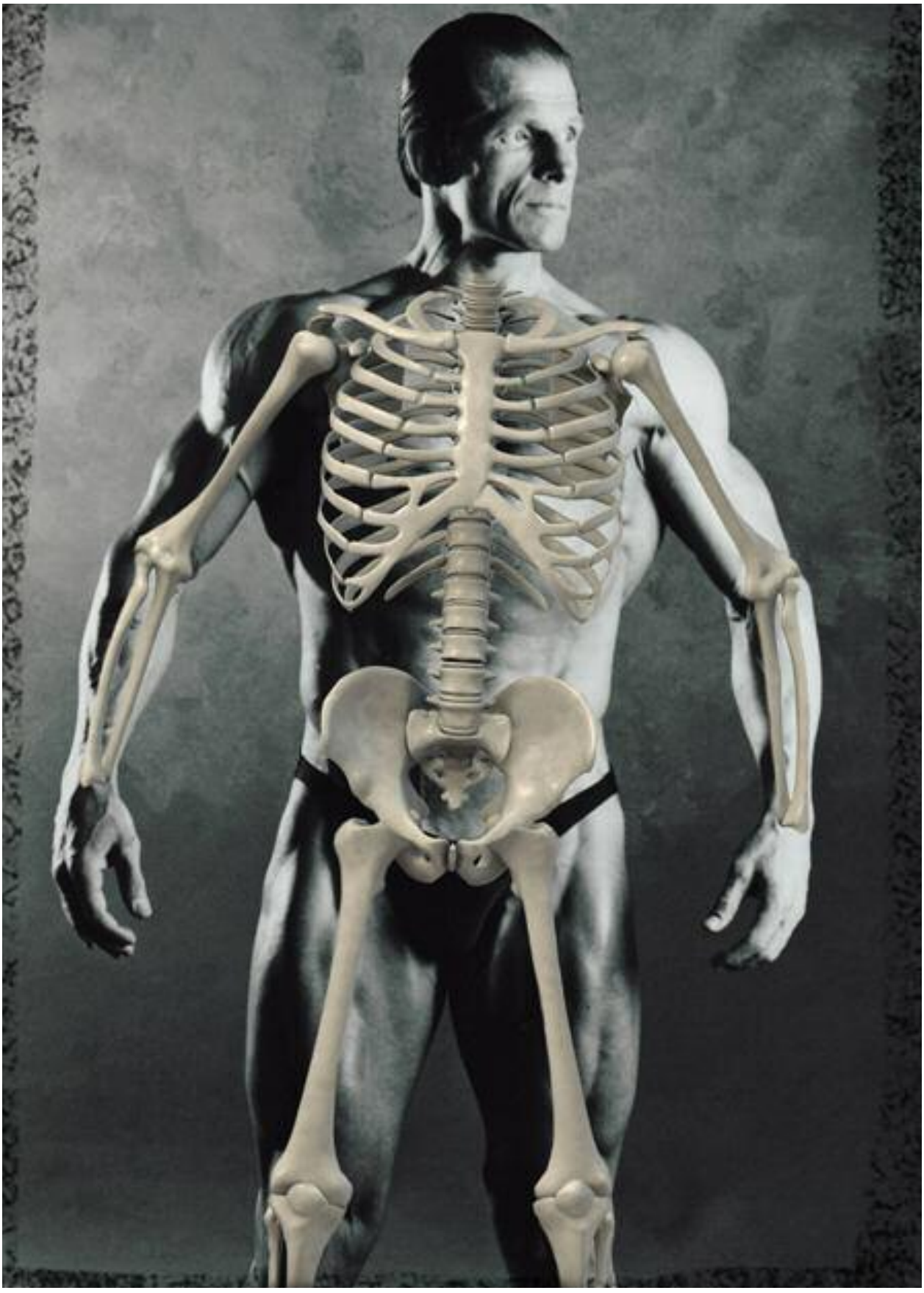
The Skeletal System

The human skeleton (skeletos = dried up) is comprised of 206 bones and is divided into the axial skeleton (head and trunk) and the appendicular skeleton (arms and legs). The bones are the framework of the body and are attached to each other at joints. The study of bone structure and related disorders is known as osteology (osteon = bone; logos = study of).

The Function of Skeletal Tissue

Our skeleton is what enables us to stand erect and achieve extraordinary feats of artistic grace, athletic endeavor and physical endurance. It supports surrounding tissues and protects vital organs and other soft tissues of the body. The skeleton gives attachment to the muscles, providing leverage and assisting in body movement. It also acts as a storage facility for lipids in the form of yellow bone marrow. Red marrow produces red blood cells, white blood cells and platelets. Of course bones also store many mineral salts including calcium, magnesium and phosphorus.



Composition of Bones

The entire skeletal system consists of cartilage, bone tissue, bone marrow and a surrounding membrane called the periosteum. Bone, or osseous tissue, is a form of connective tissue, consisting of four types of cells. Its basic composition is 25% water, 25% protein and 50% mineral salts. Poor hydration and insufficient protein intake contribute as much to faulty bone development as does inadequate intake of essential minerals.

Check This Out

The bones support your body and give it shape. They protect the internal organs and act as a system of levers moved by skeletal muscles. Red and white blood cells are produced in the red marrow of some bones that also act as mineral reserves, storing such elements as calcium, sodium, magnesium, zinc, iron and phosphorus.

Contrary to appearance, skeletal tissue is very much alive, with its own system of blood, lymphatic vessels and nerves

The mineral salts in bone consist mainly of a crystallized form of tricalcium phosphate called hydroxyapatite and to a lesser degree, calcium carbonate. Both are available in supplements, as well as calcium citrate, lactate, malate, gluconate, ascorbate, amino acid chelate, etc…The hardness, pliability and tensile strength of bone is a function of balance between its mineral density and collagen fiber matrix.

Small spaces throughout bone tissue act as channels for blood vessels, which feed and nourish the living tissue. Compact (dense) bone has fewer spaces and is harder than spongy bone, which contains red bone marrow. Most of the bones of the body are classified according to their shape. Long bones, such as the thigh (femur) forearm (ulnar) and fingers (phalanges) are mainly compact. Short bones are mainly spongy and cube-shaped like the wrist (carpal) and ankle (tarsal) bones. Flat bones are thin like the breastbone (sternum) and shoulder blades (scapula). Irregular bones include the backbone (vertebrae) and are complex in shape.

Two other types of bones are classified according to location. Sutural bones are small and are found in such places as the skull or between joints. Sesamoid bones like the kneecaps (patella) are also small and wrapped in tendons.

The bone cells include:

- Osteoprogenitors
  ...develop into osteoblasts
- Osteoblasts
  ...active in bone formation
- Osteocytes
  ...the principle cells of mature bone
- Osteoclasts
  ...associated with bone resorption

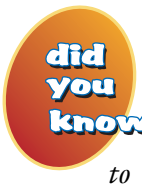
Osteoprogenitor cells are derived from mesenchyme and preceed the formation of osteoblasts, which secrete collagen and eventuate into the mature primary cells of the skeleton called osteocytes. Osteoclasts develop from circulating monocytes in the blood. They are found on the surface of bone and are

chiefly involved in the destruction of the bone matrix (resorption).

[resorption] a loss of substance by destruction, the breaking down and absorption of tissue within the body

To a large degree, the composition of bone is regulated by the amount of strain or pressure on the bone. This is a function of both gravity and the influence of muscle contraction. More strain leads to greater mineral integration and a favorable influence on bone density. Inactivity is harmful to our bones and accelerates porosity and decay. But remember, activity must include the use of all primary muscle groups under load, as the impact of weight bearing stress is generally site specific only to those regions of direct muscle involvement. As muscles shorten they force movement by tugging on bones through attachment by tendons.

Walking is useful for enhancing bone density in the pelvis, hip, femur and lower region of the vertebrae, but provides little if any stimulation in the ribs, scapula or humerous. Walking is best combined with resistance load-bearing activity such as weight training, but even your own body can be used to achieve this end.



Exercised rats gain calcium at a faster rate than non-exercised controls. When allowed access to a rotating wheel device at their own discretion, animals that expended more energy and time in voluntary physical training demonstrated a significant increase in bone mass and bone density over animals that were less active (Holy, X., (2000) Bone mass increases in less than 4 weeks of voluntary exercising in growing rats, Medicine & Science in Sports & Exercise, Vol. 32, No. 9, pp 1562-1569)

Everyday, millions of old bone cells die off. The process of replacing these old cells with new healthy ones is called "bone remodeling". Again, bone remodeling is best achieved when the fibers of the bone matrix are exposed to the right amount and form of weight-bearing stress. Pressure on these sites generates the bioelectrical flash or "spark" which ignites the continual process of growth.

Skeletal tissue serves the body as a major calcium storage facility; in fact it contains 500-1000 times more calcium than all other tissues combined. But healthy strong bones also contain many other minerals including phosphorus, fluorine, iodine, iron, magnesium, manganese, silicon and vanadium. So optimum bone health depends on more than just taking extra calcium or magnesium. Ideally a multiple mineral compound featuring a dozen or more essential minerals and trace elements should be taken throughout the day to ensure an optimal range and reliable intake of minerals (supply the demand).

Without the building blocks necessary to create and form a solid skeletal matrix, one cannot expect to build or preserve a strong skeletal foundation. Adequate protein (high-biological value, non-denatured protein) and several vitamins and hormones are essential to the remodeling process, which includes the regulation of bone formation, repair and growth.