Observing

## Touch your hand and count how many bones there are in it. Draw a diagram of the hand and mark bones on it.

The left and right upper limbs (made up of the [upper] arm, forearm, and hand) have 60 bones (30 each): [upper] arm - 1 bone, forearm - 2 bones, hand - 27 bones.

Talk

# Talk about how many bones a person has in total and what functions they fulfil.

**Functions of the skeleton and bones**

The skeleton (skeletal system) determines the shape and size of the body and constitutes strong, permanent scaffolding for the entire human body. Bones making up the skeleton serve to protect the organs, e.g., the skull protects the brain, the spine (backbone) – the spinal cord, the rib cage – the heart and lungs. The bones of the lower limbs are adapted to bearing the weight of the body in a standing position, and also act as shock-absorbers in the course of walking, running and jumping. Furthermore, the bones of the skeleton constitute levers and are an important component of the musculoskeletal (locomotor) system. Bones are connected by joints and are set in motion with the help of "special engines" – the muscles, which enable movement of individual parts of the body. Thus the whole musculoskeletal system is divided into a static (passive) part: bones, ligaments, and joints; and a dynamic (active) part: muscles.

**Parts of the skeleton**

The average weight of the skeleton, together with the bone marrow, is 10 kg in women, and 12 kg in men. We can divide it into the following parts:

- skull - 29 bones,
- spine - 33-34 bones,
- rib cage – 25 bones,
- shoulder (pectoral) girdle - 4 bones,
- left and right upper limb (made up of the [upper] arm, forearm, and hand) - 60 bones (30 each): upper arm - 1 bone, forearm - 2 bones, hand - 27 bones,
- pelvic girdle - 2 bones,
- left and right lower limb - 58 bones (29 each): thigh - 1 bone, lower leg (shin) – 2 bones, foot - 26 bones.

There are 206 bones in the skeleton of an adult human. A baby has 270 bones, and children at the age of 14 have 356 bones. A long bone can be divided into three main parts, (proximal epiphysis, diaphysis (shaft), distal epiphysis). During physical development, there are epiphyseal plates – which enable lengthwise growth – between the diaphysis and proximal/distal epiphyses.

**Types of bones in the skeleton**

Bones can be divided according to shape – length, thickness and width:
long bones, e.g.: humerus, radius, ulna, femur, tibia, fibula, metacarpals, metatarsals, and phalanges (proximal, intermediate and distal),
short bones, e.g., carpal (wrist) bones,
flat bones, e.g. sternum, pelvic bone, sacrum, coccyx, and parietal, occipital, and nasal bones,
irregular bones, e.g. true vertebrae (cervical, thoracic and lumbar),
pneumatic bones, e.g., frontal, sphenoid, temporal, and jaw bones.

Video/ Slide show

## Watch a video about types of joints.

**Joints**

Bones can join – fuse – together without the possibility of movement. The sacrum and pelvic (hip) bones, for example, contain such fusion (synarthrosis). Some bones are joined by cartilage (symphysis) and permit a little mobility – for example, the joints between the pubic bones or vertebrae. Adjacent vertebrae are also joined by ligaments (syndesmosis), reminiscent of rubber bands.

**Synovial Joints** allow the greatest mobility of the skeleton – they are also known as diarthroses (freely movable joints). They all contain certain (fundamental) components, plus some additional ones.

**(Fundamental) components of the joint:**

- articular surfaces – smooth area of the bone involved in the creation of a specific joint
- joint (articular) capsule - connects the articular ends of the bones and delimits the joint from its surroundings.
- synovial fluid - thick, egg-like fluid extending between articular surfaces: it lubricates them, maintains a constant pressure in the joint (synovial) cavity, and participates in nutritional processes of articular cartilage
- joint cavity - space filled with synovial fluid

**Additional components:**

- articular ligaments – bands of dense regular connective tissue bundles, may limit mobility in joints,
- articular labra made of fibrous cartilage – protective elastic rings against impacts to the humerus or femur,
- articular disks - fibrocartilage pads containing nerves and blood vessels, they divide the synovial cavity into two chambers and serve as movable joint surfaces,
- menisci - help to"fit" articular surfaces to each other, disperse weight and reduce friction in the joints.

Division of synovial joints according to number of axes of movement:

- uniaxial
- biaxial,
- multiaxial

Different joints have different biological tasks, and thus have different structures and mobility. Multiaxial joints allow movement in all planes – for example, shoulder and hip joints. Biaxial joints have less mobility – for example, the thumb (carpometacarpal) joint allows movement in two planes. Uniaxial joints only enable movement in one plane. An example is the elbow joint.

Constructing

# Students construct a knee joint from art materials.

The knee joint is the largest joint in the human body, constructed from the femur, tibia and patella. At the knee joint, bending (flexion) and straightening (extension) are possible, and when the knee is bent, rotational movement is also possible (medial and lateral).

Movement game

## Perform a few exercises that are good for joints and find out how to take care of them on an everyday basis.

Risk factors for adverse changes in knee joints:

- lack of physical activity
- no warm-up before starting physical activity
- physical activities and sports at a competitive level
- practicing extreme sports
- lack of morning exercises
- sedentary lifestyle.
- lack of breaks for physical activity by people performing sedentary work
- being overweight and obesity
- improper and irregular nutrition
- lack of dairy products (cheese, natural yoghurt, kefir, and buttermilk), fish and vegetables
- abdominal obesity
- low exposure to sunlight from September to March
- excessive use of creams with protective filters
- vitamin deficiency (especially vitamin D)
- lack of calcium in the bones
- low physical activity up to 24 years of age
- inadequate water intake
- abnormal hormone levels around 45 years of age, especially in women (in men around 55 years of age)
- stimulants (nicotine, alcohol, strong coffee and tea, narcotics)
- aging

Rules you need to follow to maintain your joints in good working order throughout your whole life:

- "rolling-over" in the lying position, and morning gymnastics
- physical activity tailored to the age and predispositions of the body
- breaks (physical exercises) in the course of long periods of sitting
- vitamin D – daily exposure to sun and supplementation in the period October-March
- consuming products rich in calcium: (yellow) cheese, kefir, yoghurt, fish, soya, and parsley
- regular diet (5 meals a day)
- maintaining a healthy weight, appropriate for your age, gender and height