

## Section 2: Microscopic Structure and Bone Composition

### Key Vocabulary:

**Osteocyte:** A mature bone cell responsible for monitoring and maintaining the mineralized extracellular matrix.

**Lacunae:** Tiny fluid-filled chambers within the matrix that house individual osteocytes.

**Lamellae:** Concentric, ring-like layers of mineralized bone matrix surrounding a central canal.

**Osteon (Haversian system):** The basic structural and functional unit of compact bone, consisting of a central canal surrounded by concentric lamellae.

**Central (Haversian) canal:** A longitudinal channel in the core of an osteon containing blood vessels and nerve fibers.

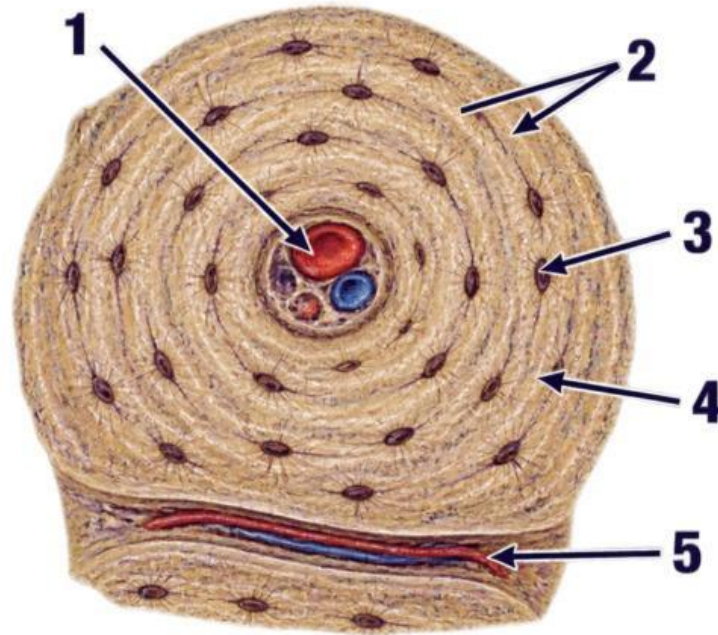
**Canaliculi:** Microscopic hairlike canals radiating outward from lacunae that connect adjacent osteocytes to one another and to the central nutrient supply.

**Volkman's (perforating) canals:** Transverse channels that run at right angles to central canals, carrying vessels from the periosteum into the interior bone tissue.

**Collagen:** Organic protein fibers providing flexible tensile strength that resists twisting and stretching forces.

**Calcium salts (hydroxyapatite):** Inorganic mineral deposits providing compressive strength and exceptional hardness.

Although compact bone appears solid and uniform, it is a dynamic, living tissue organized into microscopic repeating cylinders called osteons. Because the mineralized matrix is impermeable to nutrients, osteocytes depend entirely on an interconnected network of microscopic tunnels to exchange gases, nutrients, and waste products with the bloodstream.



**1.** Use the microscopic anatomy diagram and your understanding of osteon architecture to answer parts (a) through (c).

**(a)** Match each numbered structure from the diagram to its correct name and anatomical description by completing the table.

| Number | Microscopic Feature | Structural Description and Role |
|--------|---------------------|---------------------------------|
| 1      |                     |                                 |
| 2      |                     |                                 |
| 3      |                     |                                 |
| 4      |                     |                                 |
| 5      |                     |                                 |

**2.** Bone tissue is a composite material composed of an organic matrix reinforced by inorganic mineral salts.

**(a)** Contrast the chemical composition and mechanical contributions of bone's organic and inorganic components in the matrix analysis table below.

| Matrix Component    | Specific Chemical Substances | Mechanical Property Provided to Bone |
|---------------------|------------------------------|--------------------------------------|
| Organic Component   |                              |                                      |
| Inorganic Component |                              |                                      |

(b) A laboratory technician conducts two experiments on long bone specimens:

- **Bone A** is soaked in acid for several days, dissolving all inorganic mineral salts while leaving collagen fibers intact.
- **Bone B** is baked at high heat for several hours, incinerating all organic collagen while preserving inorganic mineral salts.

Select the option that correctly predicts how Bone A and Bone B will respond to bending and compressive forces.

- ☐ **A.** Bone A bends easily but resists compression poorly; Bone B is rigid but brittle and may shatter when bent.
- ☐ **B.** Bone A is rigid and brittle; Bone B is soft and flexible.
- ☐ **C.** Both bones remain flexible and resist compression equally well.
- ☐ **D.** Bone A is brittle and shatters when bent; Bone B bends easily and resists compression poorly.