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# BONES, JOINTS & MUSCLES

## CONTENTS

The Skeleton	p2
Joints & Movement	p5
Muscles in Action	p9

# The Skeleton

The skeleton is made up of more than 200 bones. The bones are held together by ligaments, their ends are protected from wear by cartilage, and the muscles are connected to them by tendons.

## Functions of the Skeleton

The skeleton has many functions, but four major functions are relevant to performance and participation in physical activity.

### Shape and Support

The skeleton provides the framework for the overall shape of the body, upon which its correct functioning depends. Vital organs are supported, for example the liver is suspended under the diaphragm which is in turn attached to the rib cage, which is attached to the vertebral column. The liver is the largest organ in the body, and has no internal support structure of its own. In any physical activity it must be supported to prevent rupture by sudden movement. Similarly the heart and lungs are supported within the chest cavity.

The tension of the muscles acting on the bones maintains our correct position or **posture**.

The upright posture of humans involves the muscles and bones of the legs, pelvic girdle, and vertebral column in a very complicated way. The vertebrae of the different regions of the backbone are adapted for different functions. The neck vertebrae allow movements of the head, and this mobility makes them likely to be injured. The vertebrae in the lower back are larger and stronger than those in the neck, and allow less movement as they support the weight of the body. However, despite their strength, lower back problems are common, and can be caused for example by bad lifting technique.

### Movement

Muscles are attached to the bones of the skeleton. Muscles and bones act together to produce movement of all kinds. Long bones, found in the limbs, eg. the humerus, radius, and ulna, in the arms work as levers, to increase the range and speed of movement caused by the contraction of muscles. Short bones, found in the wrist and ankle joints, allow complicated movement at these joints. Generally the human skeleton is better adapted to speed and skill, than to strength.

## Protection

Vital organs are protected; eg. the skull protects the brain, eyes and ears; and the ribs protect the heart and lungs. Some of the forces involved in physical activity, e.g. a blow to the head, are potentially very damaging. Sometimes a person has thin skull bones, and a blow that would not normally be a problem can be fatal to them.

## Production of Red and White Blood Cells

Blood cells are made by the red bone marrow, which is found in the centre of some bones, for example the ribs. The red blood cells carry oxygen to all the tissues for the release of energy from their fuel stores, the more of these that an athlete has, the better is their endurance capacity. The white blood cells help in the defence of the body against infection. If a bacterium or virus enters the body, e.g. through broken skin during participation in physical activity, the white blood cells seek them out and destroy them.

## Effects of activity on the skeleton

The more work that the body does the more it fulfils its potential. The stresses and strains exerted on the skeleton by gravity and the working muscles strengthen the skeleton. The bones become thicker, and the attachments of the ligaments and tendons stronger. One sided activities can result in obvious differences in size of limbs, some of which is due to growth of bone, such as is seen in tennis players, and factory workers doing repetitive actions. Physical activity can also result in damage to the skeletal system, such as fractures, ruptures of ligaments and wear of cartilages.

### ANSWER BOX 13

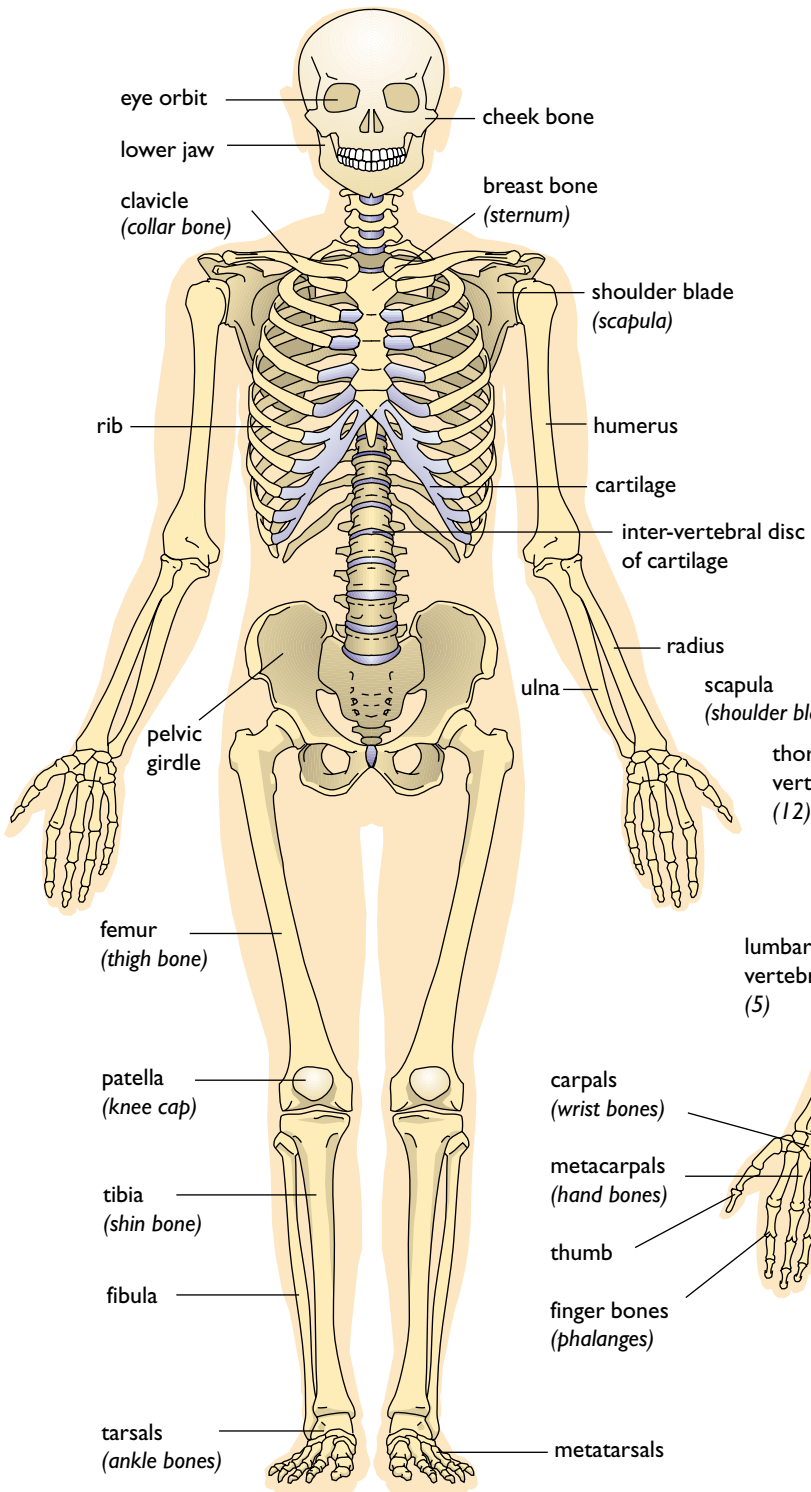
- 1 The heart and lungs are protected by the ribs, sternum and vertebral column forming the rib cage.
- 2 Red blood cells are produced by the red bone marrow in the centre of the bones.
- 3 Movement of an arm is caused by contraction of muscles attached to the bones of the arm which act as levers.

### QUESTION BOX 13

Explain the function of the skeletal system in each of the following:

- 1 Protection of the heart and lungs.
- 2 Production of red blood cells
- 3 Movement of an arm.



**Skeleton from the Front****The main bones****Skeleton from the Back**