The Structure and Functions of Bones

Introductory Note: Knowledge of the structure and function of bones and aspects of skeletal system generally are essential parts of training in human biology, medicine and associated health sciences. This page is intended to include the detail required for most Basic / First Level Courses in many therapies, and some ITEC Diplomas.

This page is divided into the following sections:

1. **The Functions of The Skeleton**
   generally - as opposed to the functions of particular bones.

2. **Types of Bones**
   with examples.

3. **The Structure of Bone**
   with diagram and definitions.

1. Functions of The Skeleton

1.	**Support** The skeleton is the framework of the body, it supports the softer tissues and provides points of attachment for most skeletal muscles.
2.	**Protection** The skeleton provides mechanical protection for many of the body's internal organs, reducing risk of injury to them. For example, cranial bones protect the brain, vertebrae protect the spinal cord, and the ribcage protects the heart and lungs.
3.	**Assisting in Movement** Skeletal muscles are attached to bones, therefore when the associated muscles contract they cause bones to move.
4.	**Storage of Minerals** Bone tissues store several minerals, including calcium (Ca) and phosphorus (P). When required, bone releases minerals into the blood - facilitating the balance of minerals in the body.
5.	**Production of Blood Cells** The red bone marrow inside some larger bones (including, for example, the ....) blood cells are produced. (Red Blood Cells, White Blood Cells and Platelets are described on the page: Structure & Functions of Blood.)
6.	**Storage of Chemical Energy** With increasing age some bone marrow changes from 'red bone marrow' to 'yellow bone marrow'. Yellow bone marrow consists mainly of adipose cells, and a few blood cells. It is an important chemical energy reserve.

2. Types of Bones

- There are axial and appendicular bones.
  (The appendages are the arms and legs, which contain approx. 30 bones each.)
- There are typically 22 bones in the head.
- There are 33 bones in the spine.
  These include:
  - 7 cervix (neck)
  - 12 thorax
  - 5 lumbar
  - 5 sacral
  - 4 coccyx.
- The pelvic girdle is fused to the sacrum at the sacro-illiac joint.
  The pelvis is the part that is added onto the spine.
- The thorax (chest) consists of 12 pairs of ribs:
  - 7 pairs 'true' ribs - joined directly to the sternum ("breast-bone"),
  - 3 pairs 'false' ribs - joined to the sternum ("breast-bone") by cartilage,
  - 2 pairs 'floating' ribs (not connected to the sternum ("breast-bone") at all, connected to the diaphragm.
- The shoulder girdle consists of the scapula (shoulder blade) and the clavicle ("collar bone").

The following table summarises the five main categories of bones, together with another category (sutural bones).

1.	**Long bones:**
	Long bones have greater length than width and consist of a shaft and a variable number of endings (extremities). They are usually somewhat curved for strength.
	Examples include femur, tibia, fibula, humerus, ulna and radius.
2.	**Short bones:**
	Short bones are roughly cube-shaped and have approximately equal length and width.
	Examples include ankle and wrist bones.
3.	**Flat bones:**
	Flat bones have a thin shape/structure and provide considerable mechanical protection and extensive surfaces for muscle attachments.
	Examples include cranial bones (protecting the brain), the sternum and ribs (protecting the organs in the thorax), and the scapulae (shoulder blades).
4.	**Irregular bones:**
	Irregular bones have complicated shapes and so cannot be classified into any of the above (shape-based) categories. Their shapes are due to the functions they fulfill within the body e.g. providing major mechanical support for the body yet also protecting the spinal cord (in the case of the vertebrae).
	Examples include the vertebrae and some facial bones.
5.	**Sesamoid bones:**
	Sesamoid bones develop in some tendons in locations where there is considerable friction, tension, and physical stress. They

	may therefore form in the palms of the hands and the soles of the feet, however their presence and quantity varies considerably from person to person.
	Examples common to everyone include the patellae (kneecaps).
6.	**Sutural bones:**
	Sutural bones are classified by their location rather than by their shape. They are very small bones located within the sutural joints between the cranial bones. The number of sutural bones varies considerably from person to person, therefore these are un-named bones.

3. The Structure of Bone

Bones grow from their ends (extremities).
Under normal circumstances bones stop growing when the owner reaches his.her late teens or early twenties.
Bone marrow (see diagram below) produces stem cells, such as erythrocytes (red blood cells) and leucocytes (white blood cells).

Definitions of main types of bone tissue:

- **Compact** (also known as "compact") tissue forms the outer shell of bones. It consists of a very hard (virtually solid) mass of bony tissue arranged in concentric layers (Haversian systems).
- **Cancellous** (also known as "spongy") tissue is located beneath the compact bone and consists of a meshwork of bony bars (trabeculae) with many interconnecting spaces containing bone marrow.

Diagram illustrating the general structure of long bones:

Above: Diagram illustrating the Structure of Long Bones

The diagram to the left labels the basic components of a typical long bone:

This is the end of this page about the structure and functions of bones.
See also how many bones are in the human body and information about cranial and facial bones and bones of the feet and hands.