Medical terms of the muscular system

Written by: Narimbetova A .
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Learning objectives

Learning objectives

What we will learn in this presentation:

- The three muscle types and their functions
- The names of important voluntary muscles
- The role of antagonistic muscle pairings and their importance to movement
- Fast and slow twitch fibres and their role in sport
- The differences between static, dynamic and explosive strength and the different types of contraction
- The importance of training to muscle strength, endurance, size and action
- The relevance of muscles to sport, daily tasks and rehabilitation
- That muscle tone affects posture and body shape which effects self-esteem.

Muscle classification

Muscles are involved in **every movement** in your body.

This includes the beating of your heart and the digestion of your food, as well as activities like running, jumping and lifting.

Muscle is a special type of tissue made up of **fibres** that **contract** (shorten) and **relax** (lengthen).

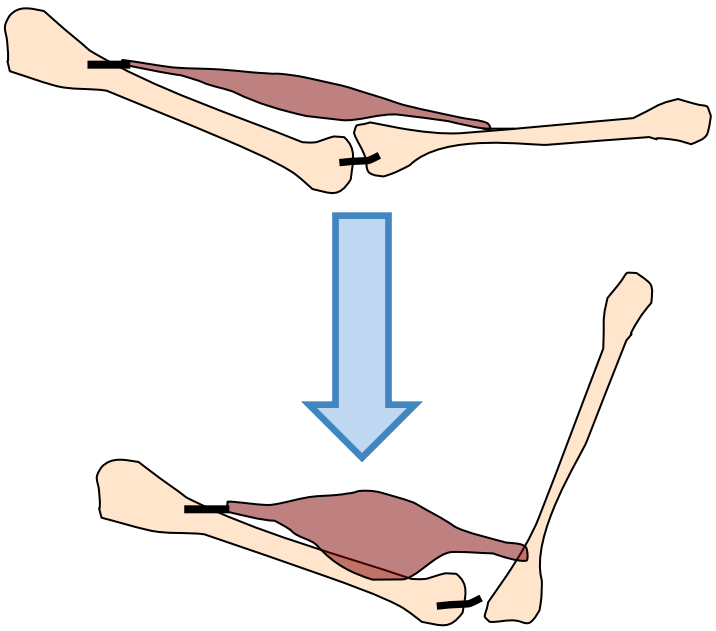
There are **three types** of muscle fibre.

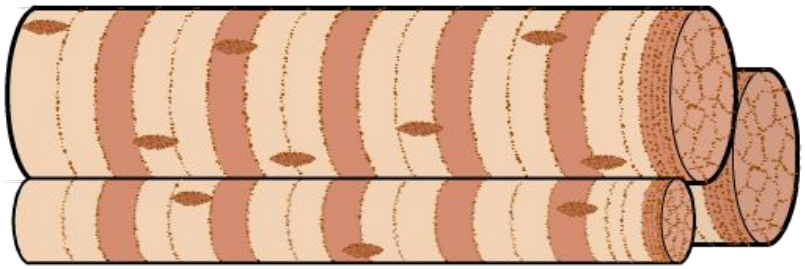
Voluntary

The type of muscle responsible for moving your arms and legs is called **voluntary muscle**.

- It is attached to **bones**.
- It moves these bones under your **conscious control**.
- It receives signals from your conscious brain via your **nervous system**.

When these signals stop, the muscles relax again.



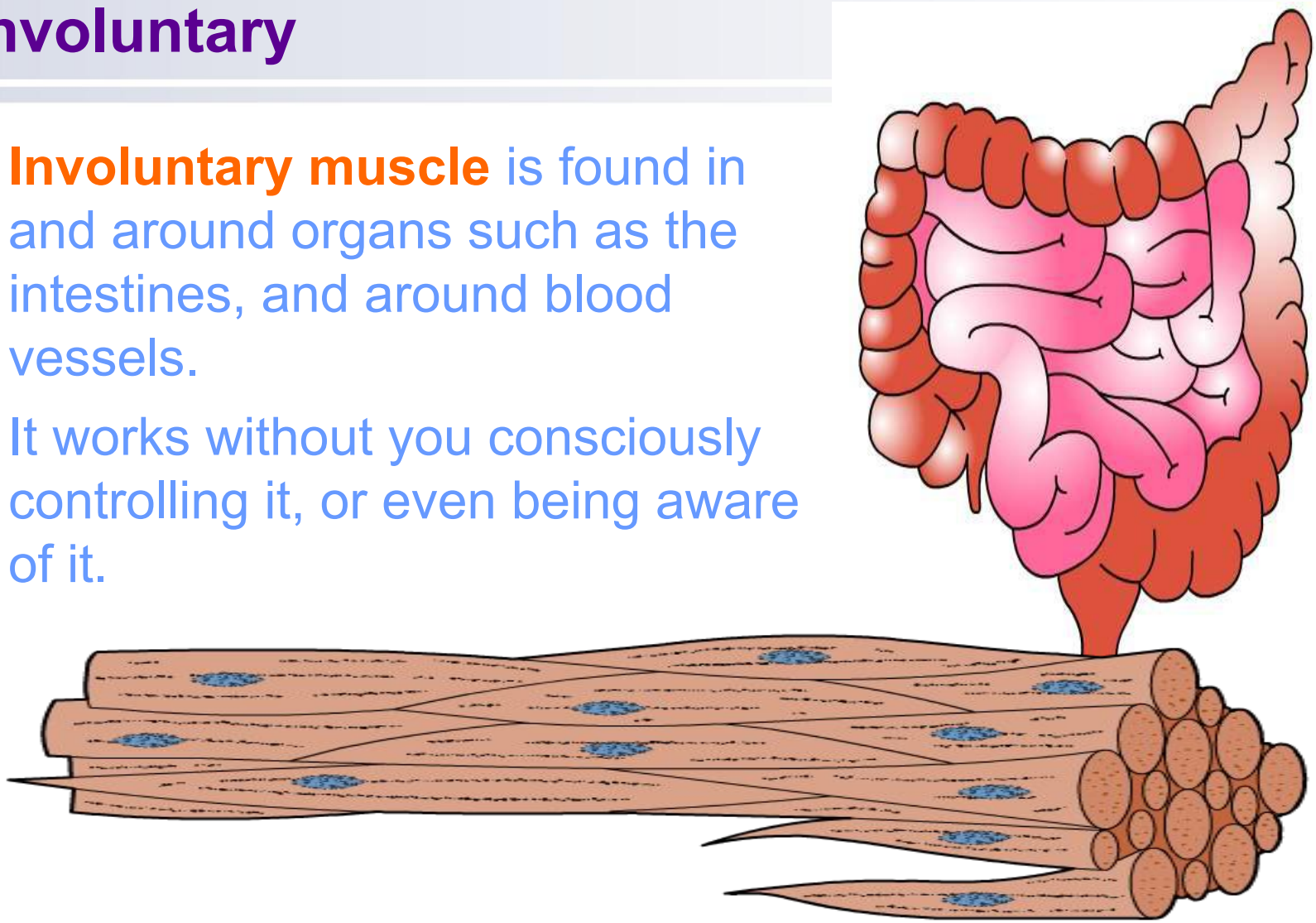


Voluntary muscle is sometimes called **striated muscle** as it has a striped appearance.

Involuntary

Involuntary muscle is found in and around organs such as the intestines, and around blood vessels.

It works without you consciously controlling it, or even being aware of it.



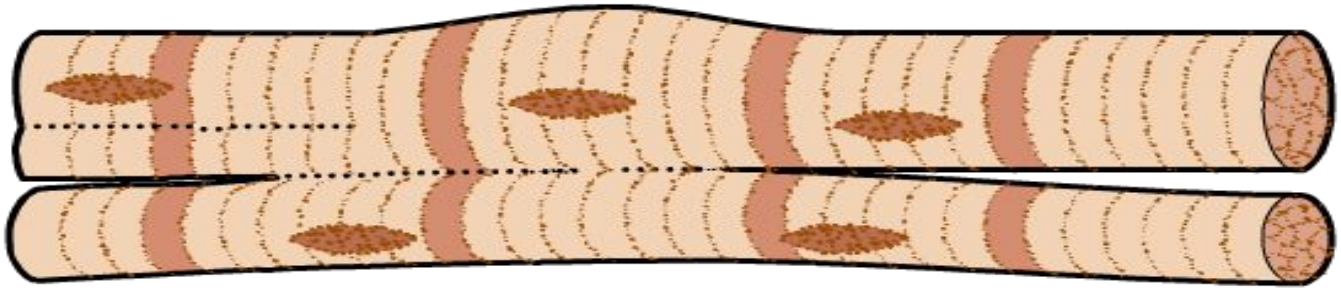
Under a microscope it appears smooth, with no stripes.

Cardiac muscle

Cardiac muscle is a special type of muscle that forms the walls of the heart chambers.

It is a type of **involuntary** muscle, as it contracts without conscious thought or effort.

As long as the heart is healthy, cardiac muscle never gets tired.



Under a microscope cardiac muscle also appears **striped**.

Muscles types

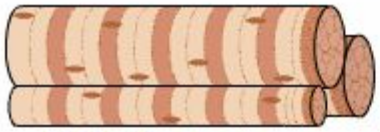
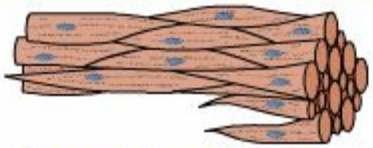
All three types of muscle are important in physical activity:

Voluntary muscle enables movement.

Involuntary muscle is essential in maintaining body systems. It helps us move substances around the body, allowing us to keep cells supplied with oxygen and nutrients.

Cardiac muscle is vital in sport because it makes the heart pump. The heart ensures that other muscles are well supplied with all the things they need to perform physical activities.

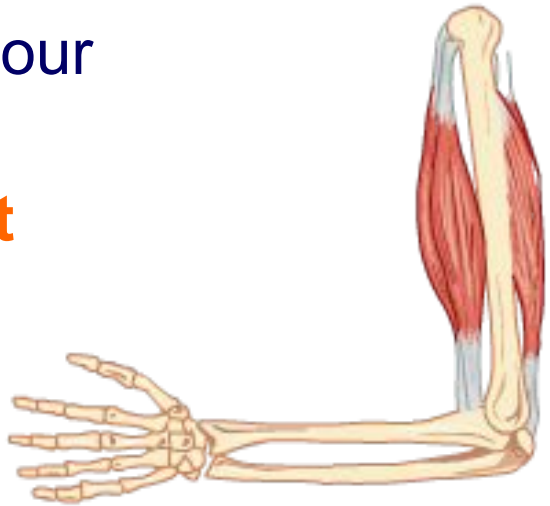
Fitness training will strengthen cardiac muscle making the heart more efficient at pumping blood around the body.

 Cardiac muscle	Not consciously controlled. Never gets tired.	Biceps
 Voluntary muscle	Under conscious control. Moves the limbs.	Intestines
 Involuntary muscle	Not conciously controlled. Not striped.	Heart

More about voluntary muscles

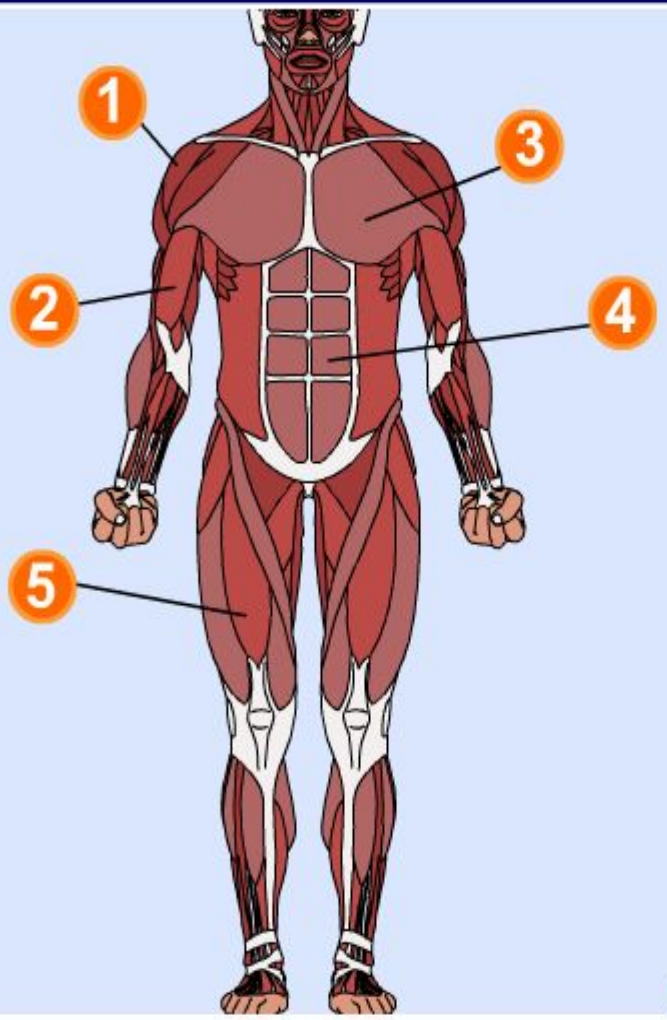
Sport is mostly concerned with the 650 or so **voluntary muscles** (sometimes called skeletal muscles).

- They give **shape** to your body.
- They are responsible for **moving** your body.
- They are attached to the bones of your skeleton by tendons.
- They make up **40% of body weight** in men, and slightly less in women because of their higher fat levels.
- They are made up of **cylindrical fibres** composed of protein.



How many voluntary muscles can you name?

Click on each number to learn about some of the muscles on the front of the body.

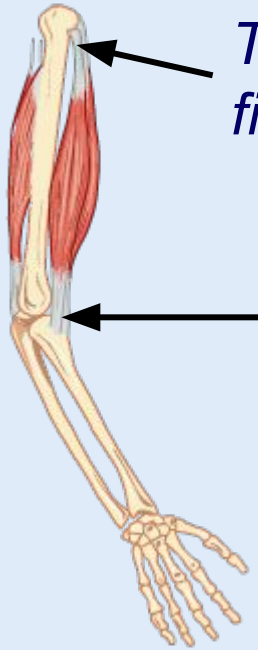


Voluntary muscles (rear)

Voluntary muscles

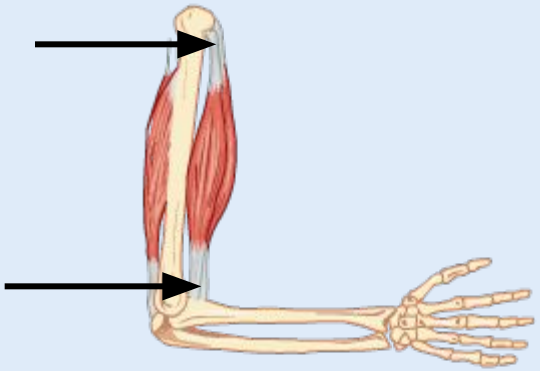
Understanding muscle action

Muscles are attached to bones by tendons.



*The tendon at the non-moving (or fixed) end is known as the **origin**.*

*The tendon at the moving end is known as the **insertion**.*



Muscles **pull** by contracting – they cannot push to produce the opposite movement.

Muscles are arranged in **antagonistic pairs**.

As one muscle contracts (shortens) its partner relaxes (lengthens). They swap actions to reverse the movement.

Upper arm muscles

The **biceps** and **triceps** work together as an antagonistic pair to move the elbow joint.

To **flex** the elbow, the biceps (the flexor) contracts and the triceps (the extensor) relaxes.

To **extend** the elbow, the actions are reversed so that the triceps contracts and the biceps relaxes.

Quadriceps / hamstring muscle action

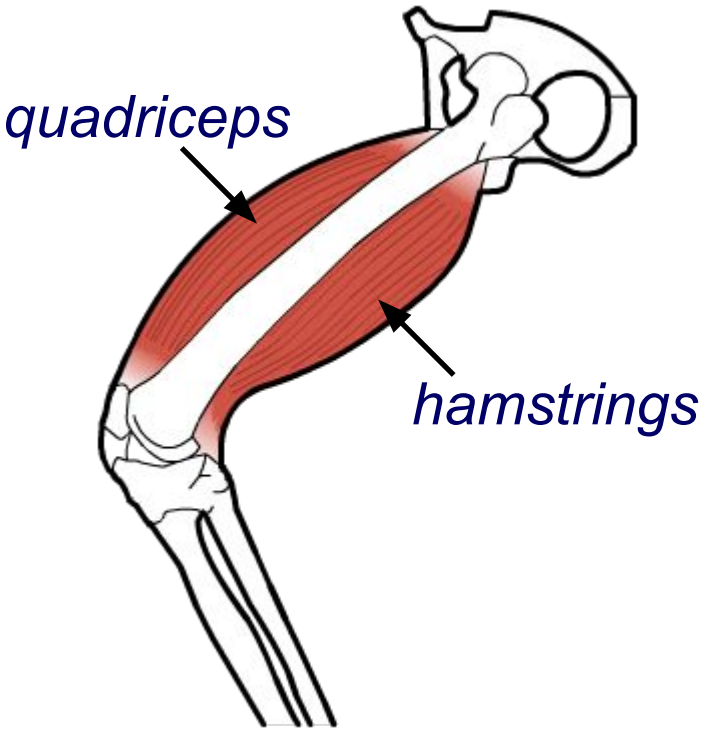
The **quadriceps** and **hamstrings** in the legs are another antagonistic pair. Can you answer the following questions?

Which joint do they move?

What types of movement are produced?

Which is the flexor and which is the extensor?

Identify the origin and insertion of each muscle.



Voluntary muscles

Muscle twitch fibres

Muscles are made up of cells or **fibres**. It is these fibres that contract.

The **number** of fibres that contract, and their **thickness**, determines the amount of force that is applied.

There are **two basic types** of voluntary muscle fibre:

Slow twitch fibres are deep red. They contract slowly, but can work for long periods.

Fast twitch fibres are paler. They contract quickly and powerfully, but tire easily.

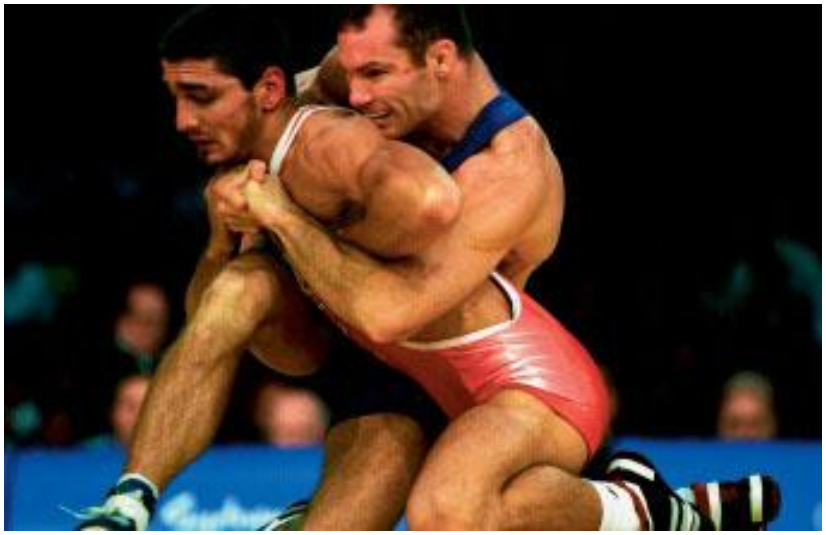
Muscle twitch fibres

Muscle twitch fibres occur in different proportions in different people.

This proportion is mainly to do with the genes you **inherit**.

The proportion can be altered to some extent by **training**.

Suggest a mix for the sportspeople shown below.



Muscle strength

Strength means the maximum force that muscles can exert when they contract.

There are **three** different types of strength:

Static strength

The amount of force that muscles can apply to a stationary object.

Dynamic strength

The amount of force that muscles can apply to move a heavy object.

Explosive strength

The amount of force that muscles can exert in one fast movement.

Muscle strength

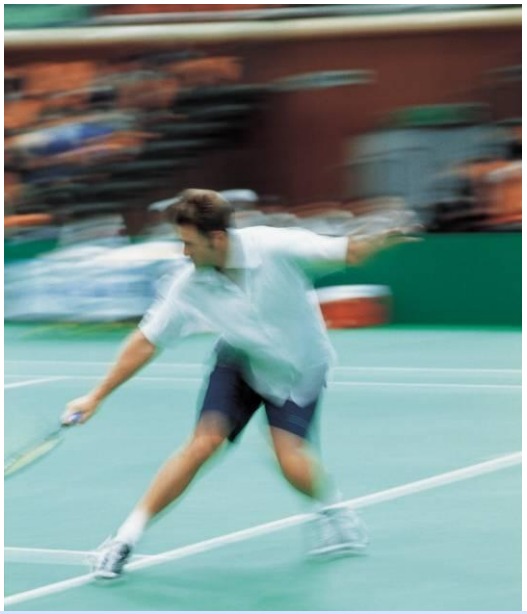
Isotonic contractions

The different types of strength are related to the different types of muscular contractions.

Isotonic contractions occur when using dynamic and explosive strength. When a contraction is isotonic, **movement** is created.

The contracting muscle **shortens** and **fattens**. This shortening action pulls on the bones, causing them to move.

Isotonic contractions are generally the more important type of contraction for sportspeople, especially **games players**. They produce both speed and power.



Fast-paced games require isotonic contractions.

Isometric contractions

Isometric contractions do not create movement – the muscle neither shortens nor lengthens. Isometric contractions produce **static strength**.

This type of contraction occurs in several situations:

- To support a weight in a stationary position.
- To hold the body in a particular position (e.g., in gymnastics).
- To stabilize part of the body so movement can occur elsewhere.

Isometric contractions occur in a rugby scrum

Strength training

The strength of muscles can be increased through **training**. Strength training makes muscles grow **thicker**, allowing them to contract with more force.

When muscles increase in size, it is called **hypertrophy**.

When muscles waste away it is called **atrophy**.

Strength training involves repeatedly lifting, pushing or pulling against a **large resistance**.

This kind of exercise can usually only be repeated a small number of times, because it is extremely **tiring**.

Muscle endurance training

Muscular endurance means the ability of muscles to repeatedly contract without getting tired.

Muscular endurance can be improved by moving a **lighter weight many times**.

Muscles become better at using oxygen and long-term energy stores (especially fat) and work better over long periods of time.

Muscular endurance is important in events like **long distance** running, cycling and rowing which take a long time to complete.

Muscle training

Muscle training – everyday tasks

Improving muscle strength and endurance through training can make **everyday tasks** easier.

Many everyday tasks like gardening, moving furniture and ironing require physical exertion. If you are stronger and have better muscular endurance, you will find these tasks less tiring.

Muscular endurance is generally more important in everyday life – most people rarely have to lift something that is very heavy.

People who do very **physical jobs**, for example, farmers and builders, may need higher levels of strength.

Muscle training – rehabilitation

Strength training can also assist **recovery** after an injury.

A performer who has suffered a joint injury may use a programme of weight training to strengthen the muscles, tendons and ligaments around the joint in order to reduce the risk of the injury reoccurring.

Light weights are used at first to prevent further injury. Gradually the performer lifts heavier weights as the injury heals and the muscles strengthen.

Strength training can also help to **prevent** injuries – strong muscles can take higher stresses without being damaged.

Muscle tone and posture

Muscles almost never fully relax – even when you sleep, there are always some fibres in a state of partial tension. This is called **muscle tone**.

Exercise improves your muscle tone – it causes more of your muscle fibres to be slightly tensed, ready for action.

Poor muscle tone leads to poor **posture** and slouching.

Maintaining muscle tone requires energy.

Posture

If you have good posture…

- Your internal organs, like your heart and digestive system, will function more effectively because good posture creates more space in the chest and abdomen.
- Straight shoulders allow more room in the chest, so lung capacity is increased.
- Good posture helps prevent strain and injury in everyday activity and sport.

But if you have poor posture…

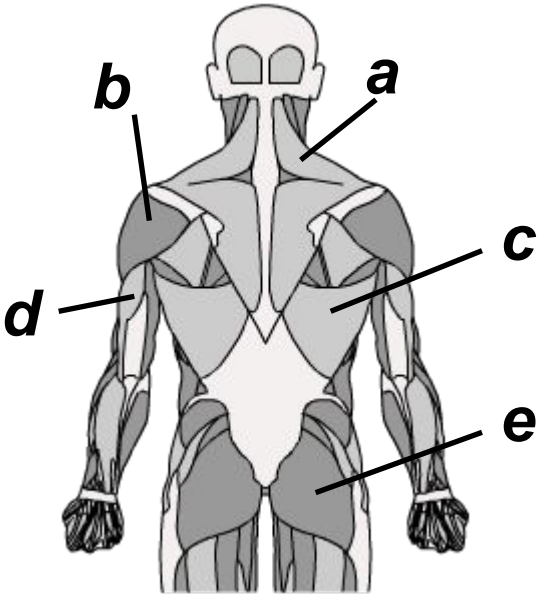
- Other muscles have to work harder to compensate for weak muscles. You will get tired sooner.
- You don't look as good. This may damage your self-esteem.

Muscle quiz

Exam-style questions

1. This picture shows part of the muscular system.

   a) Name muscles a–e.



   Janine exercises her deltoids by lifting heavy weights. She raises her arms out to the sides until her hands are level with her shoulders.

   b) What type of movement is occurring at the shoulder?

   c) What type of muscle contraction is involved?

   Janine changes her exercise to holding the weights out to the sides at shoulder level for 10 seconds at a time.

   d) What type of strength will this improve?

Exam-style questions

2. Explain what is meant by an **antagonistic pair** and give one example.

3. Muscular endurance can be improved by training.

   a) What is meant by muscular endurance?

   b) How is muscular endurance important in everyday life?

   Andrew is trying to improve his muscular endurance. He performs five biceps curls a day with a very heavy weight. Andrew's muscular endurance is not increasing much.

   c) Suggest how he could change his exercise so that he achieves better results.

Can you remember all these keywords?

- Voluntary muscle
- Involuntary muscle
- Cardiac muscle
- Antagonistic pair
- Origin
- Insertion
- Extensor
- Flexor
- Fast twitch
- Slow twitch
- Isotonic contraction
- Isometric contraction
- Hypertrophy
- Atrophy
- Resistance
- Muscular endurance
- Muscle tone
- Posture