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SYSTEMIC APPROACHES TO THE MICROSCOPIC STRUCTURE THE BONE

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Abstract: *The skeletal system is made up of compact bones and spongious bones. The compact bones consists of four components: bone lamella, osteoblasts, canaliculi and Haversian canals. Spongious bones consists of a network of trabeculae. They are arranged so they can withstand pressure from various directions and of various sizes.*
Keywords: *skeleton bone, compact bone, spongious bone, osteoblasts, Haversian canals*

1. INTRODUCTION

The skeletal system is represented by the hard skeleton, which consists mainly of the whole body bones Stefanet [8], Papilian [5]. The links between the bones can be natural (joints and ligaments) or artificial (wires, leather, etc.) so the skeleton is natural or artificial. The bones are, Papilian [5], organs of white color, hard and strong. The skeleton fulfills a complex set of mechanical and biological functions, that are described in the research literature. In this regard, Umadevi and GeethaLakshmi [9], Papilian [5], Stefanet [8], [11] show systemically the functions of the skeletal system as following these major representations:

1. Support for the shape and size of the living body. Essentially, the skeleton represents the overall "scaffold" of the living body;
2. Movement, respectively the locomotion function. The bones fulfill the role of insertion elements to skeletal muscles and tendons that provide controlled movement of the nervous system;
3. Protection for a number of vital organs, and at the same time ‘’delicate ones" of the living body (brain, bone marrow, lung, etc.);
4. Blood storage and producing blood cells in red bone marrow;
5. Storing calcium -involved in calcium metabolism-, storage of the bone marrow, intracellular iron in ferritin, with involvement in iron metabolism;
6. Endocrine regulator;
7. Growth capacity and bone regeneration.

Bone tissue is composed of two main components: a. Bone cells; b. marrow extracellular matrix. Bone cells are found under five representations, Pobirci [7]: osteoprogenitor cells (located on the inner and outer surface of the bone), osteoblasts cells (bone forming cells), bone-lining cells (covering the inactive surfaces of the bone), osteocytes cells (with the function of maintaining bone metabolism), osteoclasts cells (responsible for resorption and modeling marrow). They have specific functional roles regardless synthesis processes, structuring, maintenance, modeling and bone reconstruction.

The extracellular matrix of bone consists of organic substances (collagen type I, the fundamental substance and elastic fibers, in a small amount) and inorganic (mineral salts, in particular calcium phosphate and water). In essence, the extracellular bone matrix constitute a reserve of minerals for the body and ensures durability and strength to the bone.

2. THE MICROSCOPIC ANATOMY OF THE BONE

The study of interior conformation of the bone revealed the presence of two types of bone: a. compact bone, dense; b. cancellous or spongious bone.

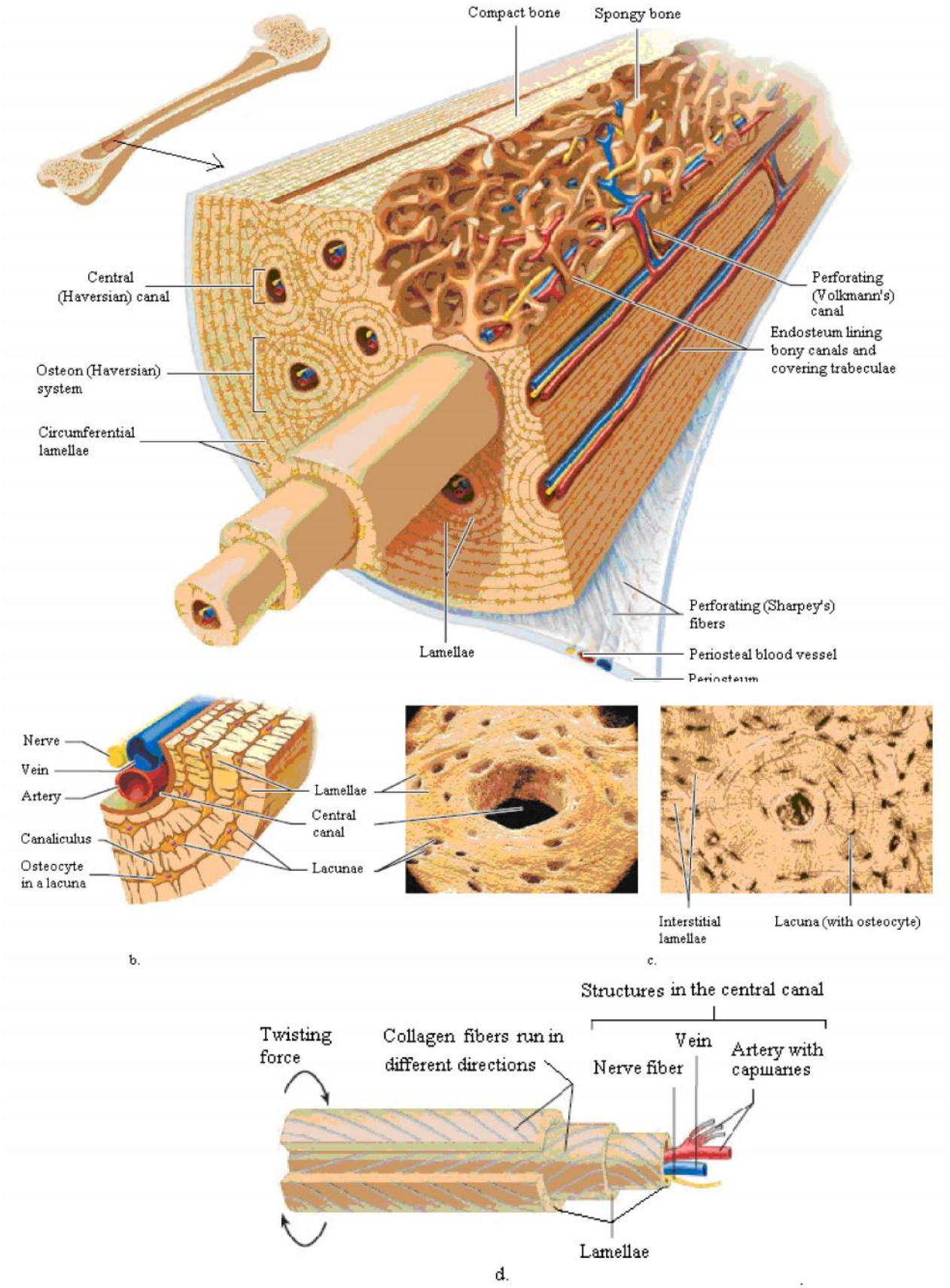

Figure 1 Microscopic anatomy of compact bone:a. diagrammatic view of a pie-shaped segment of compact bone; b. close-up of a portion of one osteon. Note the position of osteocytes in the lacunae; c. SEM of cross-sectional view of an osteon; d. A single osteon, after [11]

Compact bone tissue is a homogeneous and tough substance, formed from bone lamellae stitched together side by side, in numbers of 3-15, having a concentric available in the form of concentric telescopic tubes, around microscopic neurovascular long tubes that are called Haversian canals [11]. Haversian canals show the following features (Fig.1. a-c), Papilian[5], Ştefanet [8], [11]: a. Are oriented along the bone; b. Have a diameter between 10-300 micrometers; c. They form a network of channels and anastomoses between them through the Volkmann channels.

The network of channels open into the cavities of the foam and in the medullary cavity of the bone and at the surface, under the periosteum through some holes of order III; d. Inside them you can find blood vessels, lymph vessels and nerves. the ensemble: bone lamellae - Haversian canals, form the morphofunctional unit of the bone, also called Papilian [ ] haversian system, Haversian column or osteon (Fig.1.d). Osteons found in the bone structure can be three categories Stefaneț [ ]: a. asteons in development; b. mature osteons ; c. osteons in resorption state.

The surface, under the periosteum through some holes of order III; d. In the microscopic structure of the bone, i.e. in the bone lamellae or the spaces between them, are the osteoblasts from wich leaves a number of canaliculi which branches in the fundamental substance. The osteoblasts are microcavities of lenticular form with sizes from, Papilian [5] (20-30) micrometers long, 10 micrometers width and 7 micrometers thick. Inside osteoblasts are the osteocytes, which are bone cells. They performe series extensions that penetrate the bone canaliculi. One of the osteocytes functions is to maintain the bone matrix [11]. In the case of compact bone not all lamellae are contained in osteons. They are called interstitial lamellae. (Fig.1.c).

The compact tissue is at the center of the long bones and at the extremeties of flat bones and short ones. This structure defines the cortical or compact bone.

Spongious or cancellous bone tissue consists of bone lamellae (trabeculae) arranged in different directions and intersect at certain points (trabeculae network) leaving (marking) between them cavities of varying sizes and shapes hollow-cylindrical, and spherical or oval Keaveny et al, [2], Florencio-Silva et al. [3]. In these cavities the bone marrow is located which can be red or, hepatopoietic or yellow adipose. the spongious bone tissue is found in the places where the bone is subjected to forces of tension from different directions Olaru et al. [4], and with variable strength: at the ends of long bones and in the middle of flat and short bones this structure defines the spongious bone or trabecular bone.

The osteons are present both in compact substance and in the spongious one in separate representations. Thus, in compact substance between the two types of bone, between the compact bone and trabecular bone are constructively functional differences. They are presented, summarized in Table 1, by Braggins [1].

Table 1: The difference between compact and cancellous bone, after Braggins [1]

Type of bone	Structure	Areafound
Compact bone	Thousands of Haversian systems, composed of four parts: lamellae, lacunae (small cavities filled with osteocytes), canaliculi and the Haversian canal (a channel containing blood vessels). Held together by interstitial tissue	Shaft of long bones Outer layer of vertebral bodies
Cancellous or spongious bone	A web of trabeculae running in many directions, arranged to resist compressive, tensile and shearing stresses. Spaces between filled with red marrow	At the ends of long bones Vertebral bodies

In summary, the bone has an outer surface coated by a fibrous membrane known as periosteum (rich in blood vessels and nerves) as well as surfaces covered by articular cartilage and muscle insertions. Under the periosteum it's always the compact bone which, in turn, comprise the cancellous bone or trabecular bone (Fig.1).

The disposition of bone substance, compact and spongious in the skeleton relates to the functions that it performs and the strength (pressure), bone weight and volume. In clinical practice the morphological analysis is particularly important to reveal the osteoporotic fractures. (Fig.2).

3. CONCLUSION

The skeletal system consists of two categories: a. compact bone; b. cancellous or spongious bone. The compact bone consists of many harvesiene systems. These include four main components: bone lamellae; osteoblasts filled with osteocytes; canaliculi; Haversian canals.

Spongious bones consists of a network of trabeculae which include spaces filled with bone marrow. Trabeculae are disposed so it can withstand compression, pressure, tensile force and shear stresses.

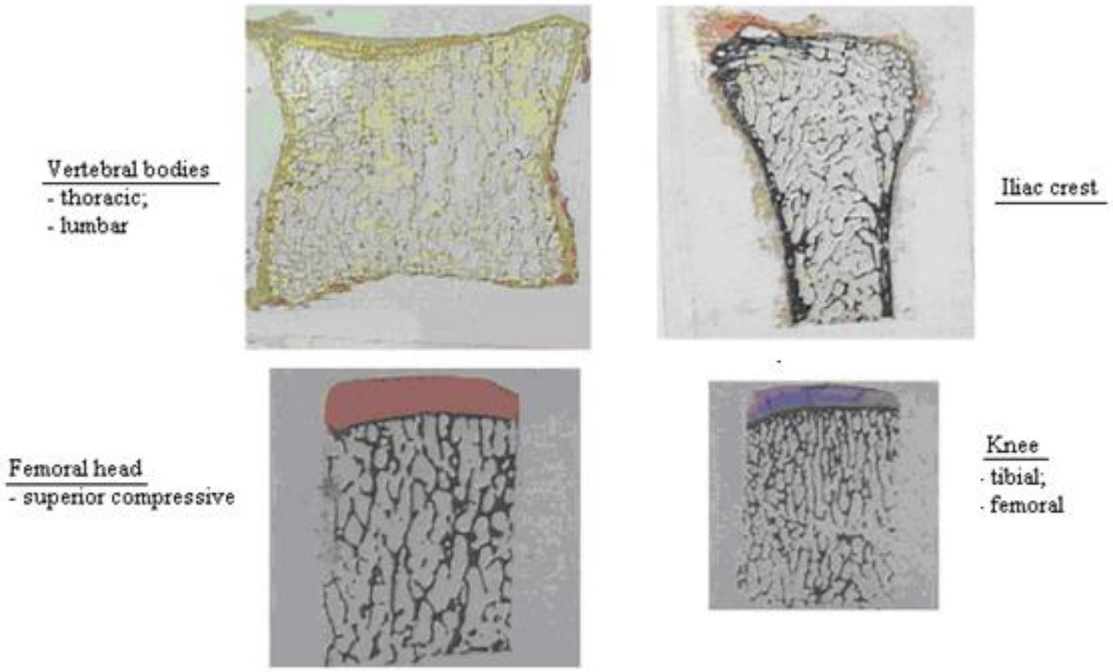

Figure 2. The histological sections of trabecular bone from multiple skeletal sites, from Parkinson and Fazzalari [6]

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