

# Bone structure and remodeling

Through the process of ossification, fibrous (felt-like) lamellar bone is formed from bone. However, even this is broken down over a period of time and re-formed by a new lamellar structure. This process is called **bone remodeling** and it exists because bone cannot grow uniformly everywhere in its mass. The process of remodeling is made possible by osteoblasts, which form osteoid and bone matrix. Then there are osteocytes, which maintain bone metabolism and osteoclasts, which break it down. Bones thus grow by *apposition* of new lamellar layers on their surface and at the same time they rebuild and thus maintain their shape.

## The course of apposition

Apposition takes place in four steps:

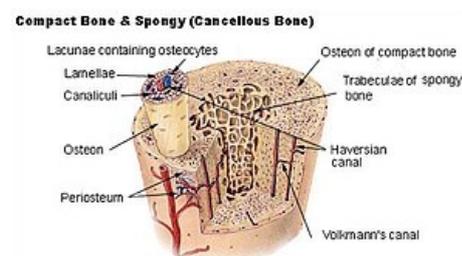
1. Osteoblasts reach the surface of the ossified trabecular bone.
2. Here the osteoblasts multiply and form a double layer.
3. The deeper layer of osteoblasts is taken into the new mass and the other remains on its surface (a new lamella is formed).
4. The layer of superficial osteoblasts proliferates again and the process of apposition repeats, creating more lamellae.

Lamellar bone occurs in two forms:

- dense bone tissue (*substantia compacta*),
- striated bone tissue (*substantia spongiosa*).

## Compact bone structure

- Haversian lamellae - they adhere to the vessels of the Haversian canals and surround them concentrically. They thus create formations called osteons.
- Interstitial lamellae - are former parts of osteons that have been disrupted and surround newly formed complete osteons.
- Surface (mantle) lamellae - surround the bone parallel from the outside (periosteum) and from the inside (endosteum).



Compact bone & spongy bone

## Compact bone remodeling

Osteoclasts, cells that destroy bone tissue, enter the bone through the Haversian canals and subsequently destroy the bone. The newly created cavities are gradually filled with emerging concentric lamellae, which creates a new Haversian canal. Interstitial lamellae are formed from the disrupted lamellae, which surround the newly formed osteons.

## Structure of cancellous bone

Cancellous bone consists of lamellar interconnected bone beams and discs. This creates a structure called a spatial network. The bone beams are arranged according to the direction in which the bone is loaded - this system is called **bone trajectory**. This type of tissue usually does not form osteons.

## Cancellous bone remodeling

The remodeling of bone according to the way they are loaded is called '*cancellous bone architecture*'. It is created during the period of erecting the body and develops as a result of the pulls and pressures that act on the tissue. The strength of the mesh beams corresponds to the force lines on which the tissue stress is applied. Thicker beams are exposed to stress, and on the other hand, unstressed beams are demolished. The adjustment ensures maximum strength in the necessary directions.

Bone remodeling takes place continuously throughout life. The high rate of bone turnover takes place mainly in young children and is associated with their growth. In this period, new creation exceeds destruction. During adulthood, both events are mostly balanced. In old age, there is a predominance of degradation.

## Links

## References

- Bone
- Structure of bone tissue

- Ossification
- Microscopic structure of bone tissue

## References

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- GRIM, Miloš – DRUGA, Rastislav. *Základy anatomie 1*. 1. edition. Galén, 2006. 105 pp. ISBN 80-7262-112-2.