**Bone structure:**

The wrist is defined in 3 parts: The carpus, the radiocarpal joint, and the wrist joints. The carpus is a set of eight bones that forms the proximal segment of the hand. The radiocarpal joint is where the radius and the carpus connect, and the wrist joints is a region surrounding the carpus which includes bones from the forearm and the metacarpus.

There are many joints and bones in the wrist that permit movement and give stability:

* There are 13 bones that form part of the wrist. Eight carpal bones(the Scaphoid, lunate, triquetral, pisiform, trapezium, trapezoid, capitate, and hamate) and five metacarpal bones(the first, second, third, and fourth metacarpal bones).
* The distal radioulnar joint is the pivot joint located between the radius and the ulna at the wrist. It allows twisting of the forearm along with the proximal radiounlnar joint, which has the same function, but is located near the elbow.
* The radiocarpal joint, also known as the wrist joint is formed by the radius and the articular disk and the proximal row of carpal bones.
* The midcarpal joint is the S-shaped joint space separating the proximal and distal rows of carpal bones.
* The intercarpal joints are the joints that connect each of the carpal bones together

A diagram showing the anterior view of the hand, complete with ligaments

An image of the human hand showing the eight carpal bones and the medicarpal bones.

**Muscles and movement:**

The extrinsic hand muscles are located in the forearm, and the tendons connecting them to the bones are threaded through the flexor rentinaculum and the extensor retinaculum, which are bands that wrap around the hand and prevent the tendons from pulling completely taut when the muscle contracts

The wrist has to degrees of freedom, not counting pronation and supination(the twisting motion) which can be considered to be a part of the forearm/elbow rather than the wrist itself. These degrees of freedom can be divided into two categories: Marginal movements and movements in the plane of the hand. Marginal movements include radial deviation, which is the movement of the wrist in the direction of the thumb and ulnar deviation, which is the opposite of radial deviation. Movements in the plane of the hand include flexion, which is the movement of the hand towards the palm and extension, which is the opposite of flexion and is the movement of the hand towards the back of the hand. These two types of movement can be combined to make intermediate movements such as moving at angles.

**What we need:**

In order to create a robotic arm that is a good representation of the human arm, we need to simplify and optimize the human model into one that is easily replicable. Since motors are going to be used instead of muscles, ligaments and tendons, certain joints and bones can be omitted without causing a significant impact on REPLACE THIS. For example, the carpal bones can be replaced with motors, since a major part of their function is assisting in smooth movements. Since the current design will not include fingers, the metacarpal joints can also be omitted or replaced with motors to emulate a claw function. The muscles leading up to the wrist, the radius and the ulna can also be replaced with motors and rods to emulate pronation and supination. Weight will be a big issue with this wrist joint, since it is very close to the end of the arm.

A depiction of some of the major muscles used for movement.