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Complex Network of Bones

Emad Tawfik*

Department of Physical Therapy, Cairo University, Egypt

***Corresponding author:** Tawfik E, Faculty of Physical Therapy, Cairo University, Egypt, E-mail: tawfik_emad@yahoo.co.eg

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Introduction

Bones are living tissue which has their own blood vessels and are made of various cells, proteins, minerals and vitamins. This structure enables them to grow, transform and repair themselves throughout life. We are born with about 300 soft bones. During childhood and adolescence, cartilage grows and is slowly replaced by hard bone. Some of these bones then later fuse together, resulting in an adult skeleton with 206 bones.

The major functions of Bones are to

- Provide structural support for the body
- Provide protection of vital organs
- Provide an environment for marrow (where blood cells are produced)
- Act as a storage area for minerals (such as calcium)

The bones are made up of two types of tissues which are compact bone, also known as cortical bone, this hard-outer layer is strong and dense and the other is cancellous bone also known as trabecular bone, this spongy inner layer network of trabeculae is lighter and less dense than cortical bone.

Cells in our bones are responsible for bone formation, resorption, maintenance and (re-)modelling:

Osteoblasts: These cells are derived from mesenchymal stem cells and are responsible for bone matrix synthesis and its subsequent mineralization. In the adult skeleton, the majority of bone surfaces that are not undergoing formation or resorption (i.e. not being remodelled) are lined by bone lining cells.

Osteocytes: These cells are osteoblasts that become incorporated within the newly formed osteoid, which eventually becomes calcified bone. Osteocytes situated deep in bone matrix maintain contact with newly incorporated osteocytes in osteoid, and with osteoblasts and bone lining cells on the bone surfaces, through an extensive network of cell processes (canaliculi). They are thought to be ideally situated to respond to changes in physical forces upon bone and to transduce messages to cells on the bone surface, directing them to initiate formation or resorption responses.

Osteoclasts: These cells are large multinucleated cells, like macrophages, derived from the hematopoietic lineage. Osteoclasts function in the resorption of mineralized tissue and are found attached to the bone surface at sites of active bone resorption. Their characteristic feature is a ruffled edge where active resorption takes place with the secretion of acid and bone-resorbing enzymes, which digest bone mineral and bone matrix.

Bone Modelling is when bone resorption and bone formation occur on separate surfaces (i.e. formation and resorption are not coupled). An example of this process is during long bone increases in length and diameter. Bone modelling occurs during birth to adulthood and is responsible for gain in skeletal mass and changes in skeletal form.

Peak bone mass is achieved for both males and females by the mid-twenties. Thereafter, a gradual decline into old age occurs in men, while a plateau followed by an accelerated period of bone loss for several years after the menopause occurs in women.

More specifically, remodelling is the replacement of old tissue by new bone tissue and continues throughout life so that most of the adult skeleton is replaced about every 10 years. This process involves the coupling of bone formation and bone resorption.

Conflict of Interest

We have no conflict of interests to disclose and the manuscript has been read and approved by all named authors.

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