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Formation of Woven and Lamellar Bone

The process of bone formation begins when osteoblasts begin to synthesize and secrete the proteins of the bone matrix. The primary protein is **collagen** which is a fibrous protein that assembles into long rope like structures once secreted from the cell. The collagen along, with other extracellular proteins secreted by the osteoblasts, are referred to as **osteoid**. The osteoid then serves as the site for bone mineralization. **Hydroxyapatite crystals** form on this protein lattice. Together the collagen and the hydroxyapatite comprise the bone matrix.

When bone first forms, the collagen fibers are randomly arranged in the matrix. Since they have a somewhat woven appearance this type of bone is called **woven bone**. Woven bone is the first bone formed in the fetal bones and it is the first bone formed during bone repair. The advantage of woven bone is that it can be produced relatively quickly. The disadvantage is that it is mechanically weak. However, once the woven bone is formed the remodeling process begins. Osteoclasts on the surface of the bone begin to digest the matrix creating long grooves in the bony matrix. After a short period of time (roughly 2 weeks) osteoblasts begin forming new bone in these grooves. This time, however, the collagen fibers are produced in a highly ordered pattern with the fibers running parallel to each other in concentric circles around the central canal of the osteon. The end result of this remodeling is the formation of **lamellar bone** (see the picture of the osteon above with the concentric lamellae). Although it takes longer to form, lamellar bone is much stronger than woven bone.



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