

How Bone Heals and Remodels

Bone feels solid and permanent, but it is living tissue, laced with cells and blood vessels, and it is being taken apart and rebuilt every day of your life. That is exactly why a broken bone can knit back together into something as strong as it was before. Healing follows a predictable sequence, and it takes longer than most people expect, so knowing the pattern makes the wait far less worrying. This page explains, in plain language, what bone is and how it mends; and then, for the curious, goes a good deal deeper into the biology, including how bone constantly remodels itself and what happens when that machinery is turned against the bone.

What bone is and what it does

Bone does several jobs at once. It is the body's **scaffolding**: the frame that holds you up and that muscles pull against to move you. It is **armour**, protecting the brain, heart and lungs. And it is a **storehouse** for minerals, especially calcium, which the rest of the body draws on constantly.

To do all that, bone is a composite material, a bit like reinforced concrete. A flexible protein mesh (mostly **collagen**) gives it the toughness to bend slightly without snapping, and a hard **mineral** (a calcium-phosphate crystal) packed into that mesh gives it stiffness and compressive strength. Take the mineral away and bone is rubbery; take the collagen away and it is brittle as chalk. You need both.

But bone is not inert. It is full of living cells and threaded with blood vessels, which is why it bleeds when it breaks, why a good blood supply matters so much for healing, and why bone, unlike a scratched table, can repair itself.

How a broken bone heals

When a bone breaks, it heals in overlapping stages that turn a gap into solid bone again.

1. **The clot (first days).** The break tears blood vessels in and around the bone, and the blood forms a clot at the fracture. This is not just a plug; it is the scaffold and the signal centre that summons the repair cells. This is also why the area is swollen, bruised and sore early on.
2. **The soft callus (first weeks).** Repair cells move in and lay down a soft, rubbery bridge of cartilage and immature tissue across the gap. The bone is joined now, but only loosely: this is why a fresh fracture needs protecting in a cast, splint or with surgery while the bridge is weak.

3. **The hard callus (weeks to a couple of months).** The soft bridge is gradually replaced by hard, mineralised bone, forming a bulky cuff (the callus) around the break. By the end of this stage the bone is usually solid enough for ordinary use.
4. **Remodelling (months to years).** The lumpy callus is slowly carved back and reshaped along the lines of stress until the bone looks and works much like it did before. In children this reshaping is so good that a slightly crooked break can straighten out over time.

Healing is genuinely slow, and that is normal. As a rough guide many adult fractures take around **six to twelve weeks** to become solid, and longer to regain full strength; the remodelling that perfects the shape can run on for a year or more. The timeline depends on the bone, the person and the injury, so treat these as guides, not promises.

What helps it heal

A few things make a real difference, and most are in your control:

- **Blood supply and a settled break.** Bone heals best when the broken ends have a good blood supply and are held reasonably still, which is the whole point of a cast or an operation. Too much movement, or a poor blood supply, is the commonest reason a break is slow to unite.
- **Not smoking.** Smoking and nicotine narrow blood vessels and meaningfully slow bone healing. Stopping, even around the time of an injury or operation, helps.
- **Nutrition.** Bone is built from protein and mineral, so adequate protein, **calcium** and **vitamin D** support healing. Most people don't need megadoses; they need to not be deficient.
- **Sensible loading.** Bone responds to use. Following the weight-bearing and exercise advice you're given, not too much and not too little, guides the healing bone to rebuild in the right places.
- **Time and review.** Most breaks heal on their own timeline. If one that should be improving isn't, that's worth reviewing; some need a helping hand from surgery.

See also

- [Bone health and osteoporosis](#) – when the remodelling balance tips toward bone loss across the whole skeleton
- [Smoking and musculoskeletal healing](#) – why smoking slows the healing described here
- [Vitamin D and musculoskeletal health](#) – the mineral side of building bone