |

**Table 5.9** programming muscular hypertrophy and strength guidelines (Adapted in Earle and Baechle 2000

## KEY TRAINING ITEMS WHEN WORKING WITH INTERMEDIATE/ADVANCED CLIENTS

- Progress to the hypertrophy/strength stage of the training pyramid as applicable, and start to incorporate more free weight and less stable exercises into the programme as proprioception should have improved
- Use compound exercises as well as isolation to target specific muscle groups
- Continue giving teaching points, start to give tempo and exercise progressions to increase the workout intensity
- Start to look at split routines

## TRAINING ROUTINES

### Whole body

These are a single workout in which all major muscle groups are worked, i.e. chest, back, shoulders, trapezius, biceps, triceps, abdominals, quadriceps, hamstrings and calves. This type of training can be frequent as the total stress on each muscle group in each training section is limited due to time. Typically 1-2 exercises per muscle group are completed.

### Upper/lower

This type of training splits the sessions of the week into upper body muscles (chest, back, shoulders, trapezius, biceps and triceps) and lower body muscles, (quadriceps, hamstrings, calves and core) in a single session. This allows more time to train each muscle group and therefore increases the workload. Typically there is a total of 4 sessions a week.

| Split Routine - Upper/Lower | | | | | | |
|---|---|---|---|---|---|---|
| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| Lower Body | | Upper Body | | Lower Body | | Upper Body |

### 3 way split

A 3 way split is a progression to upper and lower body splits as it focuses more time on muscle groups during the session, which in turn increases the muscle workload. Typically a leg day (quadriceps, hamstrings, calves and abdominals) a push day (chest, triceps and shoulders) and a pull day (back and biceps) are completed. Muscle groups are usually targeted 1-2 times a week, with longer rest periods between training.

| Split Routine - 3 Way | | | | | | |
|---|---|---|---|---|---|---|
| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| Push Day | | Legs & Abs | | Pull Day | | Upper Body |

### 4 way split

A 4 way split is a further progression from the 3 way split adding more volume and work load to each muscle group. Muscle groups are paired, for example chest/triceps, back/biceps, quadriceps/hamstrings and shoulders/abdominal work can be incorporated on any day.

| Split Routine - 4 Way | | | | | | |
|---|---|---|---|---|---|---|
| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| Chest/Triceps | | Legs | | Back/Biceps | | Shoulders/Abbs |

## PROGRAMME DESIGN FOR FLEXIBILITY

These are the ACSM 2010 guidelines for the general population to increase range of motion of muscles and joints:

| Flexibility | |
|---|---|
| Frequency | 2-3 x per week |
| Intensity | Slowly stretching to a point of mild discomfort |
| Time | Hold stretch for at least 10 secs up to 30 secs |
| Type | Static (maintenance or developmental) |

**Table 5.10** flexibility programming guidelines (Adapted from ACSM 2010)

The principles of flexibility as part of a warm up and cool down have already been discussed in Unit 4. As a brief recap, dynamic stretches tend to mimic movements that are likely to be performed in the following exercise session. Typically 3-5 whole body dynamic stretches are sufficient as part of a warm up. 10-15 repetitions of each stretch under control should be performed, gradually increasing the range of movement.

At the end of the session, the number of stretches should be sufficient to have covered the major muscles of the body worked during the main session or to maintain/develop the range of movement around a joint, which has been identified previously. For example, the client may have tight hamstrings, so time should be spent working on development all stretches for this muscle group. The stretches typically used are:

## STATIC MAINTENANCE

Static maintenance stretches are adopted to maintain the normal length of the muscles and are typically performed at the end of an exercise session. Following repeated contractions during exercise, the muscle becomes shorter and thicker and a maintenance stretch is used to return the muscle to its normal length. This is done by holding the muscle at the point of tension for up to 15 seconds.

## STATIC DEVELOPMENTAL

These stretches are used in flexibility training to develop the length of the fibres themselves, therefore increasing the range of movement at a joint. These stretches are performed by holding the muscle at the point of tension for 15 seconds (as static maintenance), the client then takes a breath in and increases the range of movement, holding at the next point of tension for a further 15 seconds (30 seconds in total).

## GOOD PRACTICE WHEN APPLYING PRINCIPLES TO A PROGRAMME

When bringing these components together: warm up, cool down, aerobic, resistance and flexibility training, there are some basic rules and general good practice to follow.

The layout of a basic session should follow this logical order:

| | |
|---|---|
| **Welcome** | • Welcome client<br>• Outline health, safety and housekeeping<br>• Overview of the session<br>• PAR-Q and readiness check |
| **Warm up** | • Cardiovascular pulse raiser<br>• Pre workout stretches – dynamic preferable for large muscle groups to be worked (mimicking movements to be included in the programme) |
| **Main cardiovascular training** | • Health or improving fitness CV section using one of the recognised methods LSD, intervals, fartlek |
| **Main resistance training** | • Main resistance section should follow the ACSM guidelines for endurance, hypertrophy or strength dependent on client's experience level and goals. Combining a mixture of free weight, resistance machine and body weight exercises |
| **Cool down** | • Cardiovascular pulse-lowering<br>• Post workout stretches - all static, either maintenance or developmental. Ideally these should be completed on the floor to assist with reducing heart rate |
| **Session conclusion** | • Client feedback<br>• Instructor feedback<br>• Summary of session<br>• Action points for next session |

**Table 5.11** basic structure of a gym programme

Please see an example of a working session below following these principles and guidelines:

### Programme Card (session 1)

**Name:** A. Client **Date:** 1/2/34

#### Warm up

| Equipment | Duration | Level | Speed | RPE/HR |
|---|---|---|---|---|
| Cross Trainer | 5 Minutes | 1-2 | 80RPM | 120BPM |

**Pre-stretching**

Lunge with rotation
Squat to overhead arm swing
Glute and hamstring kick through
Standing pectoral and trapezius

→ Dynamic pre stretches (8-10 repetitions)

#### Cardiovascular Training

| Equipment | Duration | Level | Speed | RPE/HR |
|---|---|---|---|---|
| Treadmill | 15 Minutes (LSD) | Incline 1 | 8.0Km/h | 160BPM |

#### Resistance Training

| Exercise | Resistance/weight | Reps | Sets | Rest |
|---|---|---|---|---|
| Squats (BB) | 50Kg | 15 | 2 | 60sec |
| Shoulder Press (DB) | 20Kg | 15 | 2 | 60sec |
| Single Arm Row (DB) | 25Kg | 15 | 2 | 60sec |
| Chest Press | 40Kg | 15 | 2 | 60sec |
| Lat Pulldown | 30Kg | 15 | 2 | 60sec |
| Hamstring Curl | 30Kg | 15 | 2 | 60sec |
| Bicep Curl (DB) | 12Kg | 15 | 2 | 60sec |
| Tricep Pushdown | 18Kg | 15 | 2 | 60sec |

| Bodyweight | Resistance/weight | Reps | Sets | Rest |
|---|---|---|---|---|
| Pull Up | Under hand/close grip | 15 | 2 | 60sec |
| Press Up | Full | 15 | 2 | 60sec |
| Abdominal Crunch | Hands on temples | 15 | 2 | 60sec |
| Back Extensions | Hands on temples | 15 | 2 | 60sec |

#### Cool Down

| Equipment | Duration | Level | Speed | RPE/HR |
|---|---|---|---|---|
| Upright Bike | 5 Minutes | 6-4 | 100-60 RPM | 100-80BPM |

**Post Stretches (Static)**

Seated Chest
Seated Deltoid
Kneeling Gastrocnemius
Box Erector Spinae
Lying Quadriceps
Lying Hamstrings (Developmental)
Hold stretch for 15 seconds, relax, increase stretch for 15 Seconds (x2)

→ (Maintenance) Hold stretch for 15 seconds

# EXERCISES/EQUIPMENT AND THEIR USES

| Cardio Vascular | Muscular Fitness Freeweight | Muscular Fitness Resistance Machine | Flexibility | Motor Skills | Body Weight |
|---|---|---|---|---|---|
| Treadmill | Deadlift | Chest Press | Pectoral Stretch | Bosu Ball | Chin Up/Pull Up |
| Upright Bike | Squat | Pec Dec | Trapezius Stretch | Swiss Ball | Press Up |
| Recumbent Bike | Lunge | Seated Low Pulley Cable Row | Deltoid Stretch | Ladders | Lunge |
| Rowing Machine | Bench Press | Shoulder Press | Lattimius Dorsi Stretch | Medicine Balls | Squat |
| Cross Trainer | Shoulder Press | Seated Row | Tricep Stretch | Cable Machines | Abdominal Curl |
| | Single Arm Row | Lat Pull Down | Quadriceps Stretch | | Back Raises |
| | Upright Row | Leg Press | Hamstring Stretch | | |
| | Chest Flyes | Leg Curl | Adductor Stretch | | |
| | Lateral Raise | Leg Extension | Calf Stretch | | |
| | Frontal Raise | Seated Adductor | Gluteal Stretch | | |
| | Bent Arm Pullover | Seated Abductor | Hip Flexor Stretch | | |
| | Prone Flyes | Assisted Pull Up | Rectus Abdominis Stretch | | |
| | Bicep curl | Low Pulley Cable Bicep Curl | Erector Spinae Stretch | | |
| | Single Arm Triceps Press | High Pulley Cable Tricep Pushdown | | | |
| | | Abdominal Crunch | | | |
| | | Back Extension | | | |

# GROUP TRAINING

Group training is exercise that is usually completed within groups of 2-15. These contain a wide variety of exercises depending on available equipment and can be completed on the gym floor, in a recreational space, or an exercise studio.

Group training sessions are increasing in popularity within the fitness industry for a number of reasons, for a client they:

- Allow training to take place in a social environment
- They can reduce intimidation from training in a one to one session, as clients can feel more comfortable in a group, with people with similar goals and abilities
- They are often cheaper to participate in
- They cater for all levels of experience, as the instructor should cater for all levels of ability and skills by offering suitable progressions, alternatives or adaptions

There are also numerous benefits as an instructor:

- It enables you to build a rapport with a large number of clients which can lead to additional business opportunities. These include personal training or teaching additional group training sessions
- Can be time and cost effective, as if doing group sessions you can instruct, interact and communicate with an increased number of client's with similar goals and interests

There are a few disadvantages however. As an instructor, it can be difficult to observe clients' techniques throughout the whole exercise due to the lack of one to one instruction.

## PREPARING AND PLANNING GROUP TRAINING SESSIONS

When planning a group training session the instructor should adhere to 3 stages of exercise programme planning, these include:

1. **Pre screen**
2. **Information gathering**
3. **Programme design**

### Pre-screen

A written/verbal PAR-Q and informed consent form must be completed by every class member. This information will enable you to plan adaptations for the planned exercises suitable for the group.

### Information Gathering

The Instructor should gather general information on what the group/individuals are trying to achieve. It may be hard to target everyone's goals specifically, but there could be a general theme to a session. For example, hypertrophy or weight loss in which participants can chose the session in which they train.



### Programme Design

There are a number of things to consider when designing a group session:

#### 1. Equipment Availability

Body weight and free weight exercises may be suitable, as having a large number of resistance/cardiovascular machines may not be possible.

#### 2. Progressions/Regressions

Exercises should be suited to the participants experience level. Some will need to have regressions if new participants are taking part in the class.

#### 3. Space Available

The instructor will need to ensure that when planning various exercises there is enough space to minimise risk of collisions. This is especially important when incorporating cardiovascular and resistance training in a small environment.

#### 4. Monitoring Exercise Intensity/Teaching Positions

When instructing a group session the instructor will need to vary their teaching position regularly due to the number of participants. Moving around exercise stations will also enable the instructor to check RPE, talk test and communicate with participants on an individual basis.

## GROUP INDUCTIONS

A thorough gym induction is an important starting point for a beginner in learning the safe, effective and correct use of gym equipment. It is recognised as best practice in the industry for a new gym member to go through an induction process with a qualified level 2 instructor and more commonly in health clubs and gyms this is happening in a group setting.

When instructing group inductions, the purpose and structure of the induction should be made clear to the group from the outset and the instructor should inform the group to be mindful of their surroundings to ensure that their safety takes priority. Emphasis should be placed on the importance of being aware of exercisers around them and the equipment they are using. They should also be encouraged to stay close to the group, pay attention to the instructor and to refrain from performing exercises or using machines when they have not be inducted on them or been given permission by the instructor.

The NAMSET acronym also works well within a group environment. It is sometimes helpful for the instructor to use an individual from the group to reinforce teaching points and technique. It is important that the instructor is happy that every member of the group knows how to use the equipment and exercises demonstrated.

Due to time constraints and depending on the size of the group, it may not be possible for every member to practice every exercise or machine demonstrated, but the instructor should try to make sure that all clients have participated at some stage during the induction. It is imperative that the instructor manages the group effectively and maintains their attention by manoeuvring them into appropriate viewing positions so that all members are able to view demonstrations and listen to the various teaching points.

# PLANNING GYM BASED EXERCISE

## CAN YOU NOW...

- [ ] Understand how to collect client information to plan gym based exercise
- [ ] Understand how to plan gym based exercise
- [ ] Use client information to plan a safe & effective gym based programme with clients



UNIT 6

# INSTRUCTING GYM BASED EXERCISE

**By the end of this section you should be able to...**

Understand how to Provide Gym Based Exercise

Prepare Self & Equipment for Gym Based Exercise

Prepare Clients for Gym Based Exercise

Instruct Gym Based Exercise

Supervise Clients within the Gym Environment

Bring a Gym Based Session to an End

Reflect on the Provision of Gym Based Exercise

Support Clients Participating in Gym Based Exercise

# PREPARING YOURSELF, CLIENTS AND EQUIPMENT FOR GYM BASED EXERCISE

Once the instructor has completed the four stages of consultation, from pre-screening to detailed planning, the final step before delivery is thorough session preparation.

## INSTRUCTOR PREPARATION FOR GYM BASED EXERCISE

It is the responsibility of the instructor prior to the session to prepare and organise the environment in which activity will take place. This includes:

- Equipment safety checks (i.e. treadmill belts, cables on resistance machines, free weights are secure)
- Environment safety checks (i.e. water available, know your fire exits and that they are clear, duty first aider, first aid kit location, nearest telephone)
- Special arrangements (i.e. access if special populations client)
- Identifying suitable alternatives (if applicable and dependant on the client on the day)
- Personal Image (i.e. suitably attired – uniform)
- Pre-prepared session documents (i.e. consultation notes, session card)

## CLIENT PREPARATION FOR GYM BASED EXERCISE

It is the responsibility of the instructor to make the client feel at ease at the beginning of the session. This time should be used to welcome the client, to go through 'housekeeping' and start to develop a general rapport. This should include:

- Health and safety update (i.e. nearest emergency exits, first aider, location of nearest telephone and first aid equipment)
- Facilities emergency procedures (i.e. Fire evacuation procedure)
- Verbal checks of Par-Q, to ensure no changes have occurred since consultation, such as injury
- Outline the physical and technical demands of the session prepared for the client (i.e. warm up, main session and cool down)
- Reinforce how the session relates to the clients goals – this helps to increase motivation and adherence as well as keeping the client involved in programming towards their goals
- Answering or addressing any issues or problems the client may have prior to the session starting

After completing instructor preparation and the welcome, a warm up should be undertaken to finalise client preparation for the exercise session. A typical warm up may include a cardiovascular exercise with a gradual increase in intensity; this is often referred to as a pulse raiser. Mobilisation exercises to promote joint movement and pre-exercise stretching (static, dynamic or ballistic) may also be included.

A warm up is prescribed to raise the body temperature to 39/40 degrees, this small increase in temperature has many benefits to exercise performance.

1. This heating effect will allow the muscles and tendons to become more extensible. This in turn will create more supple muscle fibres and enhance stretching.
2. An increase in oxygen and essential nutrients to muscle tissue, this occurs due to an increase in blood flow through vasodilation.
3. Specific warm ups that mirror the activity about to take place will enhance neural pathways, which speeds up reaction time.
4. Secretion of synovial fluid helps lubricate joints.
5. Psychological preparation for physical activity/exercise.

# INSTRUCTIONAL SKILLS

Effective gym instruction is all about 'giving information on how to perform something', which ensures the safety and effectiveness of an exercise and ultimately the workout. This is achieved through the effectiveness of the instructors communication skills, combining both verbal and non-verbal instruction skills. The table below shows examples of verbal and non-verbal communication tools the instructor needs to develop:

| Verbal | Non-Verbal |
|---|---|
| Instructions | Demonstration |
| Teaching Points | Observation |
| Motivation/Praise | Body Language |
| Voice Intonation | Teaching Position |
| Correction | Facial Expression |
| Cueing | Eye Contact |

**Table 6.1** variety of verbal and non-verbal instruction skills

## VERBAL INSTRUCTIONS

### Terminology

Words are the most useful tool the instructor has if used in the correct way. Instructors should try and use simple terminology when working with clients, keep instructions user friendly and engage the clients. For example when using resistance machines 'keep wrists fixed and knuckles facing forward' rather than take a 'strong pronated grip'.

### Motivation

Effective motivation is essential for clients to achieve their goals and targets. It not only comes from self-motivation but also from external sources, and as an instructor you can influence this by:

- Being motivated yourself and being passionate about what you are doing
- Using motivation terminology and language appropriate to your client
- Portraying confidence
- Achieving realistic goals and targets
- Using appropriate praise and rewards

### Teaching Points

Should be used to support your visual demonstrations, as it allows instructors to explain, correct and reinforce exercise technique. By adding verbal teaching points to demonstrations, and whilst clients are performing, it promotes learning and understanding through the 3 main learning styles (seeing, listening and doing). This promotes and reinforces correct technique, along with safe and effective execution of exercises for all clients. The language used should target your client, be relevant and in a simple and logical format.

### Voice Intonation

The way the instructor says something can emphasis the information that they are trying to get across. Words and language should reflect what is being undertaken. For example, during a final set of a demanding resistance exercise the instructor may use words such as '2 more reps to go, drive them out' or 'dig deep' compared to a cool down stretch where this may change to 'relax' or 'chill out'. This ensures that the instructor communicates in a way that is appropriate to the client, what they are doing and the surrounding environment. This also avoids monotone instructing. Methods to develop voice intonation include:

- Varying tone
- Varying speed
- Varying volume
- Develop a variety of instructions and phrases

## VISUAL INSTRUCTION

### Demonstration

Instructors must be competent in the exercise technique before demonstrating or instructing. Clients should be suitably positioned to observe all set up points, joint movements and exercise actions. The demonstration should be given accurately and correctly, supported by teaching points as discussed previously. The instructor should perform between 5-8 reps slowly and controlled focusing on correct technique and posture.

### Teaching Positioning and Instructor Observation

It is important that the instructor positions themself to enable effective communication and to observe the clients performance. This may mean moving around the client and at times to be in their eye line. For example when a client is on a treadmill giving instructions or communicating with them from behind may not be suitable, as they may try to look over their shoulder causing them to trip or lose their footing resulting in an accident. Likewise when the client is performing floor based exercises the instructor should get down to their level as not to be intimidating, by towering over them and talking down to the client.

### Body Language

This combines both non-verbal and visual communication and gives clues to someone's current emotional or mental state. For example if someone was depressed then they may have slumped or rounded shoulders. An instructor should adopt open body language at all times for example unfolded arms and using hand gestures creates an open environment, a feeling of energy and enthusiasm rather than closed body language with folded arms, which can be seen as defensive. The body language of an instructor can alter the client's mood and mind set, influencing the effectiveness of the training session. Eye contact and facial expressions are also important tools in praising and motivating clients. No matter how an instructor is feeling, they should always have open body language, which is positive and motivating to their client.

### Instructing New Exercise

The majority of a gym instructor's time is spent introducing new gym members to the equipment and exercises available on the gym floor. Educating them how to safely and effectively use the equipment and perform the exercises.

When doing this a clear and logical instructing format should be used, to teach new exercises and equipment to clients:

## NAME THE EXERCISE

give the name of the exercise or piece of equipment

## AREA OF THE BODY

name the area of the body the exercise/machine works

## MUSCLES WORKED

name the muscle group/s being worked

## SILENT DEMONSTRATION

instructor should complete set up and 5-8 reps of the exercise, allowing the client to observe and concentrate on the technique and movement motions

## EXPLANATION

complete a few more reps, but this time talk through the set-up, movement and teaching points with the client

## TEACH

the instructor should now get the client to have a go and perform the exercise, observing them closely, reinforcing the teaching points and correcting technique

For the new instructor this may seem like a lot to remember but with practice and regular use this process should become second nature. Combined with good communication skills discussed previously, such as simple terminology, voice intonation and body language, this process is an effective way to introduce new exercises to clients, and more importantly for them to remember them.

## VITAL FACTS

### IMPORTANT SPOTTING FACTORS TO CONSIDER:

1. Spotters should be strong enough to assist the client if required
2. Spotters should know the correct exercise technique & be able to adapt the exercise they are spotting
3. Spotters should know the number of repetitions the client is attempting to lift
4. Spotters should be concentrating on the client & their technique at all times
5. Be aware that some exercises may need 2 spotters e.g. heavy back squats, for client safety

# SPOTTING

Spotting is a term used to describe the act of supporting a client in an exercise, to assist in the completion of an exercise and to avoid injury in the process. Correct spotting is important to ensure the safety of a client during a resistance training session. As an instructor you may be required to be a spotter for your clients. There are four main functions of a spotter:

1. To safely lift and pass weights to the client (i.e. passing a bar over head when prone on a bench)
2. To assist the client if in difficultly (i.e. if they reach failure during a resistance set)
3. To ensure correct lifting technique
4. To apply high intensity training techniques

There are a variety of exercises that may require a spotter. Free weight exercises are the most common, for example:

- Overhead (shoulder press)
- Exercises with the bar on the back e.g. back squat and lunges
- Exercises where the bar passes over the head/face e.g. bench press, chest flyes or lying tricep extension
- Exercises with the bar rested on the clavicles e.g. front squat (more advanced lifting exercises)

## SPOTTING TECHNIQUE

### There are two spotting techniques - barbell & dumbbell

For both spotting techniques the instructor should ensure that they have a solid base of support, and maintain a neutral spine especially when lifting (following deadlift procedures). There should be constant communication between the instructor and client, especially when passing and receiving the load.



**Overhead Barbell Spot:**

- Be at the head of the bench with the bar, deadlifted to waist height
- Using either an alternated grip or same grip
- 4 hands on bar as it passes over the face
- To get bar into start position: upright row and step into the head of the bench at the same time, so the bar passes over the clients head and face to start position
- Once in position, client can start exercise, remain at head of bench to spot and give teaching points and motivation from that position

**Figure 6.1** barbell spotting

**Dumbbell Spot:**

- Each dumbbell needs to be spotted into position separately
- Deadlift weight from the side of the bench and get client to take an underhand grip
- Get the client to rest the weight on body, and repeat the process on the other hand
- Get the client to extend arms with DB's, in to start position, whilst the spotter comes to the head of the bench
- From here the spotter can support the elbows of client if required, as well as give teaching points and motivation



**Figure 6.2** dumbbell spotting

# MONITORING SAFETY & PROGRESS OF EXERCISE

## SAFETY

An important part of instructing is to monitor and ensure the safety of exercise. The instructor should ensure clients are following and maintaining good practice in terms of postural alignment and exercise technique. If a client is unable to maintain good technique and posture, then the instructor should stop the exercise and offer a suitable alternative or regression of the exercise. It is good practice to have alternatives, progressions or adaptations planned for your clients, which can be recorded on a session plan.

## PROGRESS

It is the job of the instructor to be able to identify whether or not a client is ready to move forward, stay where they are or need to regress. The instructor has a variety of ways to monitor the progress of their clients in a gym environment, which can be used to identify the client's readiness to develop, for example:

- **Rating of perceived exertion (RPE scale) or Heart Rate**
  When using RPE (Borg 6-20 scale or 1-10 scale) or heart rate measures (% of Heart Rate Max) to identify client exercise intensity, it is possible to adjust the exercise variables to raise or lower the rating to the required levels

- **Observations**
  Observing the clients performance in terms of technique, strain or effort, along with sweating and redness can all provide a visual gauge of performance levels. With time the instructor will come to recognise their client's expressions and be able to use them as a guide to intensity and make us of exercise variables to adjust the levels
- **Percentage of 1 Rep Max**
  Can be used to monitor the intensity of resistance training and can be increased or decreased to progress or regress clients. It can be used to ensure the client is working within the correct training zone, for example working between 67-85% of 1 rep max for hypertrophy training

# SESSION CONCLUSION

## COOL DOWN

At the end of the session it is important that the instructor carries out a cool down. It is beneficial for both the instructor and the client for many reasons:

- Control the clients return to a resting state
- Allow time to develop or maintain client's flexibility
- Enhance mental and physical relaxation
- To provide the client with feedback on the session
- Discuss lifestyle factors
- Reinforce session content and relation to adherence to goals

The cool down should be tailored to the session completed. For example, if the session focused predominately on legs then the flexibility and stretching should focus on the legs or areas that lack range of movement.

It should also reflect the intensity of the session. If it has been a high intensity workout finishing on high intensity intervals, then the cool down may need to start at a higher intensity to bring the client's levels back down.

The cool down may also need to be adapted to the client's health condition. For example, if the client is pregnant, then minimal static maintenance stretches should be applied. This is due to the effects of relaxin on the joints, which can cause over stretching, especially when if undertaking development stretches.

## CLOSING THE SESSION

The cool down is a good time to provide feedback to the client based on their session performance. It should be positive but honest, ensuring to highlight what and where they put the effort in. It should also highlight areas in which the client needs to work on and develop. The instructor's communication skills will affect how the feedback is received i.e. tone of voice, context and body language. By praising and highlighting areas of success and good performance will untimely assist with motivation and adherence to their client's exercise programme.

Feedback should be two way, as it is important to get feedback on the session from the client's perspective. The instructor should offer their client the opportunity to:

- Reflect on the session overall – enjoyment, difficulty, what they liked/disliked
- Ask questions – to clarify components/exercises of the session and relevance to goals
- Provide feedback – how they felt the instruction was in terms of motivation, communication and teaching style
- Identify further needs – modification of goals, intensity and future sessions/ assistance

The instructor should be satisfied that the client leaves the session with the knowledge and skills to be able to use the gym without direct supervision. If the client is still unsure then an appropriate follow up session should be arranged.

At the very end of the session it is the responsibility of the instructor to leave the gym environment in a suitable condition for future use. They should encourage 'good housekeeping' which will also assist with health, safety and cleanliness, by:

- Wiping clean equipment, benches and mats after use
- Tidying away equipment and returning to correct place
- Reporting any equipment which has been damaged to the appropriate individual

# REVIEW & REFLECT – REFLECTIVE PRACTICE

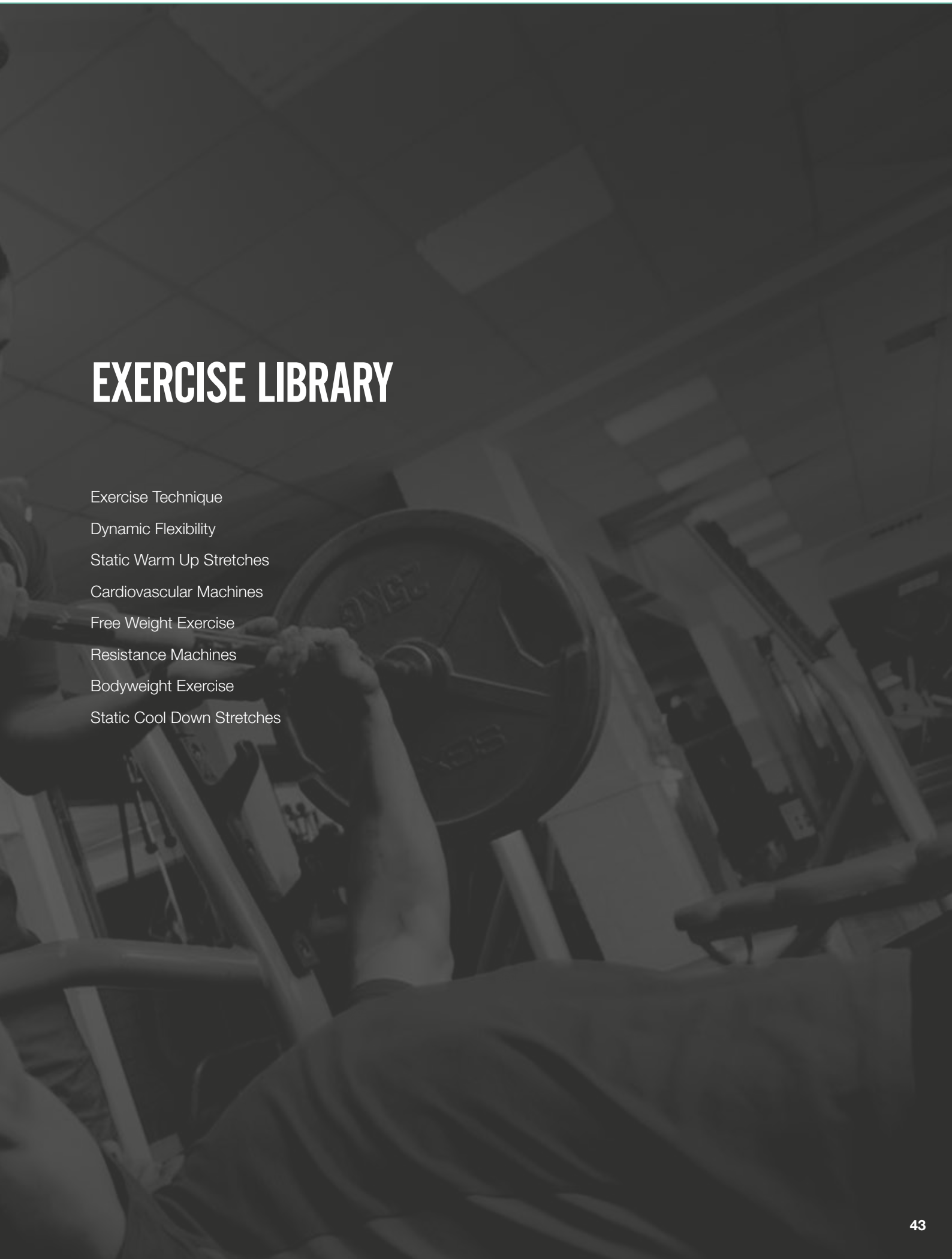
As Bright 2012 explains reflective practice is a way of studying your own experiences to improve the way you work. The act of reflection is a great way to increase confidence, become a more proactive and qualified professional. Engaging in reflective practice should help to improve the quality of the sessions you give and close the gap between theory and practice.

Following any gym session, at a suitable time after the client has left, the instructor should reflect on a session. The instructor should use both the feedback they gave the client along with the feedback received from the client. This is known as reflective practice and it is good to do this to identify areas of development and improvement, not only for the clients programme but also for the development of an instructor. It will highlight:

- How well exercises met the client's goals and objectives
- How effective and motivational the relationship with the client was
- How well the instructing style matched the clients' needs

From the process of reflective practice and evaluation instructors may use this information to improve their instructing style, the content and effectiveness of their sessions and their personal practice overall.


ECHO
kg
lbs
USA



# EXERCISE LIBRARY

Exercise Technique

Dynamic Flexibility

Static Warm Up Stretches

Cardiovascular Machines

Free Weight Exercise

Resistance Machines

Bodyweight Exercise

Static Cool Down Stretches

# EXERCISE TECHNIQUES

## HAND GRIPS

There are three main grips you take when handling or completing resistance and free weight exercises, below are images of these grips and examples of when you may use them.



### PRONATED GRIP

- Front Raise
- Lateral Raise
- Seated Row
- Shouder Press
- Triceps Pushdown
- Upright Row



### SUPINATED GRIP

- Biceps Curl
- Chest Flyes
- Chin Up



### REVERSE GRIP

- Deadlift
- Spotting

## STANCE

There are two main stances you take when completing free weight exercises, below are images of these stances and example of when you may use them



### NEUTRAL STANCE

- Biceps Curl
- Deadlift
- Frontal Raise
- Lateral Raise
- Lunge
- Prone Flyes
- Shoulder Press
- Squat
- Triceps Extension (single arm)



### SPLIT STANCE

- Biceps Curl
- Frontal Raises
- Lateral Raises
- Shoulder Press
- Triceps Extension (single arm)

## SAFE LIFTING

When moving and handling any weights it is important to use a safe lifting technique to minimise the risk of injury (manual handling) for both barbells and dumbbells





- Both techniques start with the deadlift
- Bending at the knees and hips
- Ensuring the back is neutral
- Keeping the chin the off chest
- Select grip dependant on exercise
- Lift up through the legs, weight into the heels
- Keeping the bar or dumbbells close to the body

## CLEAN AND PRESS

The clean and press is the safe way of lifting and returning the bar bell onto the 'fleshy' part of the upper back to perform exercises such as squats and lunges



- With barbell resting on the floor, place feet under the bar so shins are lightly touching
- Bend at hips and flex the knees, grasp bar with a pronated grip slightly wider than shoulders. Chest out, head neutral, and maintain a neutral spine
- Lift bar from floor by raising the hips and shoulders
- As bar passes the knees drive the hips forward to stand up straight, keep the shoulders back throughout
- When the is at the top of the thighs, keeping the bar close to the body, complete a wide upright row, to bring the bar to the top of the sternum
- As the bar reaches the top of the sternum, roll the wrists on the bar so knuckles now face the ceiling (palms facing forward)
- Bend knees slightly and drive the bar up and over the head, not locking out the elbows
- Bring the bar down to rest on the 'fleshy' part of the upper back (not on the neck), ensuring soft knees to receive the bar

# DYNAMIC FLEXIBILITY

## SQUAT TO OVERHEAD ARM SWING

### MUSCLES WORKED:

- Quadriceps
- Gluteus Maximus
- Latssimus Dorsi
- Soleus





### TEACHING POINTS:

- Squat down by bending the ankles, knees, and hips
- Swing the arms down and back as descending into the squat position
- Keep chest lifted throughout
- Return to standing position with the arms stretched overhead
- Repeat

## LUNGE WITH ROTATION

### MUSCLES WORKED:

- Quadriceps
- Gluteus Maximus
- Obliques
- Iliopsoas





### TEACHING POINTS:

- Stand in an upright position with the feet hip width apart
- Lunge forward while simultaneously rotating the torso towards the lunging side leg
- Push back strongly off the lead foot and return to the starting position
- Note: during the lunge ensure that the lead foot remains on the floor

## STANDING PECTORAL AND TRAPEZIUS

### MUSCLES WORKED:

- Pectoralis Major
- Rhomboids
- Mid Trapezius





### TEACHING POINTS:

- Stand upright with the feet hip width apart
- Pull the arms back into a press up position
- Push the arms forward while allowing the thoracic spine to round slightly
- Repeat the above varying the angle of re-traction

## GLUTE AND HAMSTRING KICK THROUGH

### MUSCLES WORKED:

- Quadriceps
- Gluteus Maximus
- Hamstrings





### TEACHING POINTS:

- Stand upright with the feet hip width apart, use a wall to balance if required
- Flex at the knee to bring the heal of the foot to the Glutes
- Kick through as high as comfortable extending the knee
- Repeat

## GUIDELINES FOR DYNAMIC STRETCHES

Dynamic stretches should only be used during the warm up

- Stretches selected should cover the whole of the body, or in the case of split routines, the stretches should target the specific areas that will be worked during the workout
- The stretches that are selected should replicate the movement patterns that will be used during the workout
- No more than 8-10 repetitions of each dynamic stretch are required, any more than this may prematurely fatigue the client
- The movement speed should be consistent, controlled and appear fluid movements
- For clients with poor co-ordination and balance, dynamic stretches may need to be broken down into component parts or regressed to use static warm up stretches

# STATIC WARM UP STRETCHES

## TRAPEZIUS

### TEACHING POINTS:

- Keep an upright posture
- Knees soft
- Neutral spine
- Arms flexed at 90 degrees
- Without fingers interlocking, palms facing out
- Push shoulder blades apart
- Hold stretch for an appropriate duration



## CHEST

### TEACHING POINTS:

- Keep an upright posture
- Knees soft
- Neutral spine
- Place both hands in the small of the back
- Pushing elbows together to the point of mild discomfort
- Hold stretch for an appropriate duration



## DELTOID

### TEACHING POINTS:

- Keep an upright posture
- Maintain a neutral spine
- Bring the arm across the body
- Hold onto the fleshy part of the arm
- Hold stretch for an appropriate duration
- Repeat on the other side



## TRICEPS

### TEACHING POINTS:

- Stand with an upright posture
- Place one arm overhead, flex the elbow
- With the other hand apply pressure to the elbow to feel the stretch
- Hold the stretch for an appropriate duration
- Repeat on the other side



## LATISSIMUS DORSI

### TEACHING POINTS:

- Stand with an upright posture
- Place arms overhead hands clasped together
- Reach towards the ceiling to feel the stretch
- Hold the stretch for an appropriate duration



## HIP FLEXORS

### TEACHING POINTS:

- Adopt a stride stance
- Place hands on the supporting thigh
- Keep chin off chest, and neutral upright spine
- Tilt pelvis forward to stretch hip flexors of the rear leg
- Hold the stretch for an appropriate duration
- Repeat on the other side



## QUADRICEPS

### TEACHING POINTS:

- Stand upright
- Flex the knee
- Same side holds the foot, bringing it closer to the buttock
- Point the involved knee down to the floor
- Keep body upright and eyes fixed forward
- Repeat on the other side



## HAMSTRINGS

### TEACHING POINTS:

- Adopt a stride stance with the back leg bent and stretching side leg straight
- Flex forward at the hips, whilst maintaining a neutral spine
- Push hips back and up for added intensity
- Hold the stretch for an appropriate duration
- Repeat on the other side



## ADDUCTOR

### TEACHING POINTS:

- Stand tall facing forward
- Neutral spine
- Leg to be stretched should be abducted to the side with feet inline with the knee
- Hold the stretch for an appropriate duration
- Repeat on the other side



## GLUTES

### TEACHING POINTS:

- Pick up the right leg and cross it over the left leg (above the knee)
- Sink the weight through the buttocks by pressing the hips back
- Rest the arms on the lower back, keep the chest lifted and eyes looking forwards
- Hold the stretch for an appropriate duration
- Repeat on the other side



## GASTROCNEMIUS

### TEACHING POINTS:

- Adopt a stride stance in front of a wall
- Hands contact the wall at shoulder height
- Keep head upright and look forward
- Ensure toes are facing forward
- Keep feet flat on the floor, pushing weight down trough the rear heal
- Repeat on the other side
- Hold the stretch for an appropriate duration



## GUIDELINES FOR STATIC STRETCHES

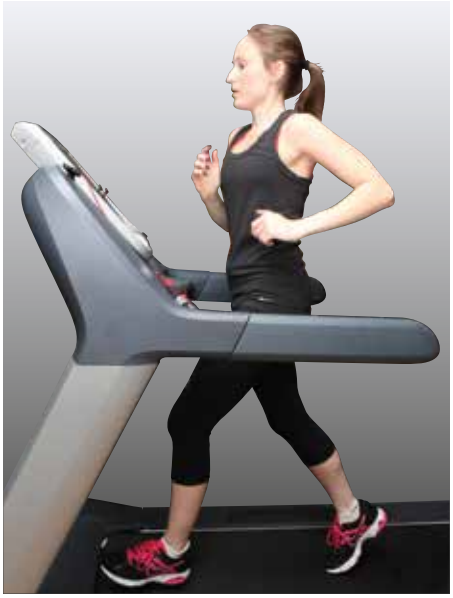
- Stretches selected should cover the whole of the body, or in the case of split routines, the stretches should target the specific areas that will be worked during the workout
- Hold each static warm up stretch for no more than 8-10 seconds
- The stretch should be held at the point of mild discomfort, and do not apply excess pressure to joints when stretching

# CARDIOVASCULAR MACHINE

## TREADMILL

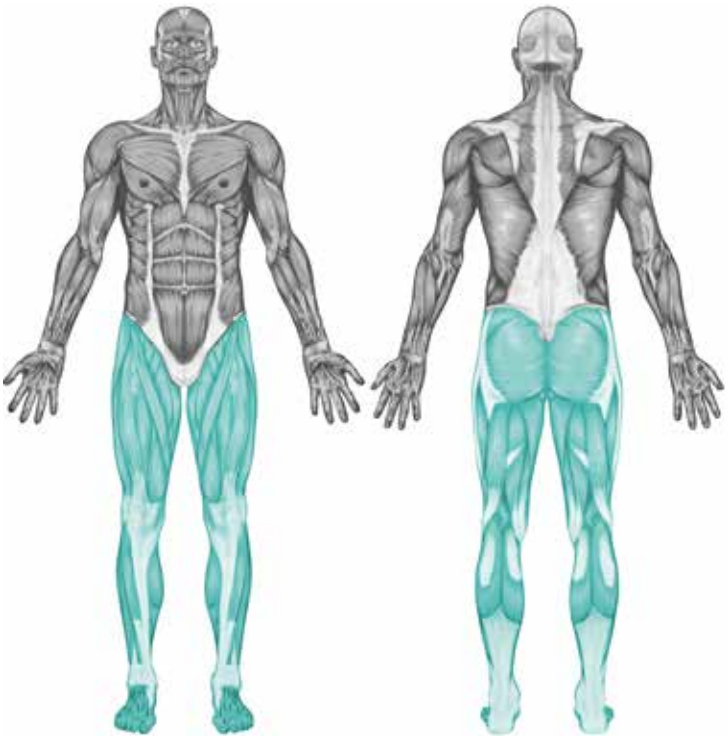
### TEACHING POINTS:

- Maintain a position in the centre of the belt
- Take a good stride
- Look forward, standing tall
- Strike the belt with a heel-to-toe action
- Swing the arms
- Keep the knees soft throughout



### PRIMARY MUSCLES WORKED:

Quadriceps, Hamstrings, Glutes and Gastrocnemius



### SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Able to do exercise, but need to monitor/reduce intensity, increase rest period. Could use cross trainer to reduce impact on bones/joints – reducing risk of growth plate factures.

**Older Adults:**

Cross trainer – less impact to bones and joints, but still weight bearing and working heart/lungs (CV system).

**Pre/Post Natal Clients:**

Upright bike – seated so more stable, requiring less balance/coordination. Also, recumbent bike, supporting lower spine. Both options still giving CV workout.

**Disability Client – Wheelchair User**

Hand bike/ergo – working arms rather than legs and still giving CV workout to the client.

### ALTERNATIVE

Cross trainer.

# UPRIGHT BIKE

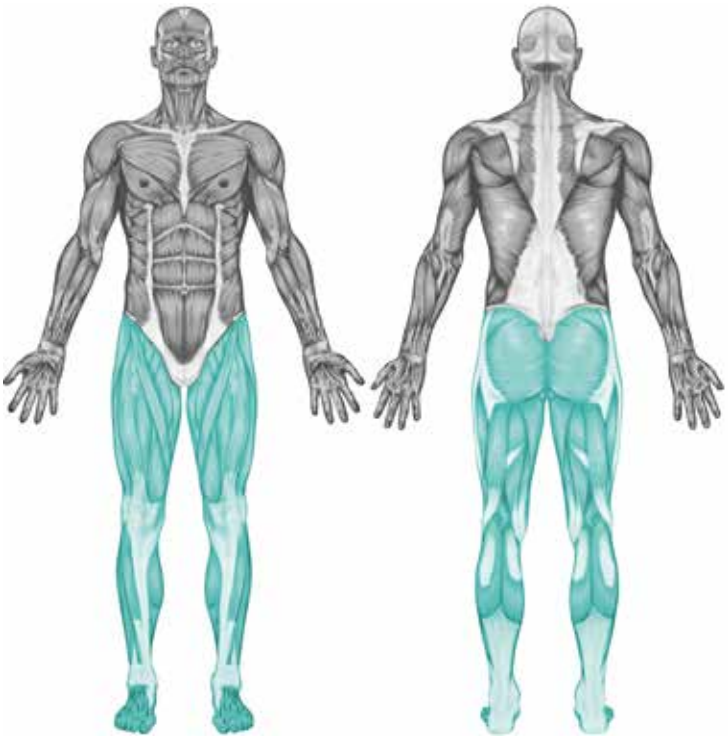
## TEACHING POINTS:

- Sit tall, facing forward, abdominals supporting the back
- Pedal without rocking from one side to the other
- Keep hips, knees and ankles in line



## PRIMARY MUSCLES WORKED:

Quadriceps, Hamstrings, Glutes and Gastrocnemius



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Able to do exercise, but need to monitor/reduce intensity, increase rest period.

**Older Adults:**

A recumbent bike could be used as it reduces impact to bones and joints, and is more stable and supportive.

**Pre/Post Natal Clients:**

A recumbent bike could be used to support the lower spine, and also provides stability.

**Disability Client – Wheelchair User**

Use of a hand bike/ergo could be used to work arms rather than legs and still give a CV workout.

## ALTERNATIVE

Cross trainer or rower.

# CROSS TRAINER

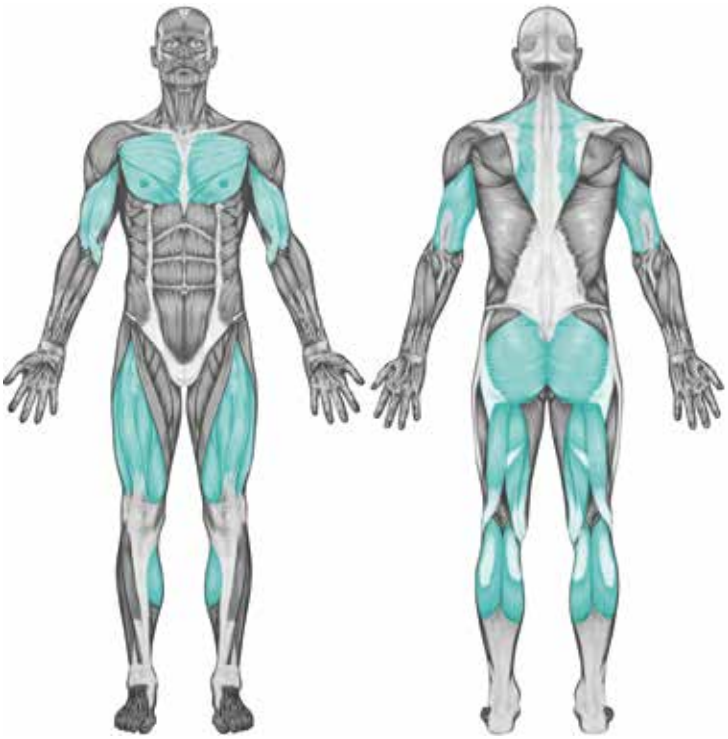
## TEACHING POINTS:

- Stand tall, keep looking forward
- Feet flat on the plates
- Hips, knees and ankles in line
- Keep the knees and elbow soft
- Let legs start/drive the movement rather than arms pulling and pushing



## PRIMARY MUSCLES WORKED:

Quadriceps, Hamstrings, Glutes, Gastrocnemius, Pectorals, Biceps, Triceps and Trapezius



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Able to do exercise, but need to monitor/reduce intensity, increase rest period.

**Older Adults:**

An upright bike could be used as it reduces impact to bones and joints, and is stable and supportive.

**Pre/Post Natal Clients:**

An upright bike could be used as its more stable, requiring less balance and co-ordination. Also, a recumbent bike if more lumbar support is required.

**Disability Client – Multiple Sclerosis**

Use of a recumbent bike to increase stability and support, therefore less weight bearing. Also important to keep intensity to health related levels.

## ALTERNATIVE

Treadmill or upright bike.

# ROWING MACHINE

## TEACHING POINTS:

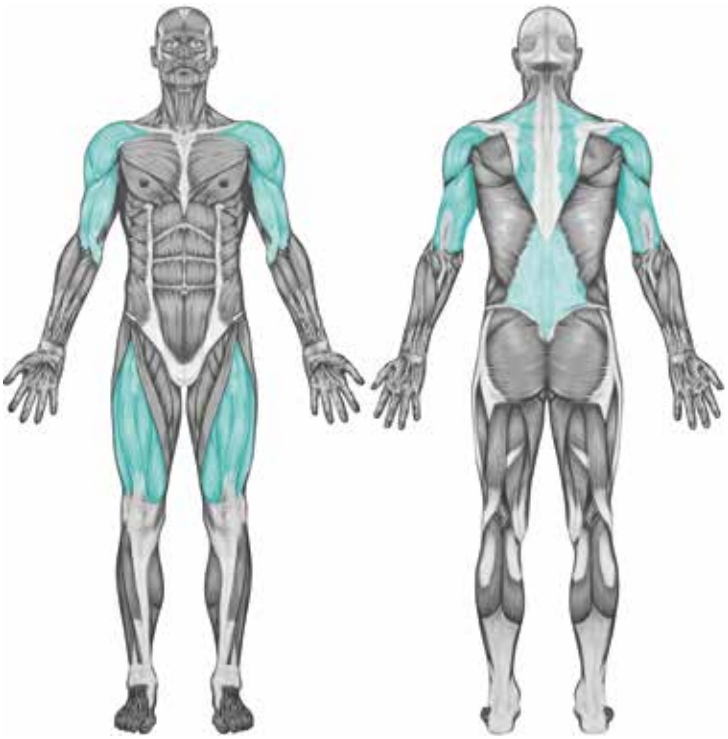
- Abdominals tight, back straight
- Wrists in line with forearms
- Follow this sequence of movement - legs, arms, arms, legs
- Try not to lean too far back
- Keep the chain level with the midline of the body





## PRIMARY MUSCLES WORKED:

Quadriceps, Biceps, Triceps, Erector Spinae, Deltoids, Trapezius and Rhomboids



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Able to do exercise, but need to monitor reduce intensity and increase rest periods.

**Older Adults:**

Cross-trainer, as still gives whole body CV workout, but is easier to get on and off.

**Pre/Post Natal Clients:**

Can do the exercise, but in later stages of pregnancy may need alternative, due to low unsupported seated position on rower.

**Disability Client – Neuromuscular disease**

Upright bike could be used as the rower requires lots of co-ordination and balance compared to the supported upright bike.

## ALTERNATIVE

Cross trainer or treadmill.

# FREE WEIGHTS

## DEAD LIFTS

### TEACHING POINTS:

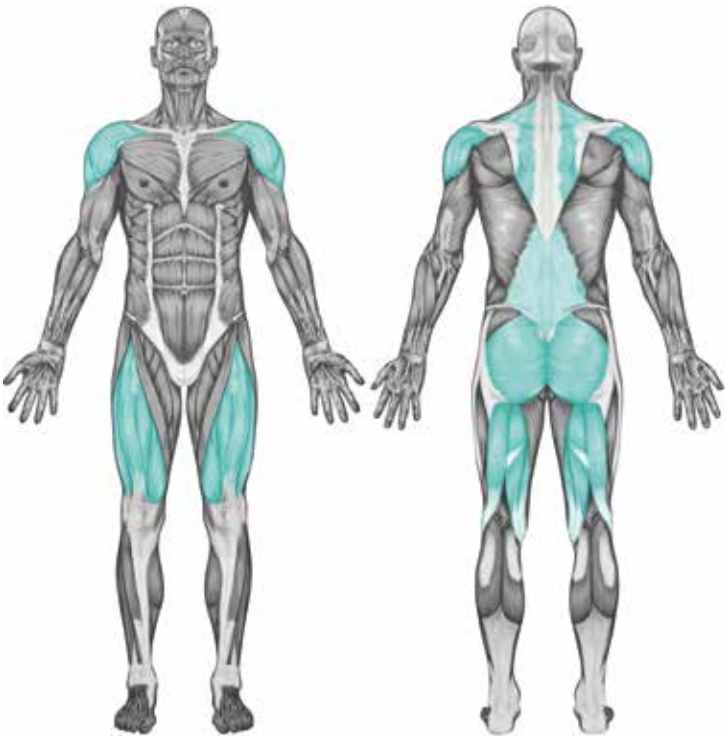
- With barbell resting on the floor, place feet under the bar so shins are lightly touching
- Bend at hips and flex the knees, grasp bar with a pronated grip slightly wider than shoulders. Chest out, head up, and maintain a neutral spine
- Lift bar from floor by raising the hips and shoulders
- As bar passes the knees drive the hips forward to stand up straight, keep the shoulders back throughout
- On return to the start position tilt forwards from the hip, thus driving the hips backwards.
- As the bar descends past the knees allow them to flex until reaching the starting position
- Keep chest lifted and maintain a neutral spine throughout





### PRIMARY MUSCLES WORKED:

Quadriceps, Hamstrings, Glutes, Erector Spinae, Trapezius and Rhomboids



### SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

A combination of bodyweight exercises, squats and back extensions.

**Older Adults:**

Complete the exercise with resistance in endurance levels, increase rest periods and reduce the range of movement as suitable.

**Pre/Post Natal Clients:**

Due to the nature of the exercise a combination of exercises such as a seated leg press and low row could be completed.

**Disability Client - Stroke**

Complete the exercise using dumbbells so the weight can be adjusted according to strength of each side of the body, spotting is essential to guide and correct the movement.

### ALTERNATIVE

Straight leg deadlift.

# BENCH PRESS (BB)

## TEACHING POINTS:

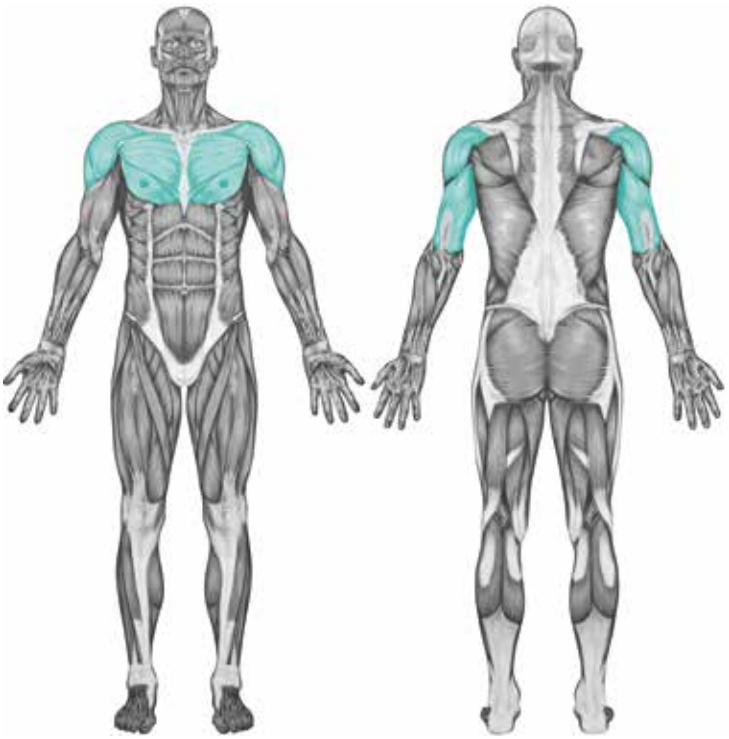
- Lie on the bench with upper body and head supported on the bench
- Grip the bar firmly with hands outside shoulder width and keep the wrists straight
- Barbell should be level with the chest
- Extend the arms without locking out and return the bar to mid-chest level without resting on the chest





## PRIMARY MUSCLES WORKED:

Pectorals, Deltoids and Triceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use a body weight alternative to reduce workload, press ups.

**Older Adults:**

Seated chest press could be used to increase exercise stability.

**Pre/Post Natal Clients:**

To avoid lying supine and to increase exercise stability use the seated chest press or pec dec machine.

**Disability Client – Wheelchair user**

Use a cable crossover machine to complete a chest press, this will enable the exercise to be completed in the wheel-chair.

## ALTERNATIVE

Dumbbell bench press, seated chest press machine, pec dec machine, dumbbell flyes or press ups.

# SUPINE TRICEP PRESS (BB)

## TEACHING POINTS:

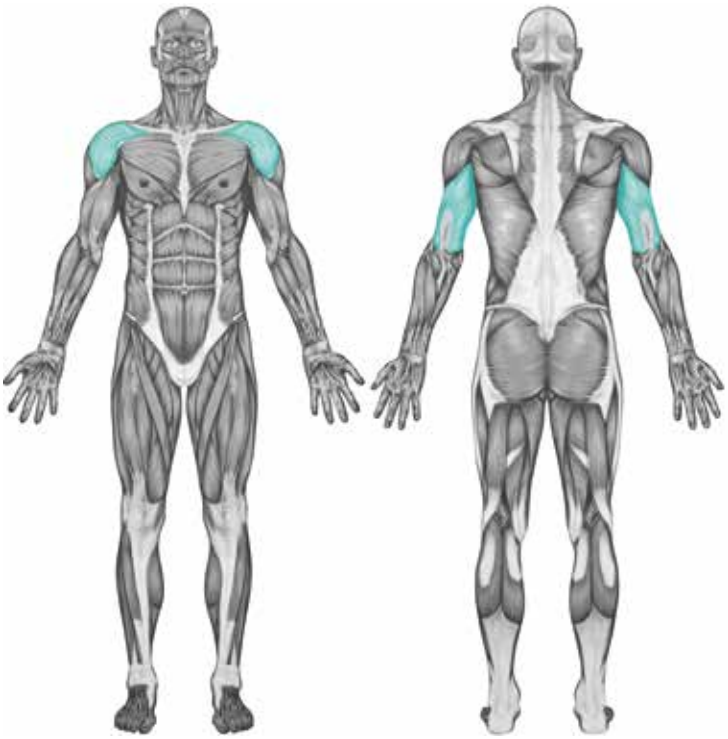
- Lie on the bench with upper body and head supported on the bench
- Grip the bar firmly with hands shoulder width and keep the wrists straight
- Barbell should start level with the bottom of the sternum
- Extend the arms without locking out and return the bar to the starting position keeping the elbows close to the torso





## PRIMARY MUSCLES WORKED:

Triceps and Anterior Deltoid



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use a body weight alternative to reduce workload, press ups.

**Older Adults:**

Seated tricep press could be used to increase exercise stability.

**Pre/Post Natal Clients:**

To avoid lying supine and to increase exercise stability use the seated tricep press or tricep pushdown (high pulley).

**Disability Client – Wheelchair user**

Use tricep pushdown (high pulley), this will enable to exercise to be completed in the wheelchair.

## ALTERNATIVE

Tricep push down (high pulley), single arm tricep extension, body-weight tricep dip or tricep extension machine.

# PECTORAL FLYES (DB)

## TEACHING POINTS:

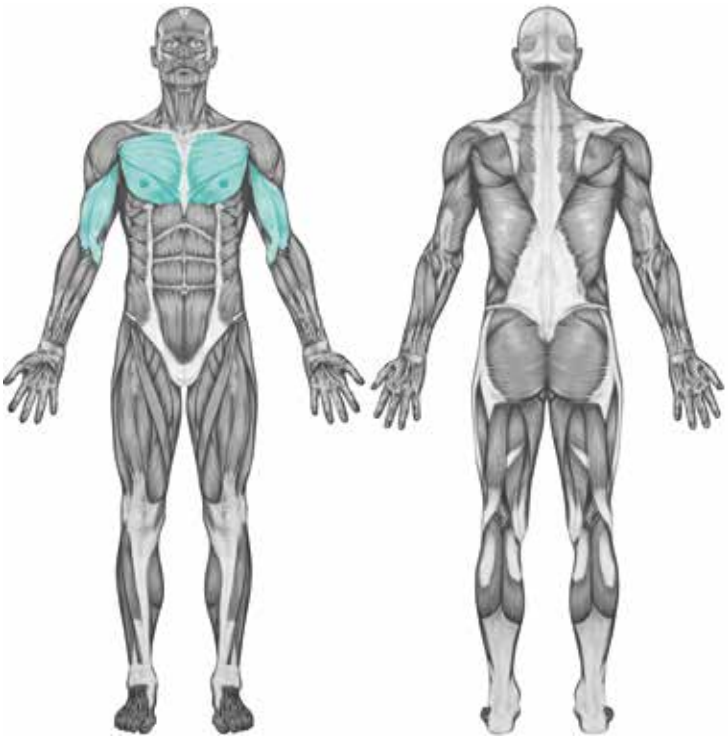
- Hold two dumbbells
- Lie with upper body and head fully supported by the bench, support dumbbells above the chest with the elbows and wrists slightly flexed
- Lower the weights directly to the side to about bench level
- Bring dumbbells back together above the chest





## PRIMARY MUSCLES WORKED:

Pectorals and Biceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use a body weight alternative to reduce workload, press ups.

**Older Adults:**

Seated chest press could be used to increase exercise stability.

**Pre/Post Natal Clients:**

To avoid lying supine and to increase exercise stability use the seated chest press or pec dec machine.

**Disability Client - Multiple sclerosis**

A pec dec machine could be used to increase the exercise stability and to help coordinate correct movement.

## ALTERNATIVE

Bench press, seated chest press machine, pec dec machine or press ups.

# SHOULDER PRESS (DB)

## TEACHING POINTS:

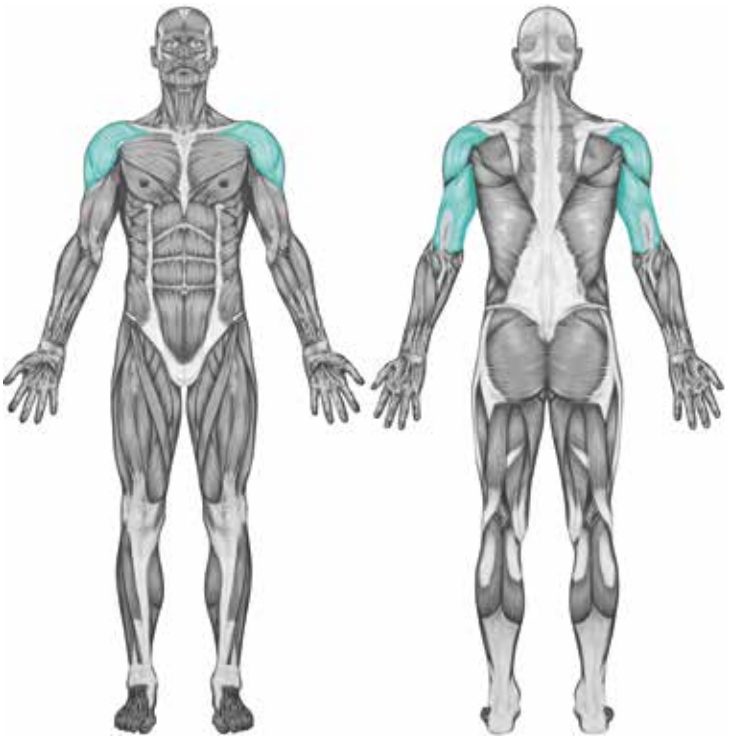
- Stand with feet a comfortable distance apart, knees soft and a neutral spine
- Position dumbbells to each side of shoulders with elbows below wrists
- Press dumbbells up until arms are extended overhead but not locked out
- Lower and repeat





## PRIMARY MUSCLES WORKED:

Deltoid and Triceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use resistance bands to complete a shoulder press, use endurance repetition ranges.

**Older Adults:**

Seated shoulder press machine could be used to increase exercise stability.

**Pre/Post Natal Clients:**

Seated lateral or frontal raises could be used to increase exercise stability and limit blood pressure increase.

**Disability Client – Hypertension**

Use frontal or lateral raises to ensure arms do not go over head height to limit blood pressure increase.

## ALTERNATIVE

Shoulder press machine, front raise or lateral raise.

# LATERAL RAISE (DB)

## TEACHING POINTS:

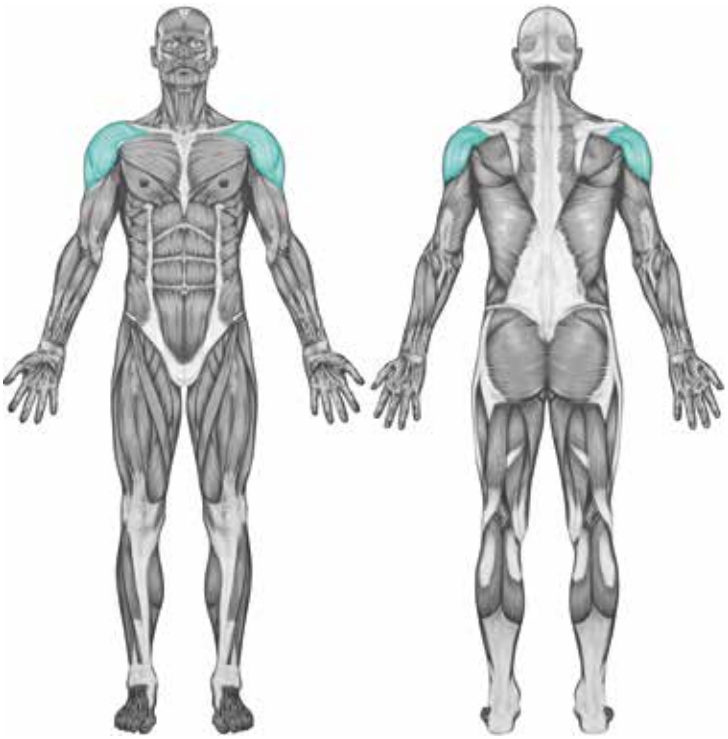
- Stand with feet shoulder width apart or slightly wider
- Place the dumbbells on the front or side of the thighs
- Maintain neutral spine and slightly flexed elbows
- Raise the dumbbells to shoulder height
- The dumbbells should be parallel to the floor
- Return to that start position





## PRIMARY MUSCLES WORKED:

Deltoid



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Complete a lateral raise exercise using resistance bands to reduce the workload.

**Older Adults:**

Seated shoulder press machine could be used to increase exercise stability.

**Pre/Post Natal Clients:**

Seated lateral or frontal raises could be used to increase exercise stability and limit blood pressure increase.

**Disability Client - Cerebral palsy**

Perform the exercise one side at a time and adjust the weight to the clients strength or weakness for each side of the body.

## ALTERNATIVE

Front raise, dumbbell shoulder press or seated shoulder press machine.

# UPRIGHT ROW (BB)

## TEACHING POINTS:

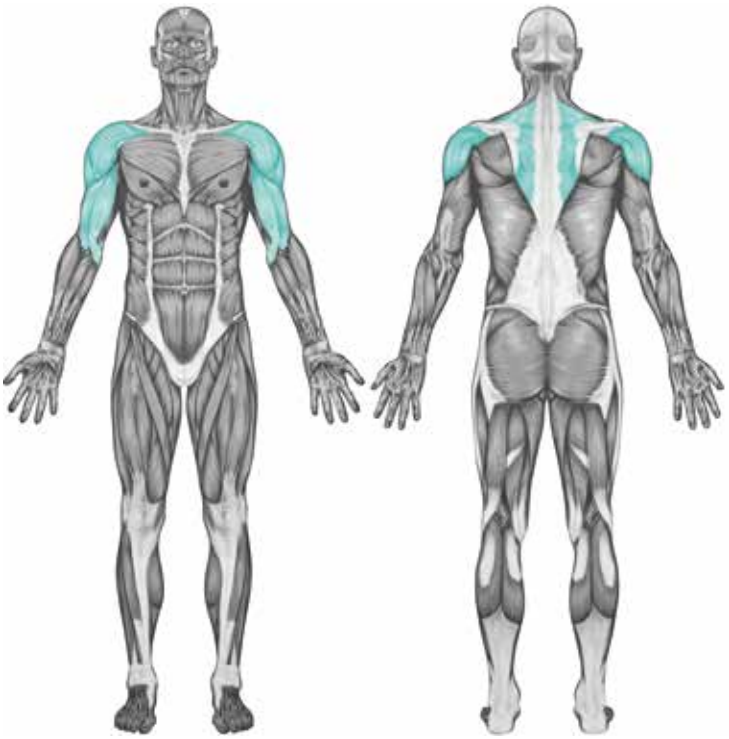
- Standing with feet just outside hip width apart
- Lift the barbell with a close overhand grip (maintain two thumb widths apart)
- Keeping the barbell close to the body, lift up towards chest height
- Keep the elbows higher than the barbell
- Lower the barbell to the original position without locking out the elbows





## PRIMARY MUSCLES WORKED:

Deltoids, Biceps and Trapezius



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Complete an upright row using resistance bands to reduce the workload.

**Older Adults:**

Use a combination of exercise such as frontal or lateral raises and shoulder shrugs.

**Pre/Post Natal Clients:**

As the client could be unable to keep the bar close to the body use a combination of seated lateral and frontal raises with shoulder shrugs.

**Disability Client – Muscular dystrophy**

Use dumbbells to work muscles on each side of the body independently and adjust the weights accordingly.

## ALTERNATIVE

Front raise, lateral raise, dumbbell shoulder press, seated shoulder press machine or shoulder shrugs.

# FRONT RAISE (DB)

## TEACHING POINTS:

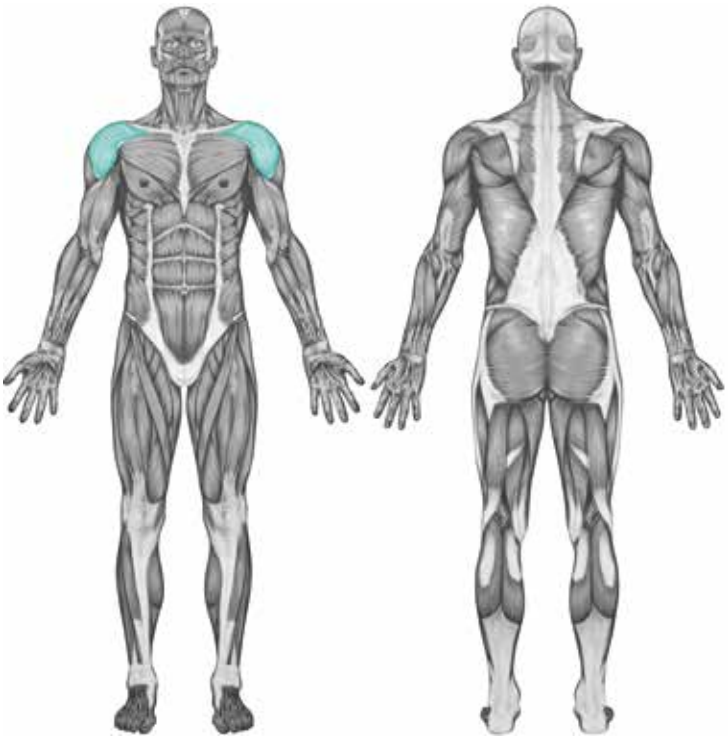
- Feet apart and neutral spine
- Hold the dumbbells in both hands to the front of the thighs
- Raise the weights directly in front of the body to shoulder height, keeping the elbows flexed slightly flex





## PRIMARY MUSCLES WORKED:

Anterior Deltoid



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Complete a frontal raise using resistance bands to reduce the workload.

**Older Adults:**

Seated shoulder press machine could be used to increase exercise stability.

**Pre/Post Natal Clients:**

Seated lateral or frontal raises could be used to increase exercise stability and limit blood pressure increase.

**Disability Client – Lower back pain**

Seated front raise or adopt a split stance to reduce pressure on the lumbar spine.

## ALTERNATIVE

Lateral raise, dumbbell shoulder press or seated shoulder press machine.

# SINGLE ARM ROW (DB)

## TEACHING POINTS:

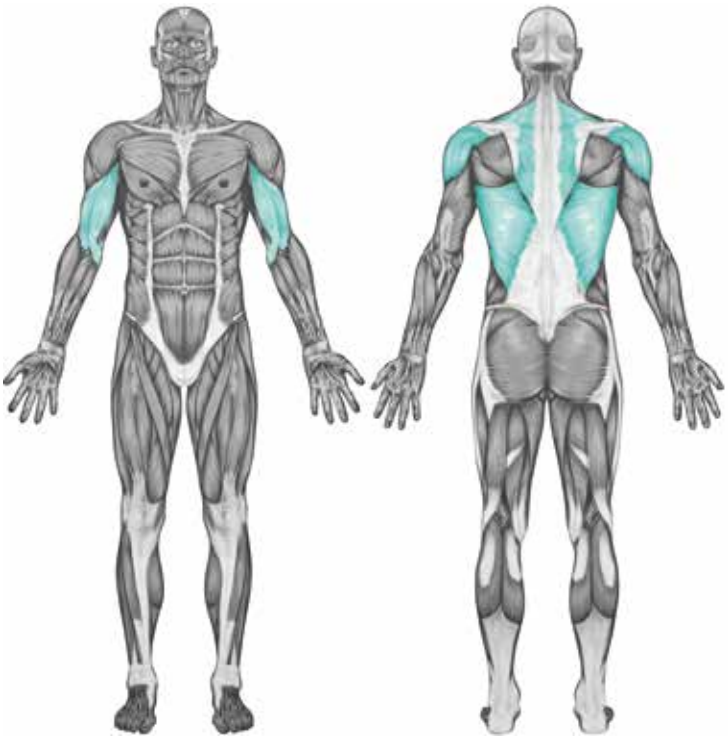
- Place the knee and the same side hand on top of a bench, with the hand under the shoulder and the knee beneath the hip
- Maintain a neutral spine and ensure that the hips and shoulders are level
- Place the other leg out to the side to stabilise
- Raise the dumbbell directly up towards the armpit keeping the elbow close to the body
- Lower back down under control ensuring elbows don't lock out
- NB all movement comes from the arm, there should be no twisting of the body





## PRIMARY MUSCLES WORKED:

Latissimus Dorsi, Posterior Deltoid, Trapezius and Biceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Resistance band be bent over row could be completed to reduce the workload.

**Older Adults:**

Seated row machine could be used to increase exercise stability.

**Pre/Post Natal Clients:**

Widen foot stance and increase the angle of the bench to reduce pressure on the lumbar spine.

**Disability Client - Wheel chair user**

Cable rows could be completed so the client does not need to leave the wheel chair.

## ALTERNATIVE

Seated cable row, seated row machine or prone flyes.

# BENT ARM PULLOVER (DB)

## TEACHING POINTS:

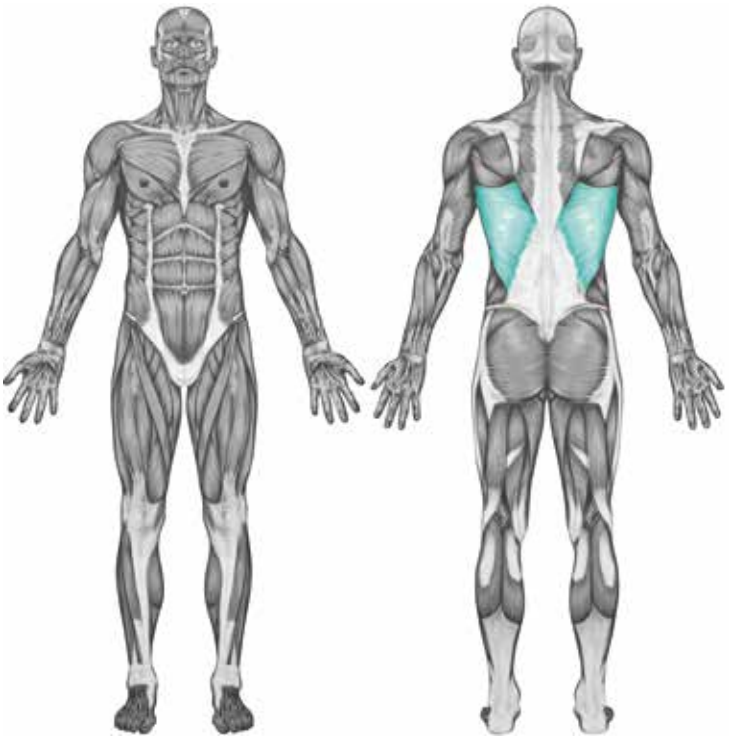
- Lie with the upper body and head fully supported by the bench
- Grasp one dumbbell with both hands from behind and position over chest with elbows bent approximately 90° and into the side of the body
- With elbows bent, lower dumbbell over and just behind head until upper arm is approximately parallel to the torso
- Return and repeat





## PRIMARY MUSCLES WORKED:

Latissimus Dorsi



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Assisted pull up machine could be used with suitable endurance repetition range and resistance.

**Older Adults:**

Use a vertical traction machine to increase the exercise stability.

**Pre/Post Natal Clients:**

To avoid lying supine change the exercise for a single arm row.

**Disability Client - Stroke**

Use a single arm row so the weight can be changed to suit weakness on either side of the body.

## ALTERNATIVE

Lat pull down, seated row or single arm row.

# PRONE FLYES (DB)

## TEACHING POINTS:

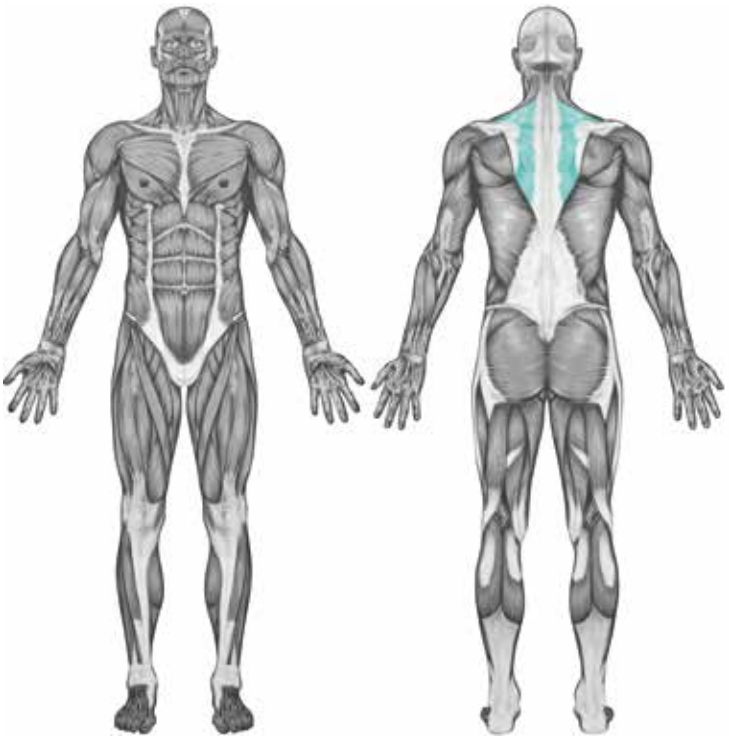
- Stand with feet a comfortable distance apart and bend forward at the hips
- Maintain a neutral spine whilst holding the forward position
- Hold the dumbbells in a neutral grip below the body with elbows slightly bent
- Raise the dumbbells directly out to the side until level with the shoulders





## PRIMARY MUSCLES WORKED:

Trapezius and Rhomboids



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

A seated resistance band prone fly could be used to reduce the exercise workload.

**Older Adults:**

Complete the prone fly in a seated position to add stability to the exercise.

**Pre/Post Natal Clients:**

Complete the exercise with a comfortable lean forward, use endurance repetition range and exercise intensity, complete sitting on a fit ball to increase exercise intensity.

**Disability Client – Wheelchair user**

Use a upright rear cross over so the client does not need to leave the wheelchair.

## ALTERNATIVE

Seated row, or single arm row.

## BICEP CURL (DB/BB)

### TEACHING POINTS:

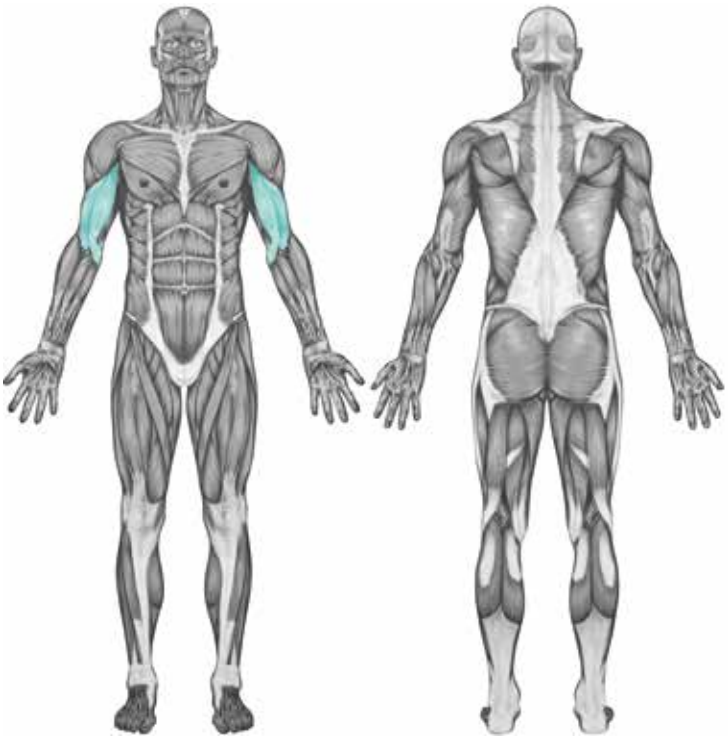
- Standing with the feet hip width apart, holding a barbell with an under hand, shoulder width grip at arms length
- With elbows tucked tightly into the sides of the body curl the barbell up towards the chest
- Pause briefly, then slowly lower to the start position without locking out the elbows






### PRIMARY MUSCLES WORKED:

Biceps



### SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use the assisted pull up machine to complete a bicep pull up or use resistance bands to complete a bicep curl.

**Older Adults:**

Seated arm flexion/bicep curl machine to increase stability. If they have good stability/coordination may use split stance to increase base.

**Pre/Post Natal Clients:**

Seated DB bicep curl to increase stability, could also use a swiss/gym ball to also work pelvic floor/ core muscles at the same time.

**Disability Client - Multiple Sclerosis**

Due to nerve deficiency reduce weight/resistance, use DB's to work arms unilaterally and can easily adjust resistance to each arm according to strength.

### ALTERNATIVE

Bicep pull up or cable bicep curl (low pulley).

# SINGLE ARM TRICEP EXTENSION (DB)

## TEACHING POINTS:

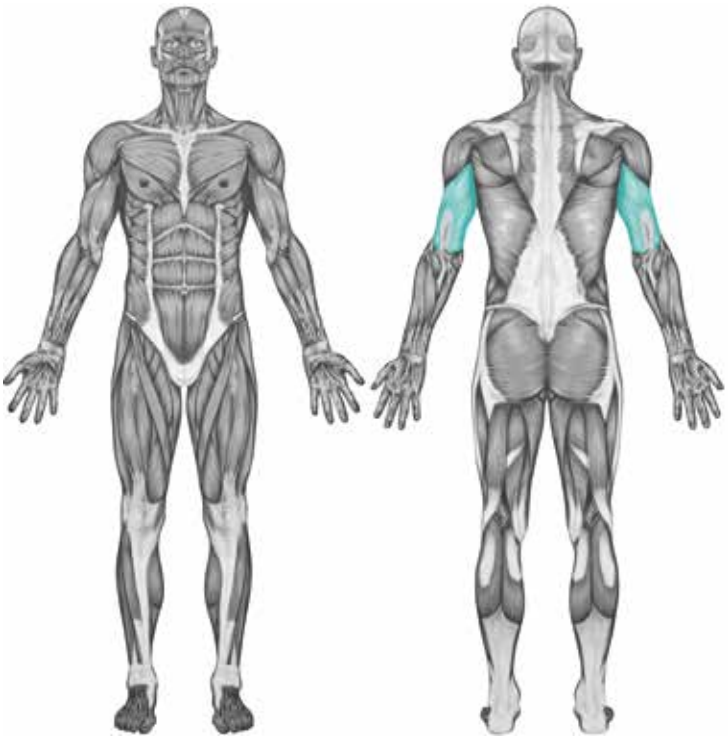
- Standing with the feet hip width apart, holding a dumbbell with an overhand grip extended above the head
- Keeping the elbow fixed, flex the elbow bringing the weight behind the head
- Pause briefly, then slowly extend the elbow to the start position without locking out the elbows





## PRIMARY MUSCLES WORKED:

Triceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use of tricep dips could be used to reduce the workload.

**Older Adults:**

Use of a tricep extension machine could be used to add exercise stability.

**Pre/Post Natal Clients:**

Use of a tricep push down on a high pulley could be given to keep arms below shoulder height to reduce blood pressure increase.

**Disability Client – Stroke**

Use of a tricep machine could be used to ensure safety as the client may have weakness on one side of body, increasing danger when working above the head.

## ALTERNATIVE

Supine tricep press, triceps pushdown (high pulley) and body-weight triceps dip or tricep extension machine.

# SQUAT (BB OR DB)

## TEACHING POINTS:

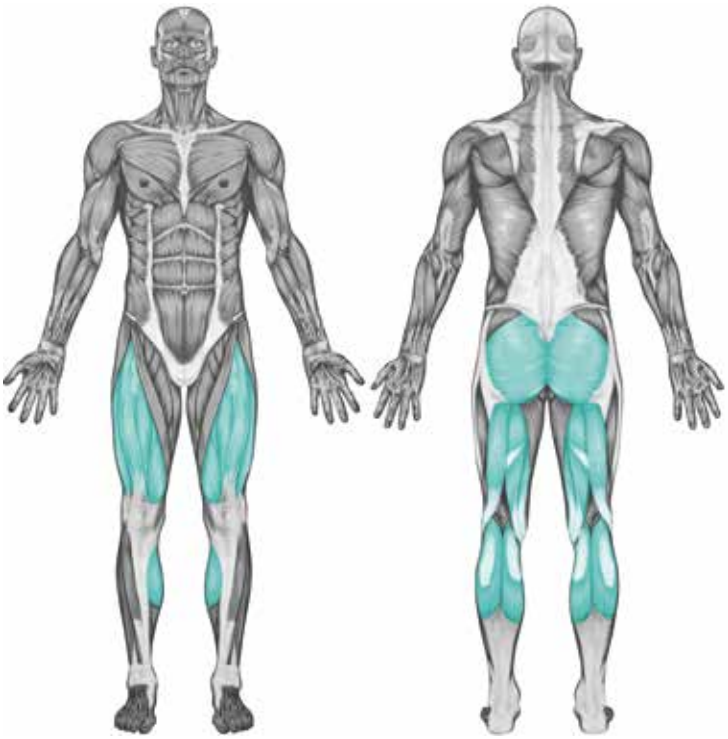
- Hold dumbbells by the side of the body
- Feet shoulder width apart
- Brace abdominal and back muscles
- Initiate squat by flexing from the knees and hips
- Lower slowly to a comfortable position
- From the bottom position push the ground away keeping the chest lifted throughout to maintain a neutral spine
- Breathe out through the sticking point
- Keep knees in line with toes and heels down throughout exercise





## PRIMARY MUSCLES WORKED:

Quadriceps, Hamstrings, Gastrocnemius and Glutes



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Body weight squats or lunges could be given to reduce the exercise workload.

**Older Adults:**

Leg press machine could be given to increase the stability of the exercise.

**Pre/Post Natal Clients:**

Leg extension and hamstring curls could be completed ensure the client is not supine or endangering the abdomen area.

**Disability Client - Stroke**

Complete a body weight squat using endurance repetition ranges, reduce the range of movement if required.

## ALTERNATIVE

Leg press, or a combination of leg extension and hamstring curl and lunge.

# FORWARD LUNGE (BB)

## TEACHING POINTS:

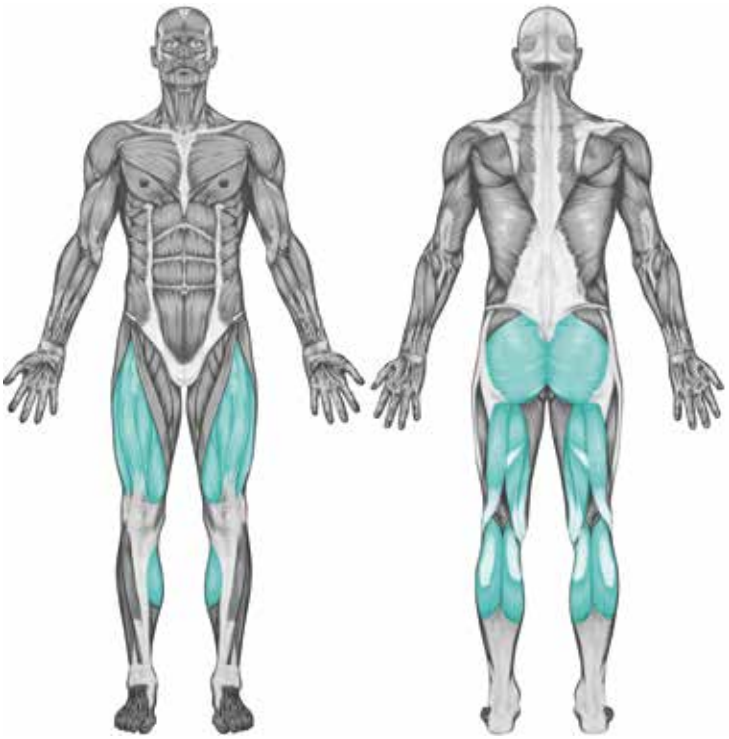
- Stand tall with a pole/bar placed across the upper trapezius
- Place the feet greater than a normal stride apart with feet hip width apart and toes facing forward
- Keep chest lifted and brace the abdominals and back muscles
- Lunge forward using alternate legs, flexing the knees until leading leg knee is roughly at a right angle, while the trailing leg knee should avoid contact with the floor
- At the bottom push the ground away keeping the chest lifted to maintain a neutral spine and return to starting position
- Keep knees in line with toes and front heel down throughout exercise





## PRIMARY MUSCLES WORKED:

Quadriceps, Hamstrings, Gastrocnemius and Glutes



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Body weight lunges could be given to reduce the exercise workload.

**Older Adults:**

A seated hamstring curl and leg press machine could be given to increase the stability of the exercise.

**Pre/Post Natal Clients:**

Body weight lunges or hamstring curls could be completed to reduce the exercise intensity.

**Disability Client – Obesity**

Used a seated hamstring curl and leg press machine to reduce pressure on the knee joint.

## ALTERNATIVE

Squats, dead lift, leg press or a combination of squats and lunges.

# RESISTANCE MACHINES

## SEATED CHEST PRESS

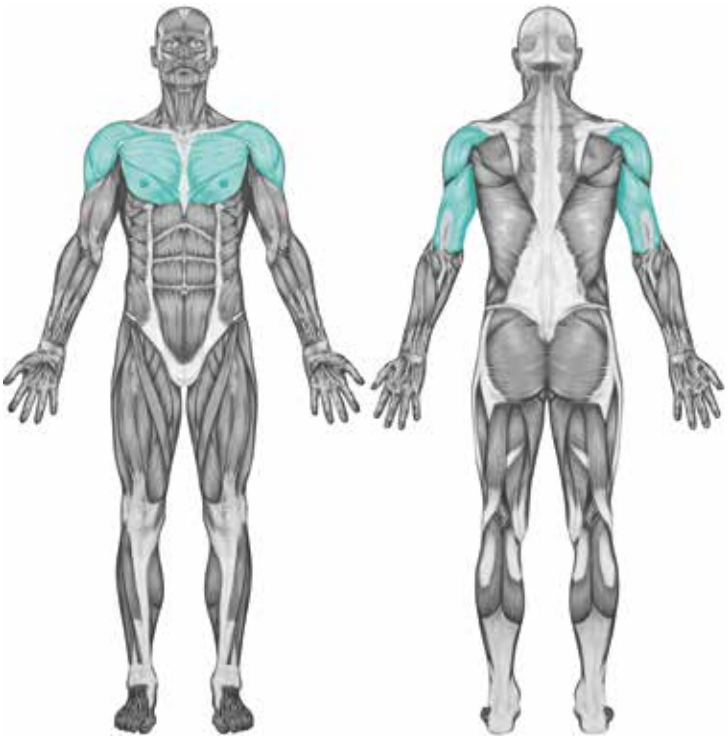
### TEACHING POINTS:

- Set the seat height so that the handle is at armpit level
- Maintain neutral spine
- Grip handles firmly and keep the wrists straight
- Push out to extend the arms without locking out the elbows
- Slowly lower the weight, keeping the elbows level with hands
- Return to start position and repeat



### PRIMARY MUSCLES WORKED:

Pectorals, Deltoids and Triceps



### SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use bodyweight press up variations to reduce the workload on muscle groups.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client – Muscular dystrophy**

Due to nerve deficiency reduce weight/resistance, use dumbbell bench press to work arms unilaterally and can easily adjust resistance to each arm according to strength.

### ALTERNATIVE

Bench press, pec flyes, pec dec machine or press ups.

# SEATED PEC DEC

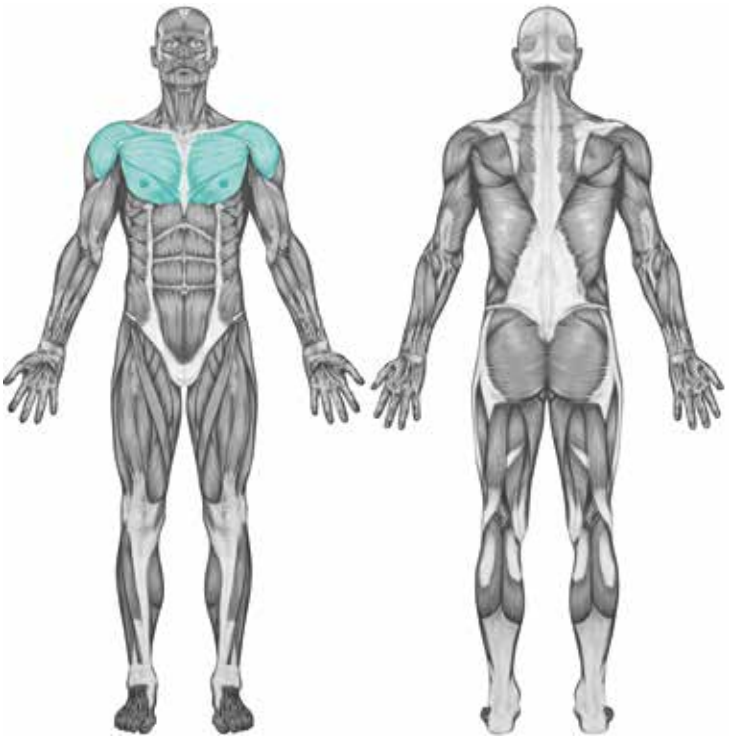
## TEACHING POINTS:

- Sit in the machine with back on pad
- Place forearms on padded lever with elbows in line with the chest
- Squeeze elbows together then return to start position
- Maintain a neutral spine throughout



## PRIMARY MUSCLES WORKED:

Pectorals and Anterior Deltoids



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use bodyweight press up variations to reduce the workload on muscle groups.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client – Wheelchair user**

Use the cable machine to complete chest flyes so the client does not need to leave the wheel chair.

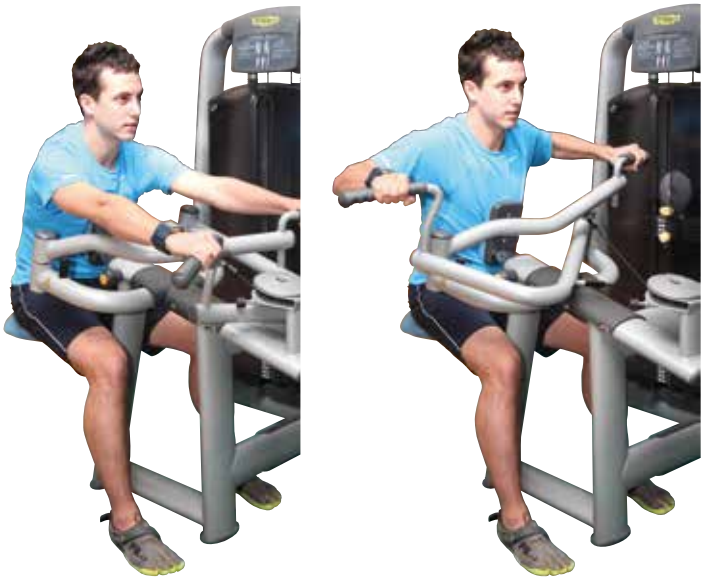
## ALTERNATIVE

Seated chest press machine, bench press or pec flyes.

# SEATED ROW (PULLEY)

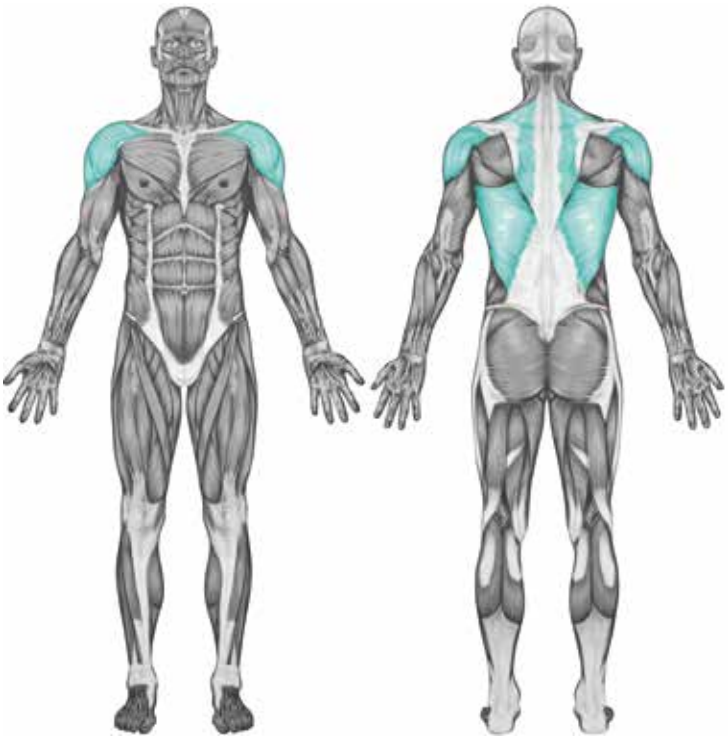
## TEACHING POINTS:

- Adjust the seat height so that it allows the chest to rest against the support pad
- Maintain a neutral spine
- Keeping the elbows close to the body and the wrists straight
- Pull the weight towards the abdomen pause briefly, then slowly return the weight to the start position



## PRIMARY MUSCLES WORKED:

Latissimus Dorsi, Deltoids and Trapezius



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use resistance bands to complete a bent over row or seated row to reduce the workload.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

A single arm row could be used to reduced risk of abdominal injury.

**Disability Client – Wheelchair user**

If the seat cannot be moved a cable machine could be used to complete a seated row.

## ALTERNATIVE

Prone flyes, single arm row or bent over row.

# SEATED SHOULDER PRESS

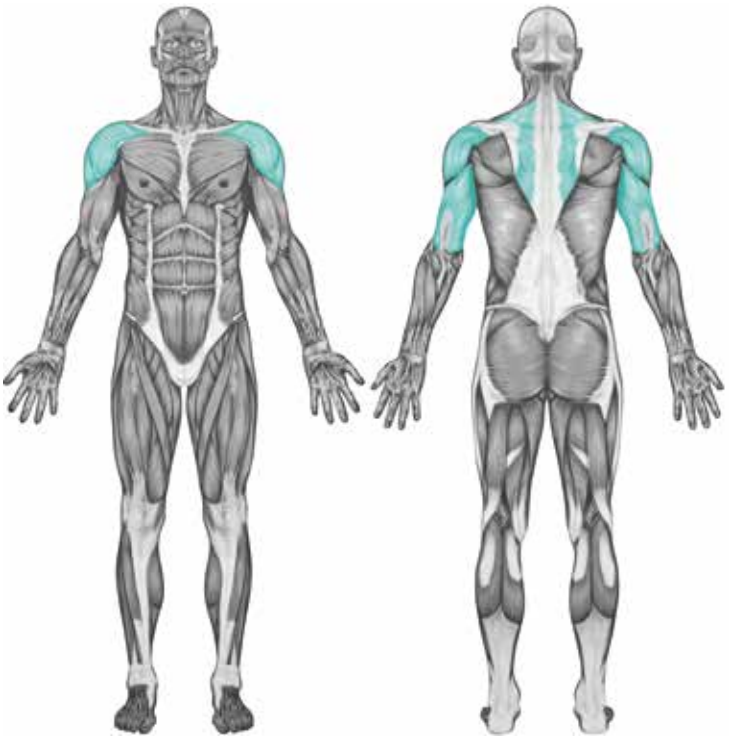
## TEACHING POINTS:

- Sit in the machine with a neutral spine and adjust the seat so that the handles are at shoulder height
- Hold the handles and push the weight upwards, keeping the wrists straight and in line with forearm
- Pause briefly at the top, then slowly lower the weight, until the hands are at ear level
- The maintenance of a neutral spine is of particular importance throughout this exercise



## PRIMARY MUSCLES WORKED:

Deltoids, Trapezius and Triceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use resistance bands to complete a shoulder press and reduce the workload.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client – Hypertension**

Complete a seated frontal or lateral raise to reduce blood pressure increase.

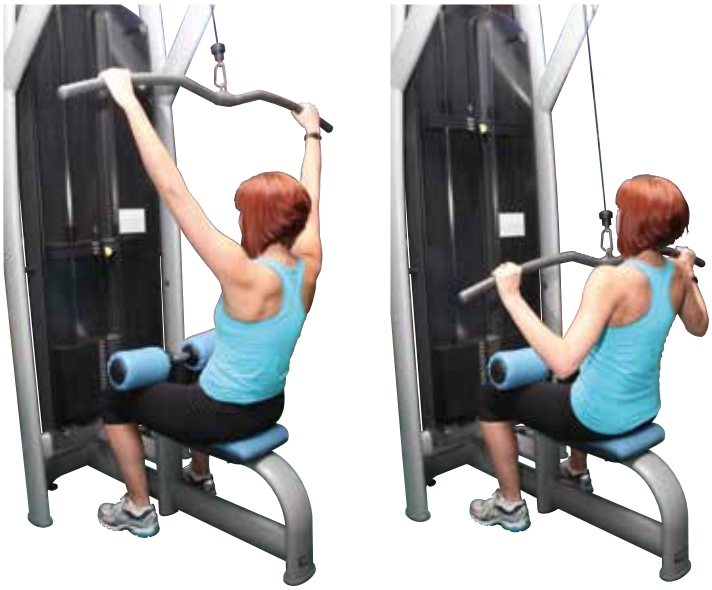
## ALTERNATIVE

Frontal raise, lateral raise or dumbbell shoulder press.

# LAT PULL DOWN

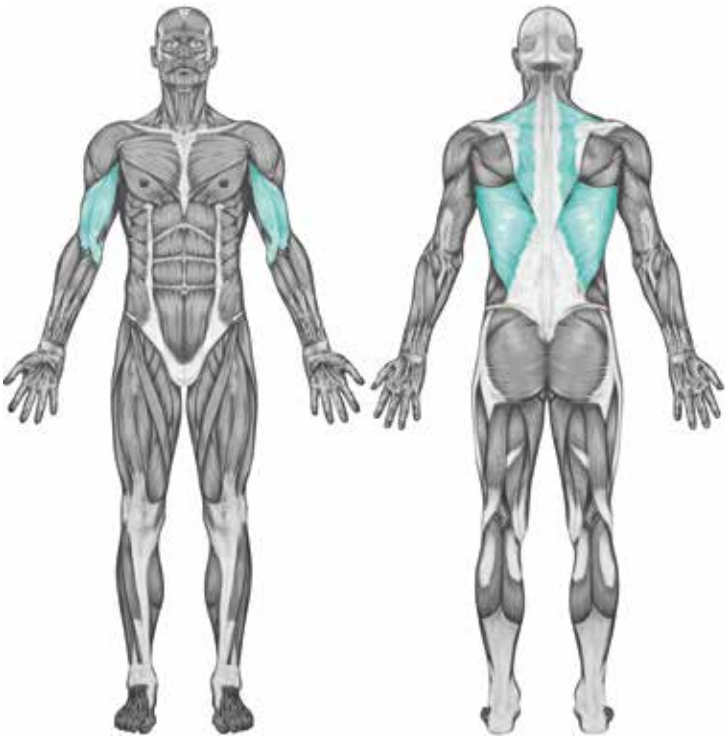
## TEACHING POINTS:

- Adopt a natural overhand grip (just wider than shoulder width)
- Sit into the machine directly under the cable pulley and lock the thighs under the pad (if necessary)
- With the arms above the head, lean back slightly, so that the sternum is now directly under the pulley
- Whilst maintaining a neutral spine, pull the bar down towards the sternum keeping the forearms completely vertical
- Pause briefly then return to the start



## PRIMARY MUSCLES WORKED:

Latissimus Dorsi, Trapezius and Biceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use assisted pull up machine to complete wide arm pull up to reduce the workload.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client – Stroke**

Use dumbbell single arm row so that the weight can be adjusted for the weaker side of the body.

## ALTERNATIVE

Single arm row, bent arm pull over, assisted wide arm pull up or vertical traction machine.

# ASSISTED PULL UP

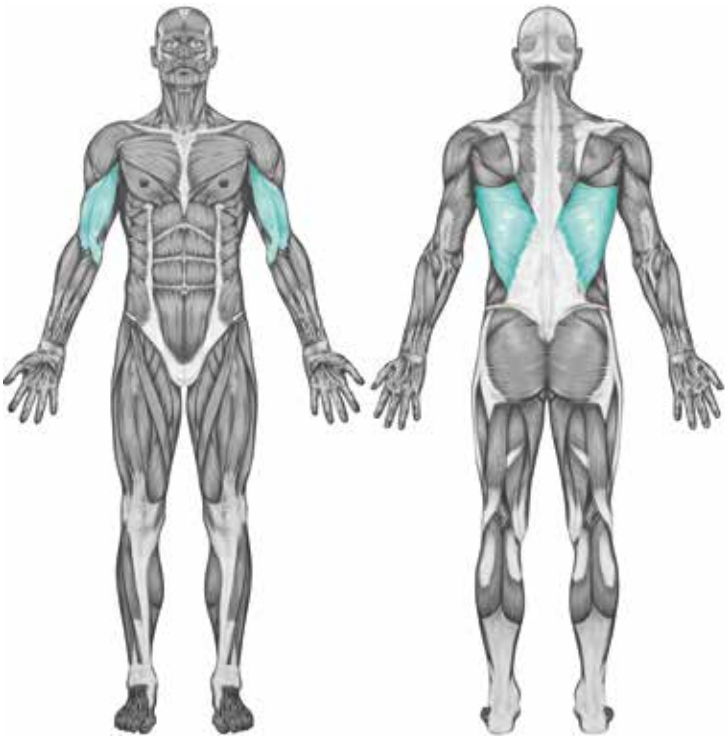
## TEACHING POINTS:

- Hold the Chin Up bar with an overhand grip
- Hands wider than shoulder width
- Pull the body up so that the chin is level with the bar



## PRIMARY MUSCLES WORKED:

Latissimus Dorsi and Biceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use vertical traction or resistance bands to complete a single arm row if the client prefers.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client – Wheelchair user**

Use a cable machine to complete a lat pull down.

## ALTERNATIVE

Lat pull down, vertical traction machine, single arm row or bent arm pull over.

# TRICEP PUSHDOWN (HIGH PULLEY)

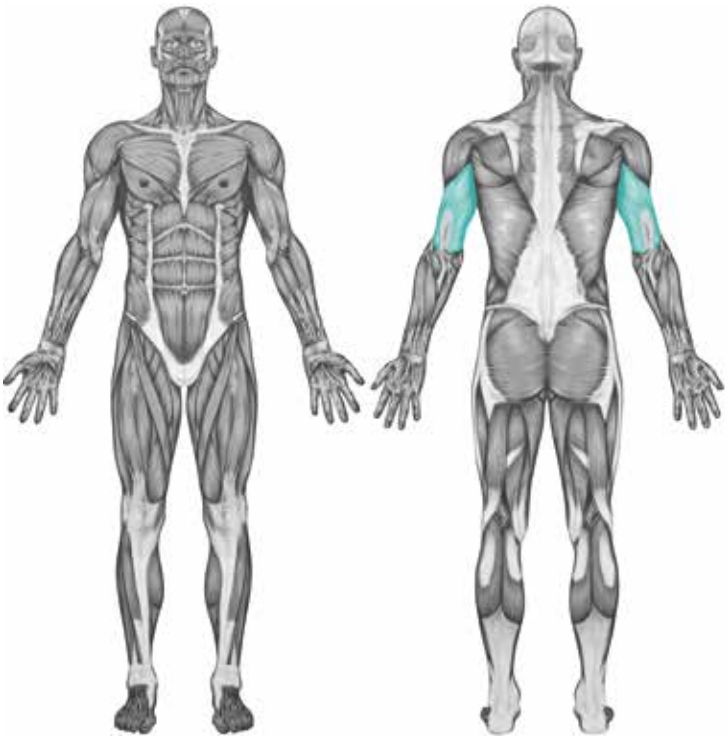
## TEACHING POINTS:

- Stand facing a cable column with a hip width stance
- Attach a short bar onto the cable and adopt an over-hand grip
- Keeping a neutral spine
- With the elbows at the side, and arm parallel to the floor, straighten the arms so that the bar rests on the upper thigh
- Moving the elbows, return the bar to the start position



## PRIMARY MUSCLES WORKED:

Triceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Complete body weight tricep dips to reduce the work load on the muscles.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the en-durance range, increase the rest periods as required.

**Disability Client – Lower back pain**

Use a seated tricep extension to reduce the pressure on the lower back.

## ALTERNATIVE

Tricep pushdown machine, dumbell tricep extension or tricep dips.

# BICEP CURL (LOW PULLEY)

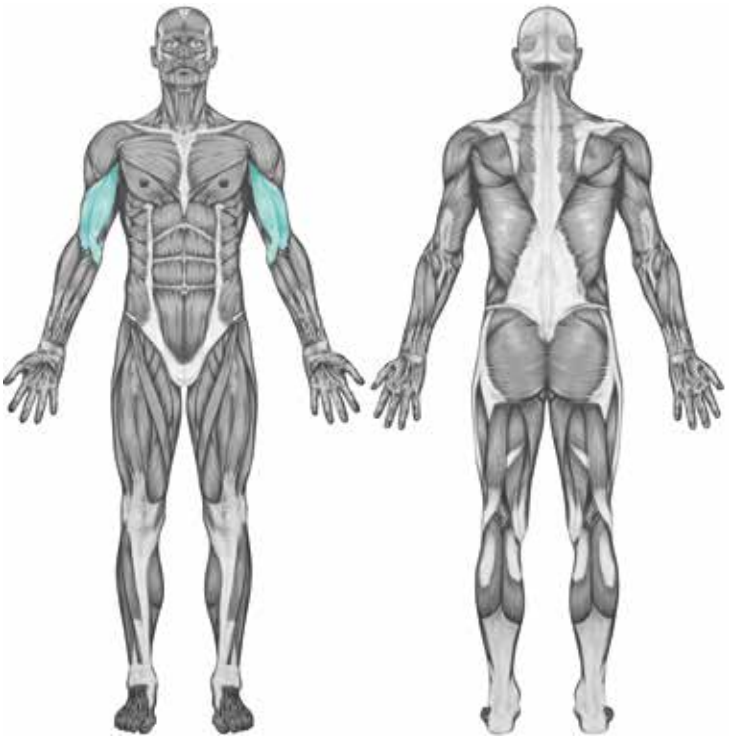
## TEACHING POINTS:

- Hold the low pulley cable bar with a shoulder width under hand grip
- Stand close to pulley with elbows to side, raise bar until forearms are vertical
- Lower until the arms are fully extended but not locked out



## PRIMARY MUSCLES WORKED:

Biceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use resistance bands to complete a bicep curl or assisted pull up machine to complete a bicep pull up.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client – Oseto arthritis**

If the client is unable to grip fully, use the cuff attachment on the fore arm.

## ALTERNATIVE

Arm curl machine, assisted bicep pull up or dumbbell/barbell bicep curl.

# LEG PRESS

## TEACHING POINTS:

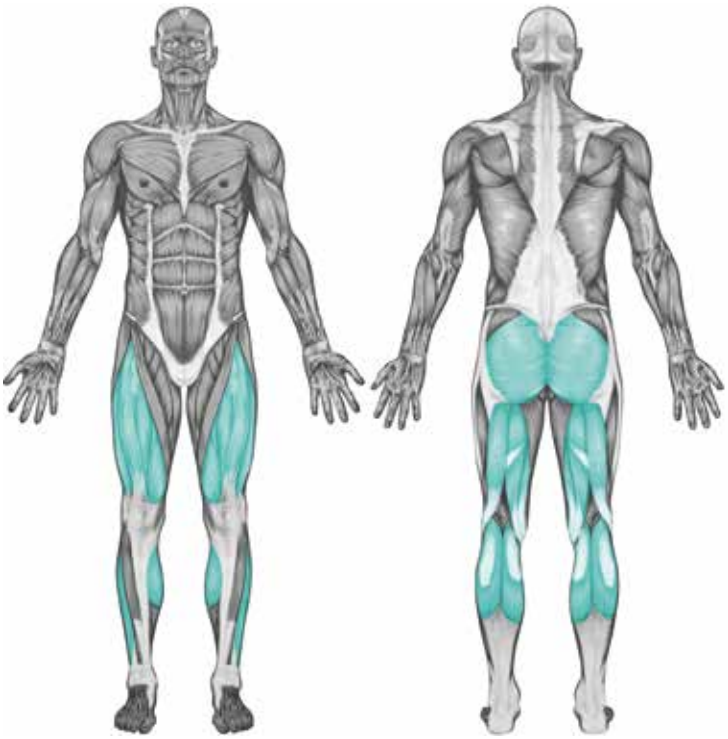
- Sit on machine with back on padded support
- Place feet on platform hip width apart, set seat so that knees are at a 90° angle
- Hold the handles at the side
- Push platform away by extending knees and hips without locking out
- Return to start position





## PRIMARY MUSCLES WORKED:

Quadriceps, Hamstrings, Gastrocnemius, Soleus and Glutes



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use body weight alternatives such as squats and lunges to reduce the workload on muscles.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client - Lower back pain**

Leg/knee extension machine seated working one leg at a time, this way the weight can be adapted for the stronger and weaker sides of the body still working the quadriceps.

## ALTERNATIVE

Leg extension combined with hamstring curl machine, squats or lunges.

# SEATED KNEE EXTENSION

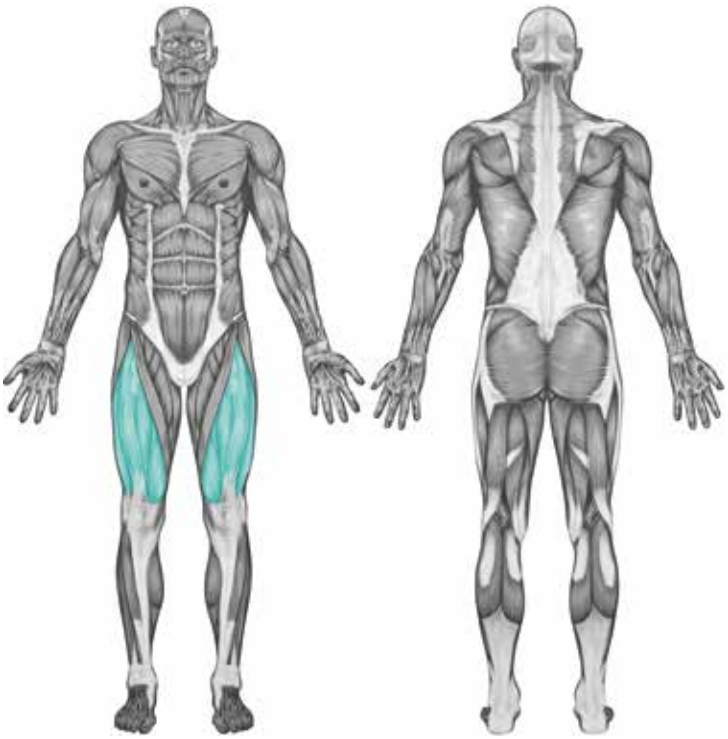
## TEACHING POINTS:

- Set the back rest so that the back is supported and the knee is at the pivot point
- Adjust the shin pad so that it is just above the shoe laces
- Sit in the machine, with the back against the rest, lightly gripping the handles
- Lift your toes towards the knees
- Extend the knees under control to full extension keeping the toes to the ceiling
- Pause briefly, then slowly lower to the start position



## PRIMARY MUSCLES WORKED:

Quadriceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use body weight alternatives such as squats and lunges to reduce the workload on muscles.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client - Wheelchair user**

Use resistance bands or ankle weights to add resistance, the client can also complete this in the wheelchair.

## ALTERNATIVE

Lunges, squats or seated leg press.

# HAMSTRING CURL

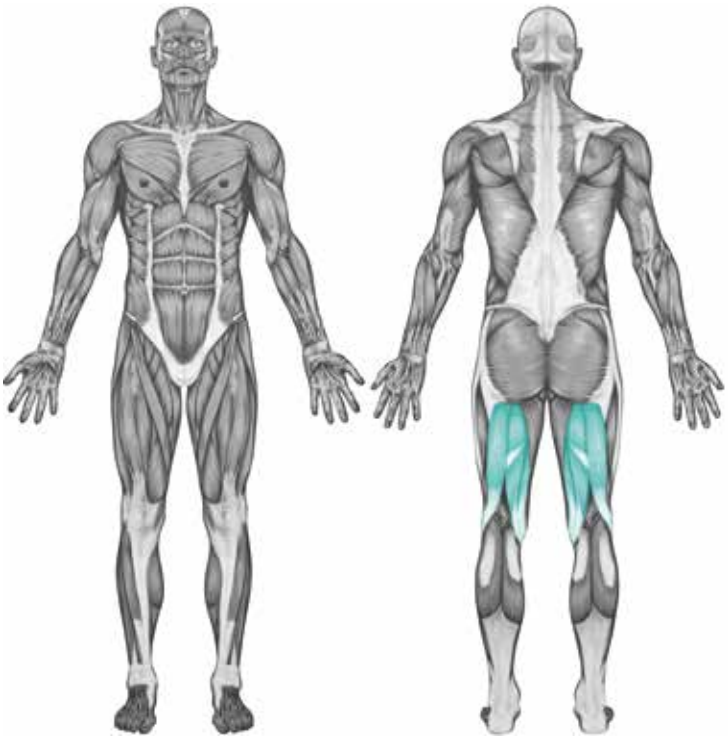
## TEACHING POINTS:

- Set the heel pad so that when the knee is at the pivot point the pad is on the Achilles tendon, just above the training shoe
- Maintain neutral spine
- Clasp the handles at the side and with the toes pointing upwards
- Flex at the knee until reaching a 90 degree angle



## PRIMARY MUSCLES WORKED:

Hamstrings



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use body weight alternatives such as body weight dead lifts, lunges and fit ball hamstring curl to reduce the workload on muscles.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Disability Client - Osteo arthritis, knee rehabilitation**

Reduce the range of movement and resistance to comfortable range ensuring the knees do not lock out.

## ALTERNATIVE

Dead lifts, lunges, lying hamstring curl machine or fit ball hamstring curl.

# SEATED ADDUCTOR

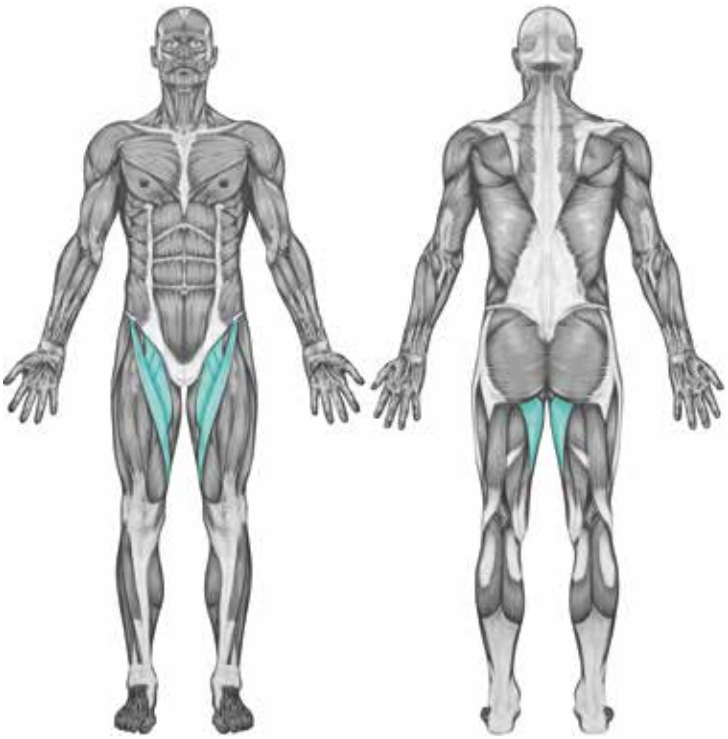
## TEACHING POINTS:

- Sit in machine with heels on bars and pads on insides of the knees
- Maintain neutral spine
- Pull on lever to position legs apart
- Release lever into position and grasp bars to sides
- Squeeze knees together by adducting the hips
- Return and repeat



## PRIMARY MUSCLES WORKED:

Adductors



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use body weight leg raises or resistance bands to increase the intensity.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required, reduce the range of movement as required.

**Pre/Post Natal Clients:**

Avoid this exercise and complete pelvic floor exercises.

**Disability Client – Stroke**

Work one leg at a time, this way the weight can be adapted for the stronger and weaker sides of the body, resistance bands can be used if required.

## ALTERNATIVE

Side lying leg raises.

# SEATED ABDUCTOR

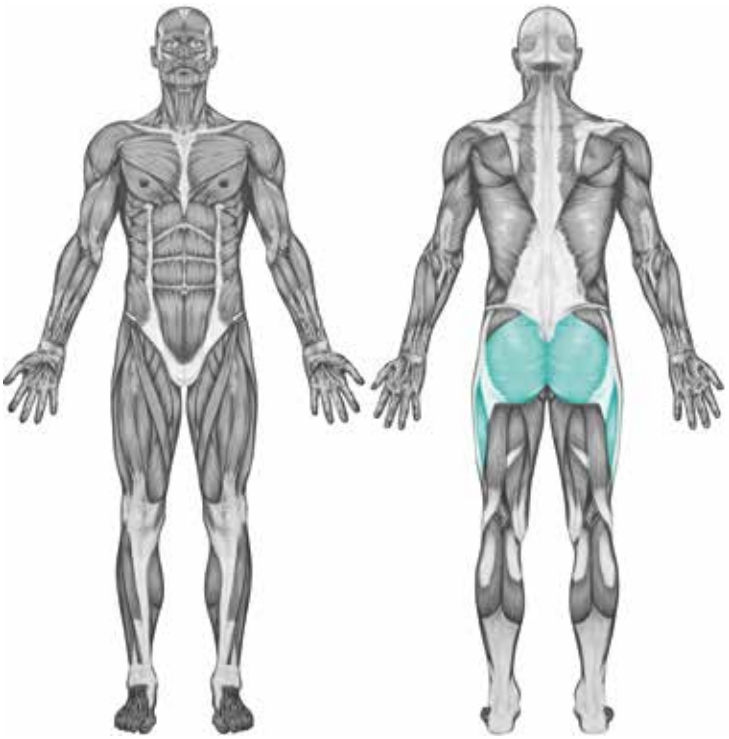
## TEACHING POINTS:

- Sit in machine with heels on bars and pads on outsides of the knees
- Maintain neutral spine
- Pull on lever to position legs together
- Release lever into position and grasp bars to sides
- Move legs away from one another by abducting the hips
- Return and repeat



## PRIMARY MUSCLES WORKED:

Abductors



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use a resistance band for inside leg swings.

**Older Adults:**

Keep the repetitions and exercise intensity within the endurance range, increase the rest periods as required.

**Pre/Post Natal Clients:**

Avoid this exercise and complete pelvic floor exercises.

**Disability Client – Wheelchair user**

Use resistance and squeeze between the knees, for example a dyno disc, the client can perform this in the wheel chair.

## ALTERNATIVE

Inside leg swings with a resistance band.

# SEATED ABDOMINAL CRUNCH

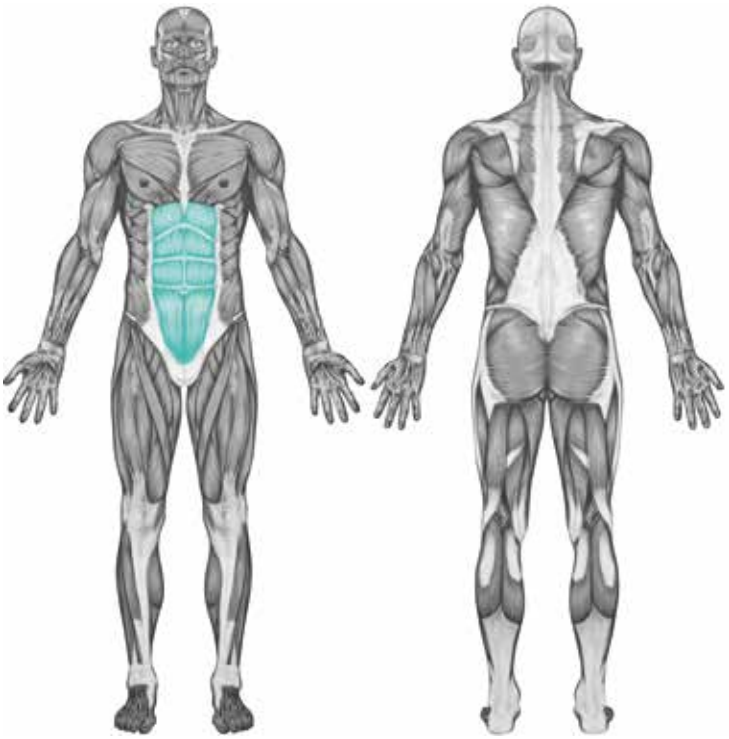
## TEACHING POINTS:

- Seated with your back against the back rest
- Fix the feet under the rollers/pads at the bottom
- Pull the top roller back until it is against your chest
- Either hang your arms over the top of the roller or cross them in front of it
- Use your chest (not the arms) to push the roller towards your knees
- Slowly return towards the starting position. Stop just before you get there and repeat the exercise



## PRIMARY MUSCLES WORKED:

Rectus Abdominals



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use body weight exercises such as a sit up or if needed use a resistance band for added resistance.

**Older Adults:**

Use body weight exercises, or reduce the range of movement if required.

**Pre/Post Natal Clients:**

Avoid this exercise and complete pelvic floor exercises.

**Disability Client – Wheelchair user**

Use a cable high pulley to replicate the movement so the client does not need to leave the wheel chair.

## ALTERNATIVE

Abdominal crunch or sit ups.

# LOWER BACK

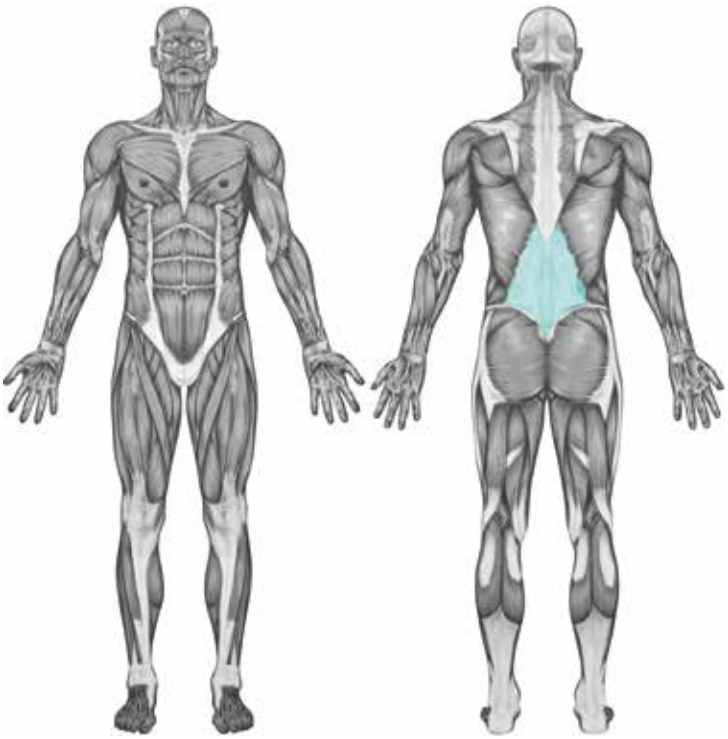
## TEACHING POINTS:

- Sit with the buttocks at the back of the seat
- Position the roller so that it is against your shoulder blades
- Maintain a curve in the lower back and keep the shoulders back and chest high throughout the exercise
- Push back from an upright position, to extend the back towards horizontal (stop before you get there)
- Slowly return to an upright position



## PRIMARY MUSCLES WORKED:

Errector Spinae



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use body weight exercises such as a back extension or if needed use a resistance band for added resistance.

**Older Adults:**

This group can complete the exercise, but you may need to reduce the resistance, range of movement and increase the rest period.

**Pre/Post Natal Clients:**

Avoid this exercise and complete pelvic floor exercises.

**Disability Client – Lower back pain rehabilitation**

Use a bodyweight alternative (back extensions) on a fit ball.

## ALTERNATIVE

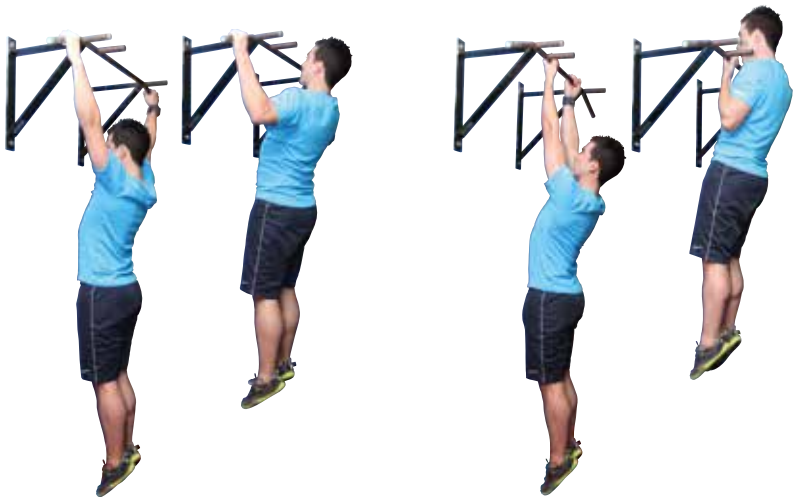
Body weight back extensions.

# BODYWEIGHT

## CHIN UP/ PULL UP

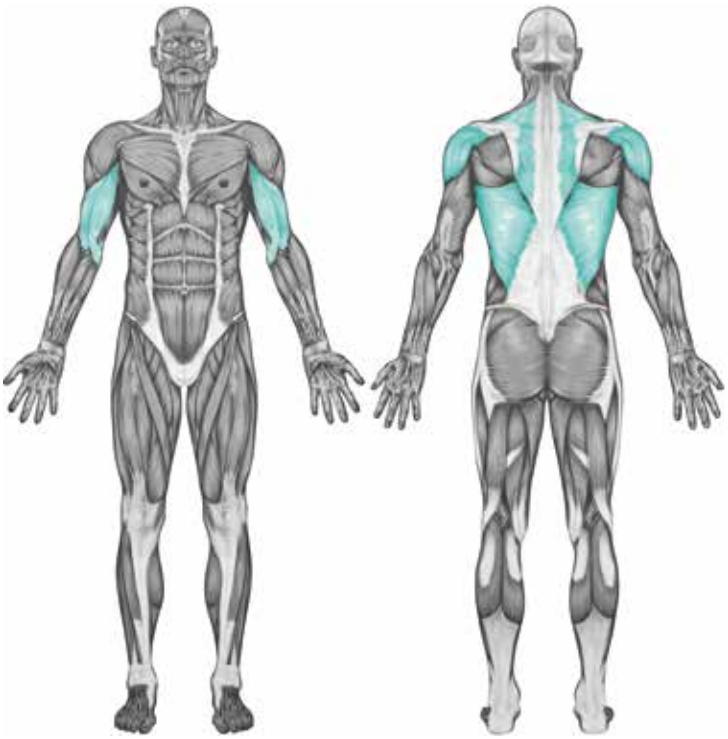
### TEACHING POINTS:

- Grasp handles using a either pronated or supinated grip
- Cross feet
- Brace abdominals and back muscles to maintain a neutral spine
- Breathe in and pull body towards bar (resist the use of momentum)
- Pause briefly (chin inline with bar), then slowly breathe out and lower to start position



### PRIMARY MUSCLES WORKED:

Latissimus Dorsi, Posterior Deltoid, Trapezius, Rhomboid and Biceps



### SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Use assisted pull up machine to reduce the work load on the muscles.

**Older Adults:**

Use vertical traction, lat pull down or bicep pull down could be used to reduce the exercise intensity.

**Pre/Post Natal Clients:**

Use vertical traction, lat pull down or bicep pull down could be used to reduce the exercise intensity.

**Disability Client – Obesity**

Use assisted pull up machine, lat pull down or vertical traction machine to reduce elbow and shoulder pressure.

### ALTERNATIVE

Lat pull down, vertical traction machine, single arm pull over, seated row or single arm row.

# PRESS UP

## TEACHING POINTS:

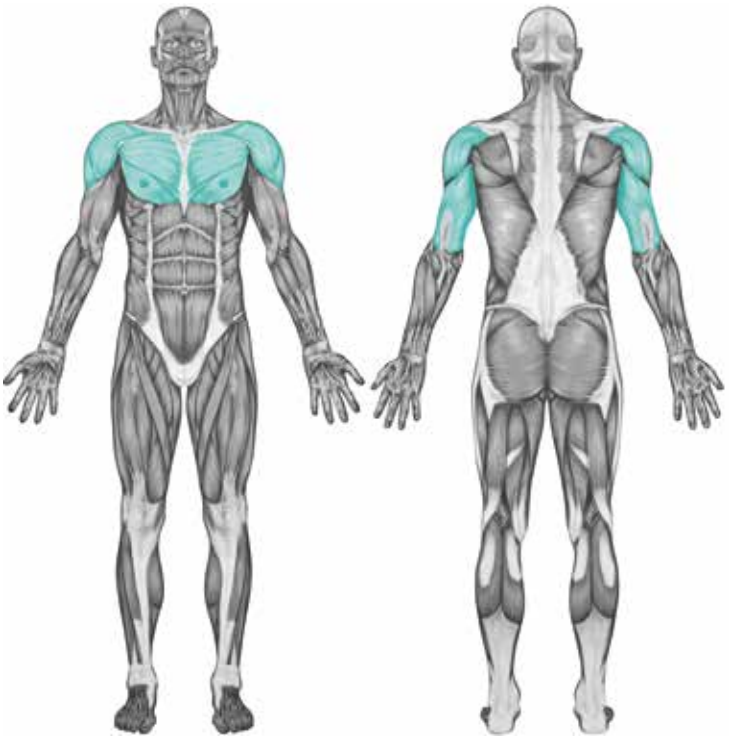
- Start in a prone position with arms extended. Ankles, knees, hips, shoulders and the head should be kept in good alignment
- Brace the abdominals and lower chest towards the floor by flexing at the elbow joints
- Pause briefly and reverse the movement by extending at the arms and returning to the start position





## PRIMARY MUSCLES WORKED:

Pectorals, Deltoids and Triceps



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Regress to a box or 3/4 press up as required.

**Older Adults:**

Regress to a box, 3/4 press up or a seated chest press machine to reduce the pressure through the wrists.

**Pre/Post Natal Clients:**

Use a seated chest press machine to reduce the risk of injury to the abdominal region.

**Disability Client – Lower back pain**

Use a seated chest press machine to reduce the pressure on the lumbar spine.

## ALTERNATIVE

Bench press, pec flyes, seated chest press machine or pec dec machine.

# BACK EXTENSIONS

## TEACHING POINTS:

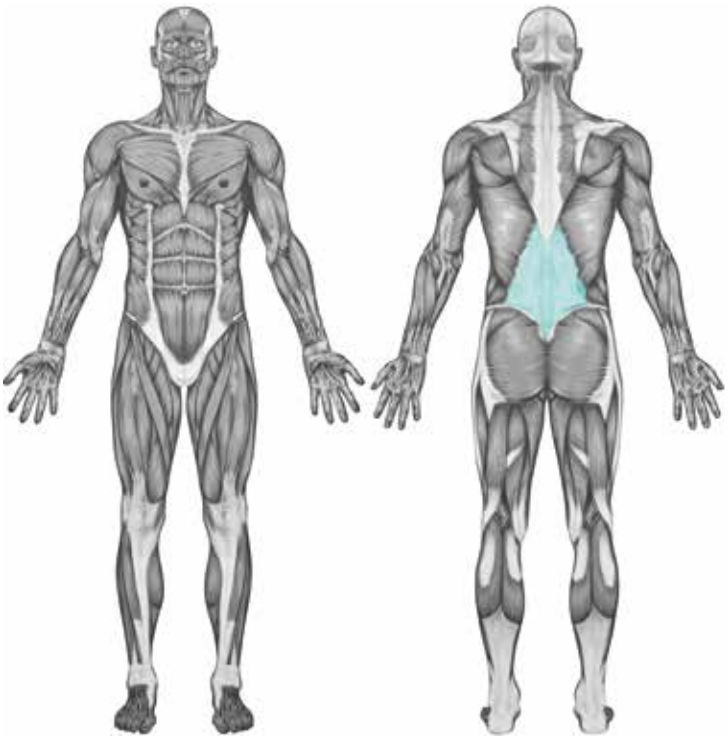
- Start in a prone position on the floor with feet in contact with the ground and fingers on the temples
- Keeping feet in contact with the floor, raise the chest off of the floor keeping head in neutral alignment
- Return to start position





## PRIMARY MUSCLES WORKED:

Erector Spinae



## SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Exercise can be completed, but ensure a safe range of movement.

**Older Adults:**

Use a back extension machine to avoid getting your client up and down from the floor.

**Pre/Post Natal Clients:**

Avoid as this can risk abdominal injury, complete pelvic floor exercises.

**Disability Client -lower back pain**

Back extension on a fit ball for increased support, limit range of movement to a comfortable range.

## ALTERNATIVE

Back extension machine or deadlift.

## ABDOMINAL CRUNCH

### TEACHING POINTS:

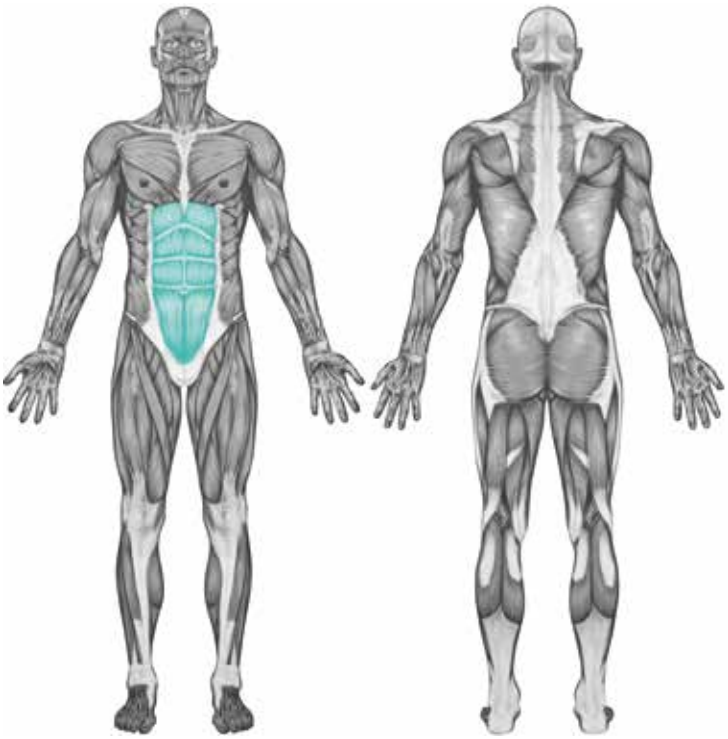
- Start in a supine position on the floor with fingers on the temples, knees bent and feet flat on the floor
- Maintaining contact between the lower back and floor, raise shoulders off the floor by flexing at the trunk
- Keep head in neutral alignment and pause briefly
- Lower back down to the start position





### PRIMARY MUSCLES WORKED:

Rectus Abdominis



### SPECIAL POPULATION ADAPTIONS

**14-16 Year Olds:**

Complete the exercise with endurance repetitions, refrain from adding weight.

**Older Adults:**

Complete the exercise with endurance repetitions on a machine to reduce the amount of floor.

**Pre/Post Natal Clients:**

Avoid this exercise and complete pelvic floor exercises.

**Disability Client - Obesity**

Use the abdominal machine in the endurance repetition and intensity range if a crunch cannot be completed.

### ALTERNATIVE

Sit up or abdominal crunch machine.

# STATIC COOL DOWN STRETCHES

## SEATED TRAPEZIUS

### TEACHING POINTS:

- Seated upright
- Neutral spine
- Arms flexed at 90 degrees
- Without fingers interlocking, palms facing out
- Push shoulder blades apart
- Hold the stretch for an appropriate duration



## SEATED LATISSIMUS DORSI

### TEACHING POINTS:

- Seated upright
- Place arms overhead hands clasped together
- Reach towards the ceiling to feel the stretch
- Hold the stretch for an appropriate duration



## SEATED CHEST

### TEACHING POINTS:

- Sit upright
- Neutral spine
- Place both hands in the small of the back
- Pushing elbows together to the point of mild discomfort
- Hold the stretch for an appropriate duration



## SEATED DELTOID

### TEACHING POINTS:

- Seated upright
- Maintain a neutral spine
- Bring the arm across the body
- Hold onto the fleshy part of the arm
- Hold the stretch for an appropriate duration



## SEATED TRICEP

### TEACHING POINTS:

- Seated upright
- Place one arm overhead, flex the elbow
- With the other hand apply pressure to the elbow to feel the stretch
- Hold the stretch for an appropriate duration
- Repeat on the other side



## LYING HAMSTRING

### TEACHING POINTS:

- Lay face up on the exercise mat
- Flex the hip and keep the opposite leg slightly flexed (so that the foot is fixed to the floor)
- Place the hands around the thigh and lever the leg into a stretch
- Hold the stretch for an appropriate duration
- Repeat on the other side



## LYING QUADRICEP

### TEACHING POINTS:

- Lay face down on an exercise mat
- Flex the knee
- Same side hand holds onto the distal end of the lower limb
- Hold the stretch for an appropriate duration
- Repeat on the other side



## SEATED GLUTES

### TEACHING POINTS:

- Lay face up on an excercise mat, cross the right leg over the left leg (above the knee)
- Lift the bottom leg off the floor, supporting it with both hands (on the thigh)
- Ease the legs towards the body
- Hold the stretch for an appropriate duration
- Repeat on the other side



## SEATED ADDUCTOR

### TEACHING POINTS:

- Seated upright
- Draw the soles of the feet together
- Gently apply pressure to the inside of the knees using the hands or elbows
- Hold the stretch for an appropriate duration



## KNEELING HIP FLEXOR

### TEACHING POINTS:

- Kneel with one knee on the floor and the other in front with the knee bent
- Place hands on the supporting thigh
- Keep chin off chest, and neutral upright spine
- Tilt pelvis forward to stretch hip flexors of the rear leg
- Hold the stretch for an appropriate duration
- Repeat on the other side



## KNEELING GASTROCNEMIUS

### TEACHING POINTS:

- Adopt a press up position
- Bend one knee up so that it rests on the mat with the opposite leg straight
- Maintain neutral spine, head facing down
- Try and push rear heel into the floor
- Hold the stretch for an appropriate duration
- Repeat on the other side



## LYING ABDOMINALS (SPHINX)

### TEACHING POINTS:

- Lay face down on an exercise mat
- Raise the trunk up off the floor
- Keep palms prone on the floor with the elbows underneath the shoulders
- Hold the stretch for an appropriate duration



## GUIDELINES FOR STATIC COOL DOWN STRETCHES

- Cool Down stretches should ideally be completed on the floor, either seated, kneeling or lying
- There are 2 static cool down stretch options in maintenance or developmental:
  - stretches should be held at a point of mild discomfort for 15 seconds
  - development stretches should be held at a point of mild discomfort for 15 seconds, then the client takes a deep breath in, increases the stretch and hold this for a further 15 seconds
- Stretches selected should cover the whole of the body, or in the case of split routines, the stretches should target muscles worked. It is also a good time to focus on muscles which have been identified as tight or need flexibility development
- They should be the final component of your programme before ending the session

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