1.3 Overview of the human musculoskeletal system: bones, joints, and muscles

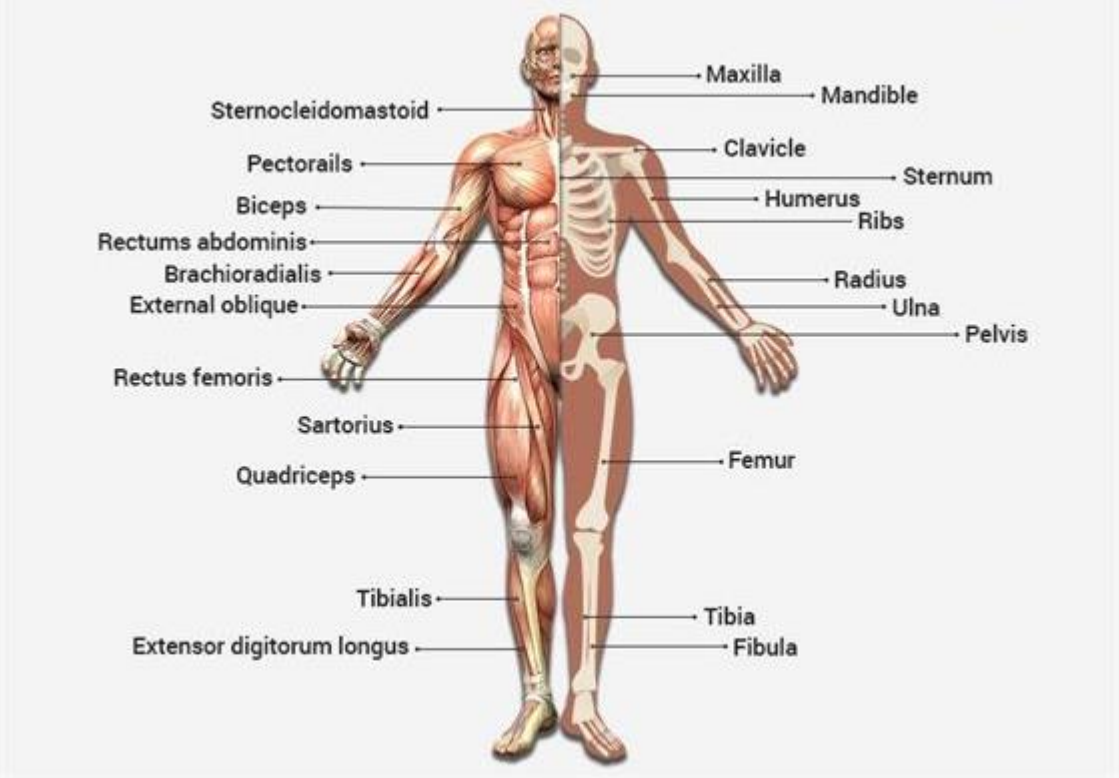
Bones, muscles and joints make up the musculoskeletal system, along with cartilage, tendons and ligaments. This system gives your body its structure and support, lets you move around and protects important organs.

Injuries and many illnesses can damage bones, muscles and joints. Around 1 in 3 Australians have some type of musculoskeletal condition, such as arthritis, osteoporosis or back pain.

Parts of the musculoskeletal system

There are many different elements that make up the musculoskeletal system:

- **Skeleton** — this is the framework of the body. The adult human skeleton is made up of 206 bones.
- **Joints** — an area where 2 bones work together.
- **Cartilage** — is a cushioning that covers the ends of 2 bones.
- **Ligaments** — tough bands of tissue that join bones to other bones to strengthen joints.
- **Muscles** — there are more than 600 skeletal muscles in the human body. They help the body move.
- **Tendons** — these are made of strong fibrous connective tissue and they attach muscles to bones.



What is the role of bones in the human body?

Bones give people shape. They hold your body upright and protect internal organs (like the heart and the liver) from injury and help you to move.

Bones are strong tissues made of collagen (a protein that forms a flexible framework) and calcium phosphate (a mineral that makes them strong and hard).

Most bone growth happens during your childhood and teenage years. However, bones are always changing through a process called remodelling. Bone cells replace old or damaged bone and build new healthy bone tissue. The centre of bones contains the bone marrow and makes new blood cells.

The spine or vertebral column is the central support of your body, helping you walk, move, twist and bend. It has 33 bones called vertebrae, separated by discs. It carries all the nerve signals from the brain to the rest of the body and sensory input from the body back to the brain.

What is the role of muscles in the human body?

There are 3 different types of muscle, each with different functions that help your body move and function well. These are:

- skeletal muscles
- smooth muscles
- cardiac (heart) muscles

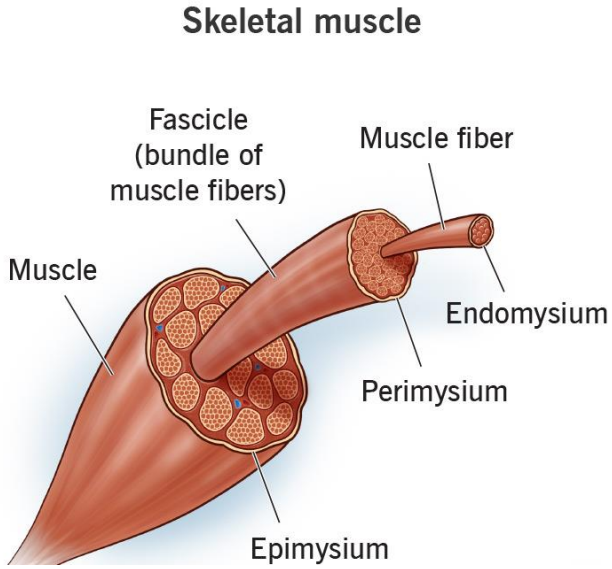
Skeletal muscle

Skeletal muscle is a voluntary muscle, which means that you can consciously control its movement. As well as helping you to move, these muscles also help generate heat in the body, protect organs and help maintain your posture.

Skeletal muscles are usually attached to the bone by tendons. When you want to move, your brain tells a muscle to contract, it shortens, pulling one bone towards another across a joint. Skeletal muscles work in pairs — when one shortens, a corresponding muscle lengthens. For example, when you contract your bicep on the front of your upper arm, your tricep on the back of your upper arm lengthens.

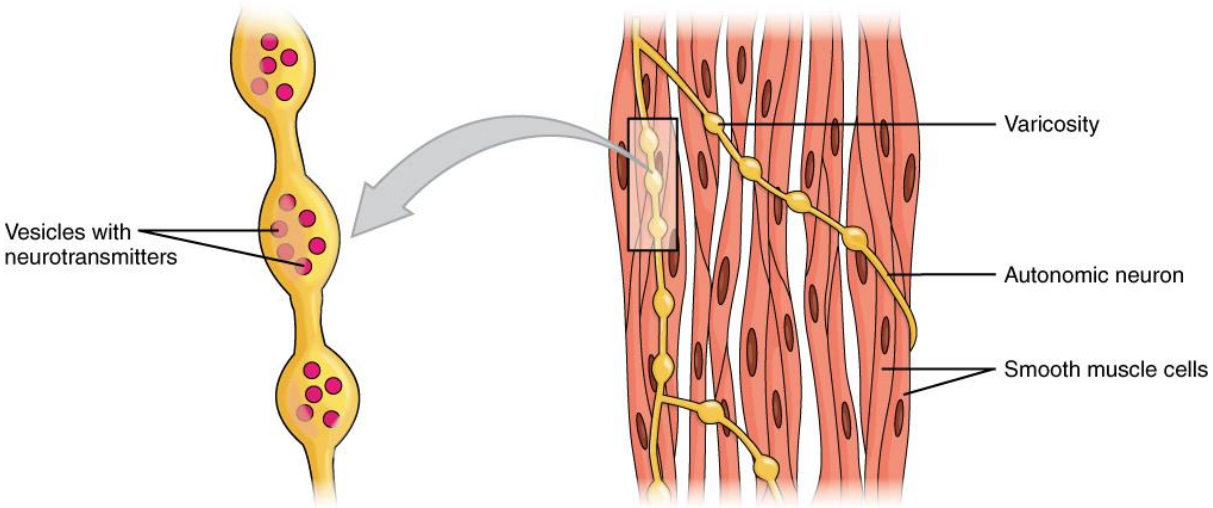
Skeletal muscle also plays an important part in regulating blood sugar (glucose) levels, by taking up glucose from the blood to use as fuel or to store for later.

Physical activity maintains or increases the strength of your muscles.



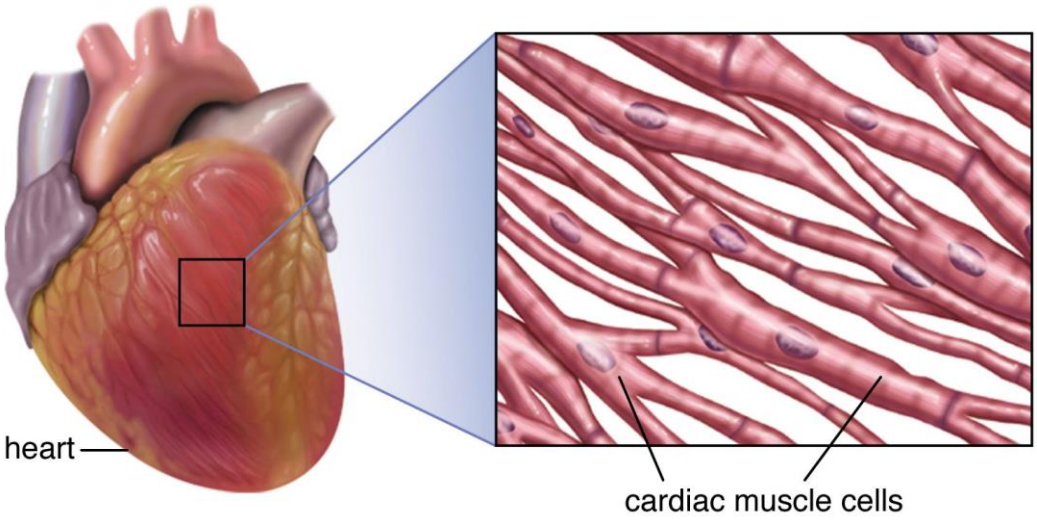
Smooth muscle

Smooth muscle is found inside blood vessels and organs like the intestines. You can't consciously control smooth muscle — these muscles are contract and relax often without you even realising they are working. For example, smooth muscles contract to move food and stool through your digestive system and in your arteries and veins to help regulate your blood pressure.



Cardiac muscle

The heart is made of special muscle called cardiac muscle. You can't control it consciously. It contracts to make your heart beat, and is controlled by your heart's inbuilt pacemaker — the sinoatrial node.



What is the role of joints in the human body?

Joints connect between the bones, and allow them to move. There are three different types of joints:

- synovial
- cartilaginous
- fibrous

What are synovial joints?

Synovial joints are the most common type of joints and are found in your arms and legs. The ends of your bones are covered with cartilage and separated by the joint cavity, which is filled with a thick gel called synovial fluid. Synovial fluid helps to lubricate the cartilage and provides nourishment.

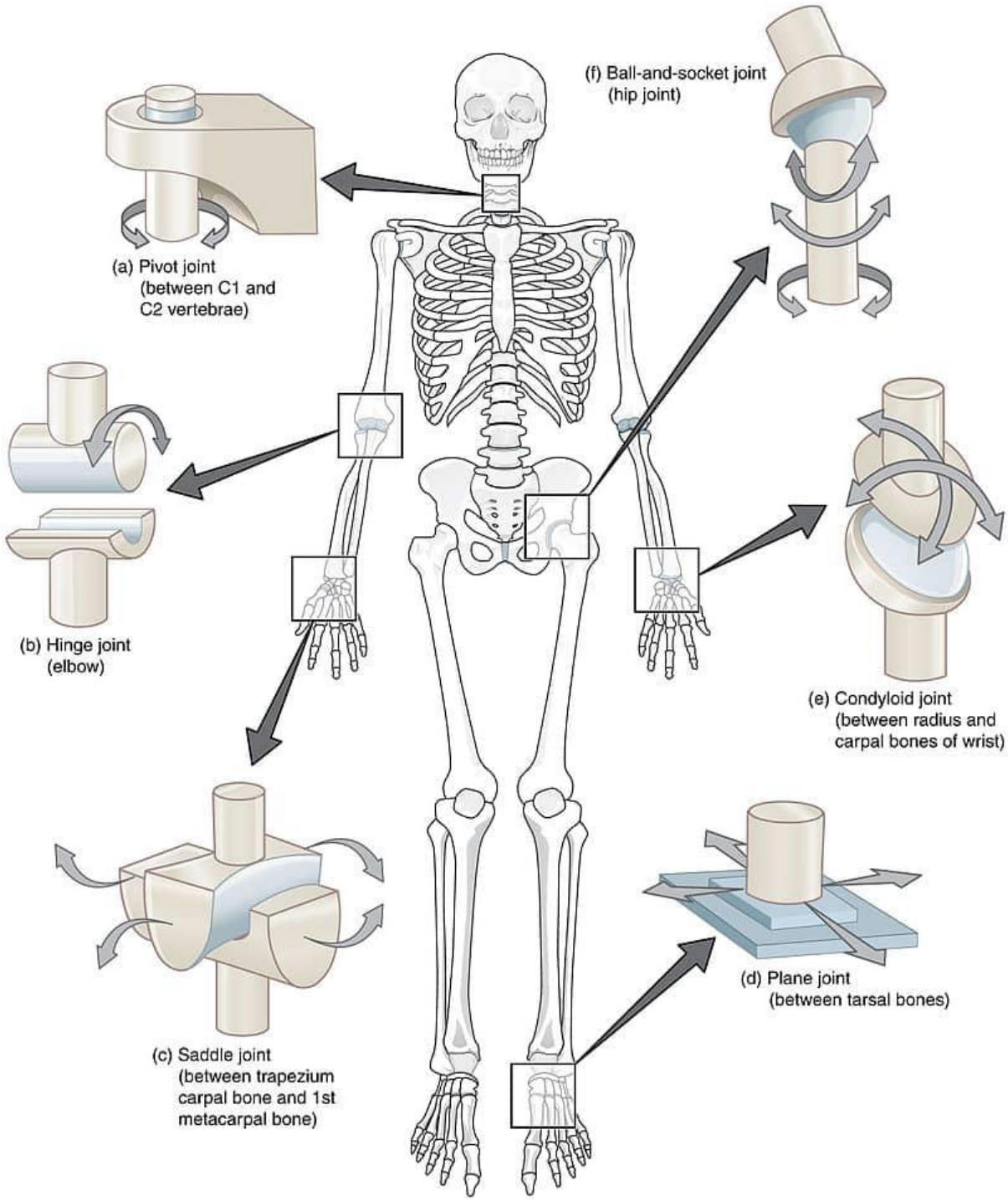
Ligaments stretch across the joint, connecting one bone to another and help to stabilise the joint so it can only move in certain directions.

What are cartilaginous joints?

Joints in the spine, pelvis and between the ribs and the sternum are cartilaginous joints. They provide more stability but not as much movement. The bones are connected by cartilage in this type of joint.

What are fibrous joints?

Fibrous joints allow no movement — just stability. They are held together by strong fibrous connective tissue. You have fibrous joints in your skull.



What conditions and injuries affect my bones?

Many different conditions and injuries can affect your bones, such as:

- **fractures** — where a bone is broken
- **osteopaenia** and osteoporosis — conditions where bone density is reduced and fractures become more likely
- **Paget's disease** — a disease that weakens and deforms bones
- **bone cancer** — either cancer that starts in the bones (primary bone cancer) or cancer that spreads to the bones from somewhere else in the body (secondary bone cancer)

- **rickets** — a bone disease affecting children, caused by low vitamin D levels
- **osteomyelitis** (bone infection) — usually caused by bacteria

While different bone conditions need different forms of treatment, the best way to have healthy bones and prevent illness and injury is by:

- eating a healthy diet that includes calcium-rich foods
- limiting your alcohol
- not smoking
- living an active lifestyle
- doing weight bearing and high impact activities if you can
- getting enough sunshine
- keeping to a healthy weight

What disorders affect my joints?

Many conditions can affect your joints. Arthritis, which is characterised by joint pain and stiffness, is one of the most common. Different types of arthritis have different causes.

Some conditions that can affect the joints are:

- **osteoarthritis** — this type of arthritis is more common as you get older and most often affects the knees, hips, finger joints and big toe joint
- **rheumatoid arthritis** — an autoimmune disease where the immune system attacks the lining of the joints
- **septic arthritis** — a type of arthritis caused by an infection (usually bacterial)
- **psoriatic arthritis** — a type of inflammatory arthritis which affects people who have psoriasis
- **gout** — a painful condition where small crystals of uric acid form in the joints, causing pain, redness and inflammation
- **ankylosing spondylitis** — a condition affecting the joints of the neck, spine and pelvis, causing back pain
- **sprains** — where the ligaments that connect and stabilise the bones in a joint are stretched or torn

What disorders affect the muscles?

Muscle injuries and disorders can cause weakness, pain or paralysis. Sports injuries are a common way that muscles can be damaged. Conditions affecting the muscles include:

- **strains** — where the muscle is over-stretched or contracted too quickly, leading to a partial or complete tear of the muscle fibres or the tendon
- **muscle cramps** — these sudden contractions of a muscle can be very painful
- **tendonitis** — inflammation or irritation of a tendon
- **fibromyalgia** — a condition that causes pain and stiffness of the muscles, extreme fatigue and poor sleep, as well as other symptoms
- **muscular dystrophies** — these are genetic (inherited) disorders that cause loss of muscle mass and progressive weakness
- **sarcopenia** — the age-related loss of muscle mass and quality
- **myositis** — inflammation of muscle tissue due to an ongoing autoimmune reaction