

# SUMMING-UP

## 1 How animals move

- **Locomotion** is necessary for animals to find food, water, to escape predators and to reproduce.
- Single-celled organisms are limited to floating in the liquid in which they

live or moving through the use of **pseudopodia**, **cilia** and **flagella**.

- Animals that live in water are able to swim.
- Animals that live on land move on the ground by crawling or walking,

due to the presence of limbs.

- Insects, birds and bats (mammals), are the only animals able to fly. Flight is made possible by particular adaptations of the skeletal and muscular systems.

## 2 Animal skeletons

- A skeleton provides a support structure to an animal, protects delicate organs, allows movement and is the store of important inorganic ions. In the animal kingdom there are three types of skeleton.

- Some invertebrates possess a **hydrostatic skeleton**, formed by fluid-filled cavities.
- Arthropods and molluscs possess an **exoskeleton**, which is a hard external skeleton; in arthropods it consists of a polysaccharide, chitin, whilst in molluscs (for which it is called a

shell) it is made of calcium carbonate.

- All vertebrates, however, possess an **endoskeleton**, which is an internal bone skeleton. The echinoderms also have an endoskeleton made of a hard inner shell.

## 3 The human skeleton: the skull and spine

- The vertebrate skeleton consists of an **axial skeleton**, which supports the body, and includes the skull and spine, and an **appendicular skeleton**,

consisting of the limbs and the girdles that support them.

- The axial skeleton includes the skull, consisting of the bones of the skull and those of the face, and the spinal column, consisting of the vertebrae.

- Across all vertebrates, the human skeleton is the only one which exhibits the peculiarity of the erect position.

## 4 The human skeleton: the limbs and joints

- The appendicular skeleton consists of the shoulder girdle, shoulder bones, the pelvic girdle, formed by the bones of the pelvis, and the limbs.

- The upper limb includes the humerus, radius, ulna and the bones of the hand (carpal, metacarpal and phalanges); the lower limb is formed by the femur, tibia, fibula, and the bones of the foot (tarsus, metatarsals and phalanges).

- Three types of **joints** make movement of the skeleton possible, they are mobile, semi-mobile and immobile.

## 5 How are the bones made

- The bones are made of living tissue. The functional unit of the connective bone tissue is the **osteon**, formed by cells called osteoblasts, which make the extracellular matrix solid.
- Osteoblasts, remaining trapped in

the matrix, are transformed into mature bone cells called **osteocytes**.

- At the centre of each osteon is a channel (called the *Haversian canal*) containing nerve fibres and blood vessels.
- Bones are formed by the ossification

of embryonic skeletal cartilage that acts as a "template".

- Bone tissue retains its ability to reform itself throughout the lifetime of an individual and allows the repair of fractures.

## 6 Muscles

- **Skeletal muscle**, in collaboration with the skeleton, allow one to maintain the posture of the body and realise movement. In addition, muscles produce the major part of the body's heat.
- Muscles are attached to the skeleton

by **tendons** and carry out movement through a system that requires the presence of two antagonistic muscles.

- Muscles enable movement due to the ability of muscle tissue to contract, i.e. to shorten. Muscle tissue consists of fibres in which the **sarcomere** is

the functional unit.

- On the microscopic level, the contraction is determined by the action of two proteins, **actin** and **myosin**, which are able to form temporary bridges.

## 7 Support and anchoring to the ground in plants

- The **root** is the organ that anchors the plant to the soil and two basic types of root are recognised in plants: fibrous roots and taproots.

- The **shaft** leads upwards to the leaves. In the trunk of trees that live in temperate climates, concentric rings can be seen that are the result of the annual production of **spring wood** and **late wood** with different

characteristics.

- The rigidity of the plant is provided by the cell wall that surrounds the plant cell. It consists of several layers made of two different polysaccharides: **cellulose** and **lignin**.