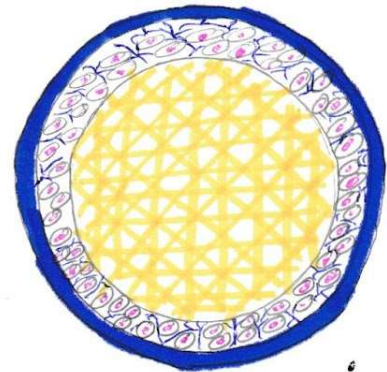


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Bones are a complex organ, and the human body has many, but there are 3 key layers that need to be understood. The 1st layer, shown in blue, is the periosteum. It acts as a cover or protective sheet for the rest of the bone. The 2nd layer, the cortical bone or compact bone, houses the majority of nerves for the bone. It also contains the osteon, a canal-like structural unit that is responsible for providing the means to create bone and repair it as needed. The final layer, the one in a honeycomb like appearance, is the spongy bone. Spongy bone is the place where bone marrow is found and thus blood vessels run through it, providing much needed nutrients for the sustained creation and maintenance of bone.

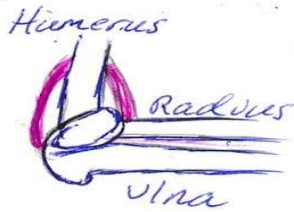


Speaking of creating and maintaining bone, there are 2 important cells responsible for this very task. The osteoblast, the more square-like cell shown on the right, is responsible for creating new bone. It is found in the 1st layer of the bone, the periosteum. The osteoclast, the more blob-like cell, is found in the boundary between the periosteum and the compact bone. The osteoclast is responsible for breaking down bone.

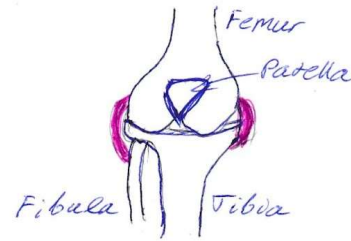
The human vertebrae, or spine, is a complex structure of 33 individual bones. It provides support for the spinal cord, the nervous tissue that is essential to movement and sensory transmission. There are 5 important sections of the vertebrae, from top down those are the cervical spine, the thoracic spine, lumbar spine, sacral spine and coccyx (tail bone). The vertebrae not only supports the spinal cord but also the body as a whole, allowing us a wide range of motion. However, it is rather delicate, and using the spine as the main driving force for some activities can be dangerous, such as when picking up something. For that reason, it is more important for the spine to serve its main function of supporting the body, and so if one is trying to lift something up, using your whole body is ideal compared to bending over and putting all the strain on the spine.



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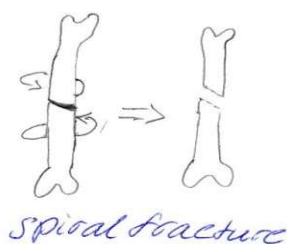
Joints are points in the body where 2 or more bones meet up. We most commonly see joints as the point where a large range of motion is centered around. On the left for example we have the elbow, where the humerus or upper arm comes into contact with the ulna and



radius, or the forearm. On the right we see the knee, where the femur or thigh comes into contact with the fibula and tibia, or the leg. Both of these joints, the elbow and the knee, are like a hinge, where range of motion is restricted to one plane. There is however a large angle to allow movement, where actions such as curling of the arm and lower leg is possible.

There are many things that can go wrong with bones. One of the most common bone disorders we think about, which doesn't immediately strike out as a disorder but merely an accident, is a bone fracture. The word disorder merely means a disruption of intended function, and if you think about it having a broken bone is something that prevents the bone from doing it's intended purpose. There are many types of fractures that can occur, but down below is an example of a spiral fracture where a twisting motion snaps the bone. With any bone fracture, the body loses a key component providing support. If a fracture like this occurred in the leg for example, it would limit movement such as walking, or if it occurred in the arm it might prevent writing or typing.

Another bone disorder that is unfortunately common is arthritis, or swelling in the joints. Much like fractures there are many types of arthritis, and are caused due to different things. Down below is an example of Rheumatoid arthritis in the knee, and we can see there are 2 key colors that stand out. The yellowish color represents bone, while the blue color represents cartilage, an important connective tissue found at the end of bones in the joint. Cartilage helps prevent direct bone to bone contact, instead absorbing friction as the bones move. With Rheumatoid arthritis, the immune system mistakenly attacks healthy cells in cartilage, and decreases the amount of it present at the joint. When this occurs, the bones are in direct contact with one another causing pain and discomfort, and there is lots of inflammation as a response to protect the body, when it is the body itself causing the harm in the first place.

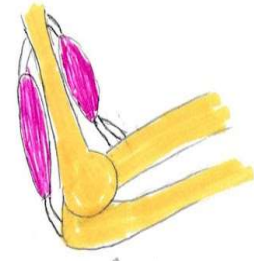


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There is always a lot of confusion between ligaments and tendons. There is a simple comparison that can be done to better understand what each of these are. Ligaments are like string, they are inelastic. They are well suited to tie knots and connect things together, and ligaments are responsible for connecting bones to other



bones. On the left we can see ligaments in the hand, and there is a special focus on the wrist because that is where many bones come together. That large white section, almost like a crochet, represents many ligaments doing their function.



On the right we see the elbow, where the upper arm and forearm come together. The focus is more on the muscles in pink, and how they are connected to the bone in yellow. At each end of the two muscles, tricep on the left and bicep on the right, there are little cords, these cords connect the muscle to bone. In contrast to the string like ligaments seen prior, these cords are elastic and can expand or contract with ease. This in turn allows the muscles to also expand or contract, essentially allowing the limbs to move thanks to the intricate connections.

Since we touched on the topic of muscles, let's think of some exercises that work out some muscles. Using the above examples of the hand and elbow, there are many exercises that use them both greatly. One might use some dumbbells and do curls, and we know that it impacts the bicep and tricep expanding and contracting them, but it also works on small muscles in the hand itself. These small muscles in the hand are not necessarily doing the bulk work of curling the dumbbells, but they are still active in holding them in the palm. If one wanted to work out the hand muscles more, exercises where you pinch or squeeze something would be needed. This can be done with something like a stress ball, where you simply cup something and squeeze down with all your fingers.