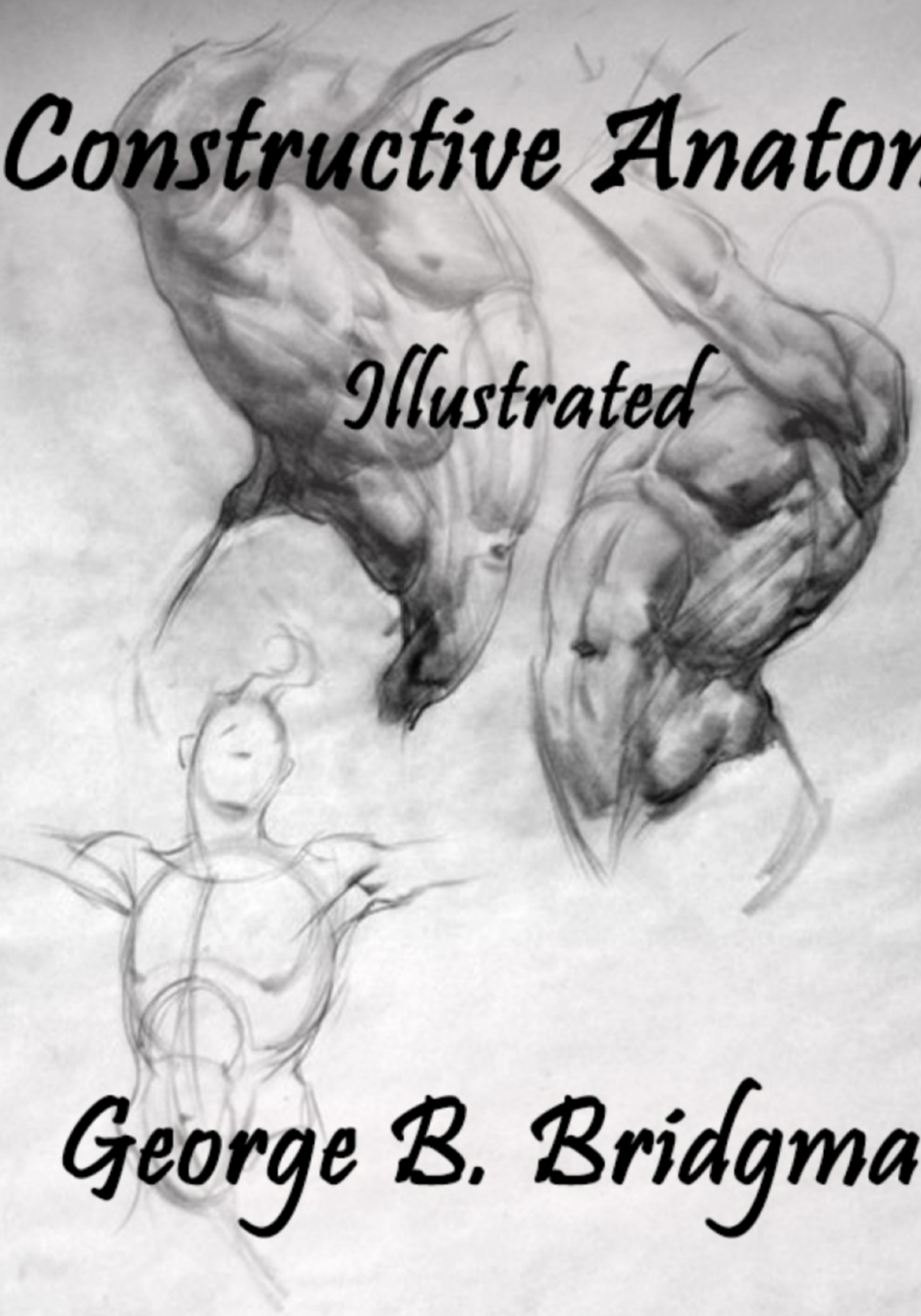


# *Constructive Anatomy*

*Illustrated*



*George B. Bridgman*

The background of the cover features several anatomical sketches. At the top, there are two detailed studies of a muscular arm, one flexed and one extended, showing the intricate structure of the muscles and tendons. Below these, there is a lighter, more gestural sketch of a human torso from the front, with the arms slightly out to the sides. The sketches are rendered in a classic artistic style, likely using charcoal or pencil, with varying degrees of shading and line work to define form and muscle mass.

# *Constructive Anatomy*

*Illustrated*

*George B. Bridgman*

George B. Bridgman

# **Constructive Anatomy**

**Illustrated**

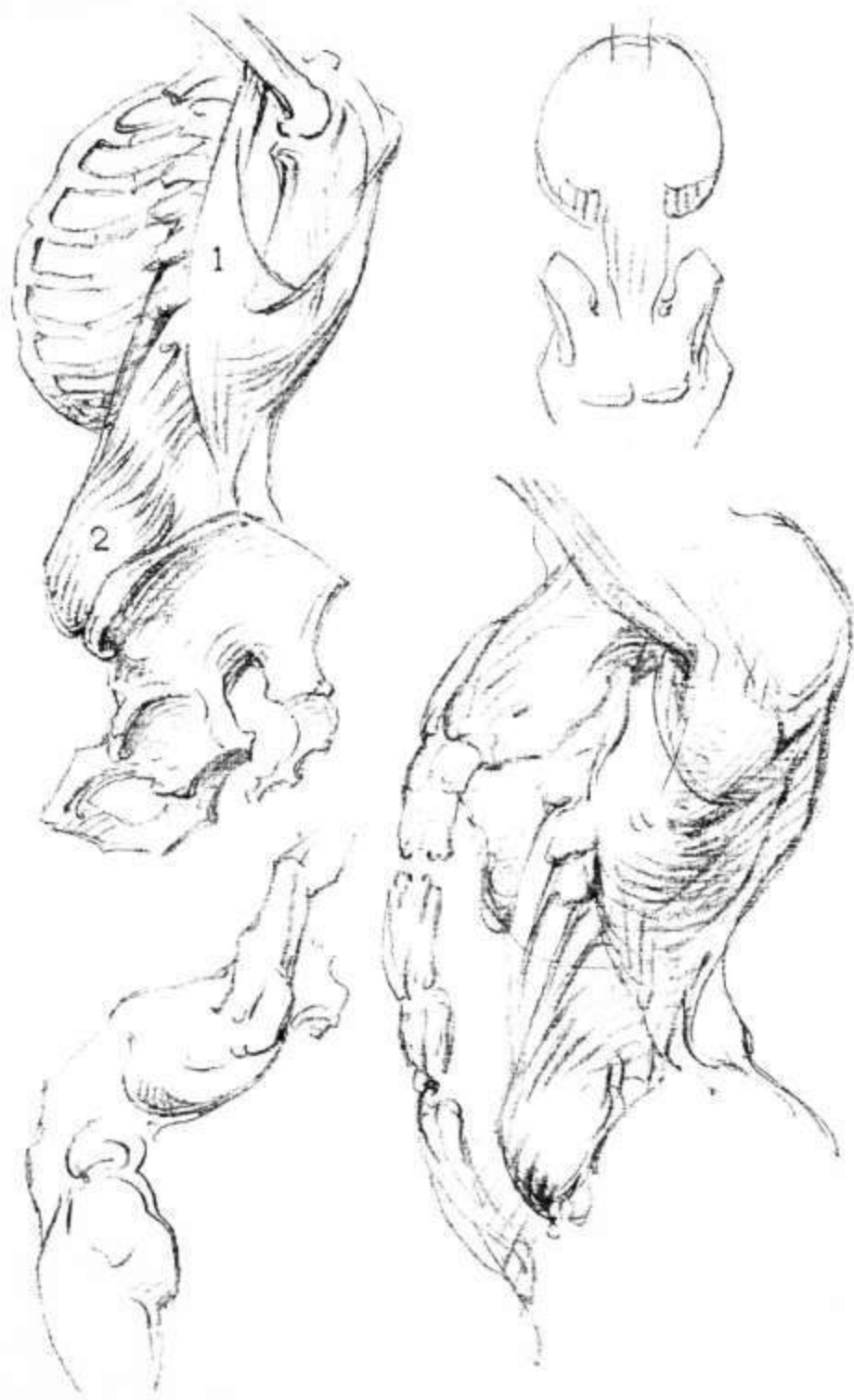
BookRix GmbH & Co. KG  
80331 Munich

# **Constructive Anatomy**

Illustrated

by George B. Bridgman

**The drawings that** are presented here show the conceptions that have proved simplest and most effective in constructing the human figure. The eye in drawing must follow a line or a plane or a mass. In the process of drawing, This may become a moving line, or a moving plane, or a moving mass. The line, in actual construction, must come first. but as mental construction must precede physical, so the concept of mass must come first, that of plane second, that of line last think in masses, define them in lines.



# CONSTRUCTIVE ANATOMY

## **Introduction**

The drawings that are presented here show the conceptions that have proved simplest and most effective in constructing the human figure.

The eye in drawing must follow a line or a plane or a mass. In the process of drawing, this may become a moving line, or a moving plane, or a moving mass. The line, in actual construction, must come first; but as mental construction must precede physical, so the concept of mass must come first, that of plane second, that of line last.

Think in masses, define them in lines.

Masses of about the same size or proportion are conceived not as masses, but as one mass; those of different proportions, in respect to their movement, are conceived as wedging into each other, or as morticed or interlocking.

The effective conception is that of wedging.

## **General Anatomy**

Bones constitute the pressure system of the body. In them are expressed, therefore, laws of architecture, as in the dome of the head, the arches of the foot, the pillars of the legs, etc.; and laws of mechanics, such as the hinges of the elbows, the levers of the limbs, etc.

Ligaments constitute the retaining or tension system, and express other laws of mechanics.

Muscles constitute the contractile or power system; they produce action by their contraction or shortening. In contraction they are lifted and bulged, while in their relaxed state they are flabby and soft. Muscles, attached to and acting on the bony and ligamentous systems, constitute the motion system. In the muscles are expressed, therefore, laws of dynamics and of power.

For instance, for every muscle pulling in one direction, there must be the corresponding muscle pulling in the opposite direction. Muscles are therefore paired, throughout the body. Every muscle on the right side must be paired with one on the left: for every flexor on the front there must be its corresponding extensor on the back.

Muscles express also laws of leverage: they are large in proportion to the length of the lever they move. Those of the individual fingers are small and can fit in between the bones of the hand. They grow larger as we ascend the arm, the leverage being longer and the weight greater. The muscles of the forearm are larger than those of the fingers; those of the arm larger than those of the forearm, while the muscles of the shoulder are larger still.



## **Masses And Movements Of The Body**

The masses of the head, chest and pelvis are unchanging.

Whatever their surface form or markings, they are as masses to be conceived as blocks.

The conception of the figure must begin with the thought of these blocks in their relation to each other. They are to be thought of first as one thinks of the body of a wasp, with only one line connecting them, or without reference at all to connecting portions.

Ideally, in reference to gravitation, these blocks would be balanced symmetrically over each other. But rarely in fact, and in action never, is this the case. In their relations to each other they are limited to the three possible planes of movement. That is, they may be bent forward and back in the sagittal plane, twisted in the horizontal plane, or tilted in the transverse plane. Almost invariably, in fact, all three movements are present, to different degrees.

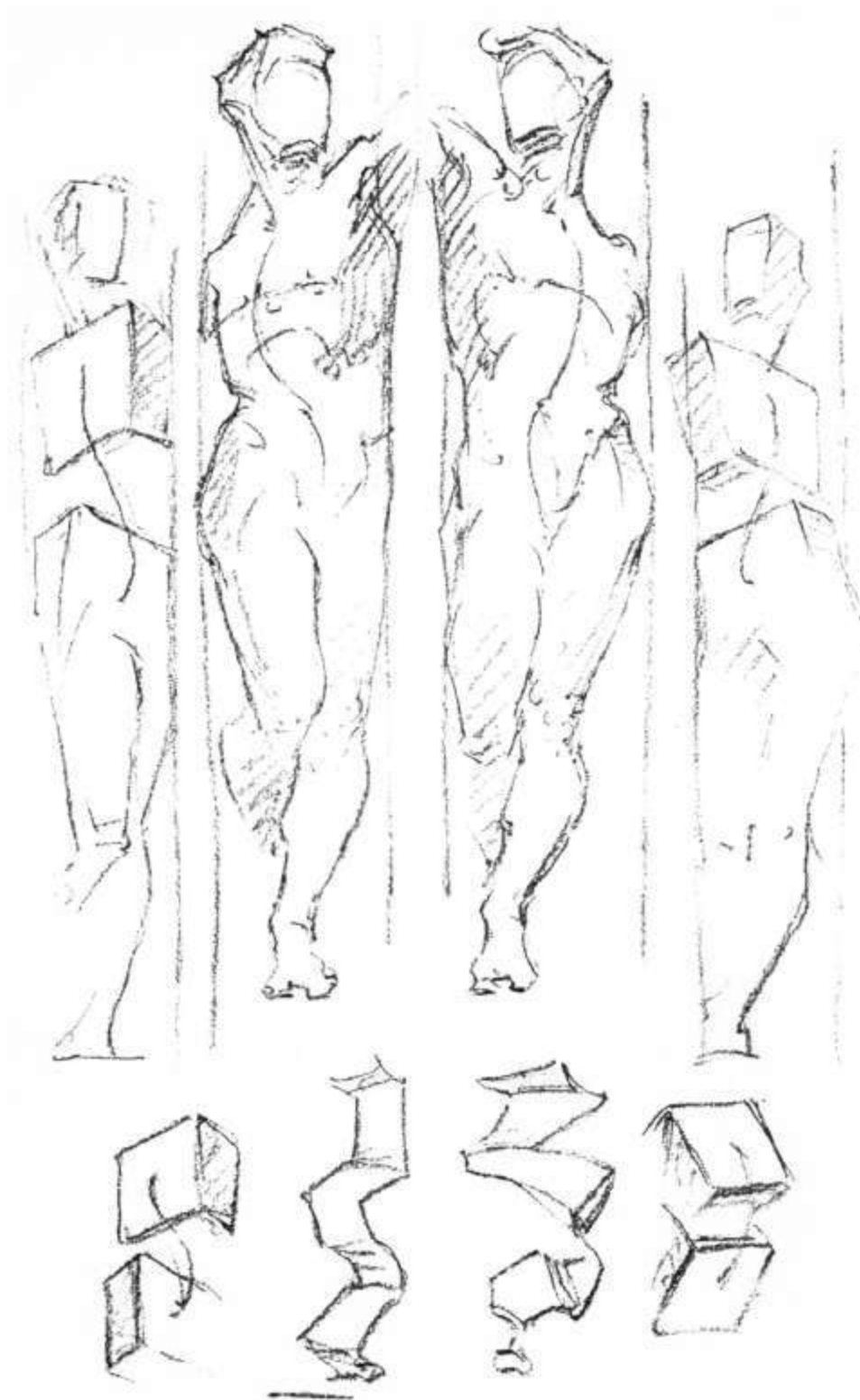
In these various movements, the limit is the limitation to movement of the spine. The spine is the structure that connects one part of the body with another. It is a strong column occupying almost the centre or axis of the body, of alternating discs of bone and very elastic cartilage. Each segment is a joint, whose lever extends backward to the long groove of the back. Such movement as the spine allows the muscles also allow, and are finally connected by the wedges or lines of the actual contour.







Construction. Masses and Movements of the Body: Tilting of the Masses.



Construction. The Horizontal, Sagittal and Transverse Planes: Tilted and Twisted.

# **The Hand**

THE HAND

## **Anatomy**

In the hand are four bones, continuous with those of the fingers, called metacarpals (meta, beyond, carpus, wrist). They are covered by tendons on the back, and on the front by tendons, the muscles of the thumb and little finger, and skin pads.

There is a very slight movement like opening a fan between these bones. They converge on the wrist bones and are morticed almost solidly to them. The hand moves with the wrist. The dorsal tendons converge more sharply than the bones.

The short muscles of the hand, crossing only one joint, the knuckle, and moving the fingers individually, lie deep between the metacarpal bones and so are called interossei. They are in two sets, back and front, or dorsal and palmar. The palmar interossei are collectors, drawing the fingers toward the middle finger, and so are fastened to the inner side of each joint except that of the middle finger itself. The dorsal interossei are spreaders, drawing away from the centre, and so are fastened to both sides of the middle finger and to the outside of the other joints. In the thumb and little fingers the muscles of this set are called abductors, and being in exposed positions, are larger. That of the first finger forms a prominent bulge between it and the thumb; that of the little finger forms a long fleshy mass reaching to the wrist.

## Masses

The masses of the hand are two - one that of the hand proper, the other that of the thumb.

The first of these is beveled from knuckles to wrist on the edge; from wrist to knuckles on the flat side, and from first to little finger from side to side. It is slightly arched across the back.

Somewhat more arched are the knuckles, concentric around the base of the thumb. The second knuckle is larger and higher than the rest; the first is lower on its thumb side, where it has an overhang, as has also the knuckle of the little finger, due to their exposed positions.

Belonging to the hand is the pyramidal mass of the first segment of the thumb, which joins on at an angle, never quite flat with the hand, and bending under it to more than a right angle with its flat surface.

The thumb may be drawn in until only its root bulges beyond the lateral line of the hand, and may be carried out to a great angle with it. In this latter position its first segment forms a triangle whose base is the side of the hand, equal to it in length; whose height is, on the palmar surface, equal to the width of the hand, and on the dorsal surface, almost as great.

On the little finger side, the form is given by the abductor muscle and the overhang of the knuckle, by which the curve of that side is carried well up to the middle of the first segment of the finger.

The pad of the palm overlaps the wrist below and the knuckles above, reaching to the middle of the first segment of the fingers.

On the back of the hand, nearly flat except in the clenched fist, the tendons of the long extensors are superficial, and may be raised sharply under the skin. They



represent two sets of tendons more or less blended, so are double and have connecting bands between them.



The Hand.



The Hand.



The Hand. Muscles of the Hand, front palmar.

- 1 Abductor pollicis.
- 2 Flexor brevis pollicis.
- 3 Abductor transversus pollicis.
- 4 Lumbricales.

- 5 Annular ligament.
- 6 Flexor brevis minimi digiti.
- 7 Abductor minimi digiti.



The Hand.



The Hand. Muscles of Back of Hand.

1 First dorsal interossei.

2 Abductor pollicis.

3 Dorsal interossei.

4 Tendons of extensor communis digitorum.



The Hand. Wedging of the Wrist: Thumb Side.



The Hand. Wedging of the Wrist: Little Finger Side.

# **The Wrist**

THE WRIST



## **Anatomy**

Morticed with the bones of the hand are the bones of the wrist: the two make one mass, and the hand moves with the wrist.

Eight bones (carpal bones) in two rows make the arch of the wrist: in size they are like deformed dice. The two pillars of this arch are seen on the palmar side, prominent under the thumb and the little finger. The latter is the heel of the hand, but the arch is thicker and a bit higher on the thumb side. Under it pass the long flexor tendons to the fingers and thumb.

The dome of the arch is seen on the back, with an apex at the trapezium under the first finger. It is crossed by the long extensor tendons of the fingers, which converge on its outer half.

## **Masses**

Its width is twice its thickness. It is narrower both ways where it joins the arm, giving an appearance of constriction.

There is always a step-down from the back of the arm, over the wrist, to the hand.

## Movements

Being solid with the hand, the wrist moves with the hand on the forearm. Its movement is like that of a boat in water; easily tipping sideways (flexion and extension) with more difficulty tilting endways (side-bending) which in combination give some rotary movement, but having no twisting movement at all. This movement is accomplished by the forearm.

The inset of this boat-shaped joint with the arm gives the appearance of constriction. The prow, under the thumb, is higher than the stern under the little finger.

When fully extended, the back of the hand with the arm makes almost a right angle; when fully flexed, the palmar surface makes almost a right angle; the total movement therefore is slightly less than two right angles.

When the wrist is fully flexed, it forms at the back a great curve over which the extensor tendons are drawn taut, so much so that the fingers can never be closed when the wrist is fully flexed. In this position the flexor tendons are raised prominently under the skin.

When hand and arm lie extended along a flat surface, it is the heel of the hand that is in contact, the arm bones being lifted from the surface.

To the four corners of the wrist are fastened muscles; two in front (flexor carpi radialis and flexor carpi ulnaris) and two behind (extensor carpi radialis and extensor carpi ulnaris, the former being double). By their contraction the wrist is moved in all directions, except twisting, which movement is produced not in the wrist but in the forearm. Only the tendons cross the wrist, the muscular bodies lying in the forearm.

## **The Hand. Construction**

In the hand as in the figure there is an action and an inaction side. The side with the greatest angle is the action side, the opposite is the inaction or straight side.

With the hand turned down (prone) and drawn toward the body, the thumb side is the action side, the little finger the inaction side. The inaction side is straight with the arm, while the thumb is almost at right angles with it.

The inaction construction line runs straight down the arm to the base of the little finger. The action construction line runs down the arm to the base of the thumb at the wrist, from there out to the middle joint, at the widest part of the hand; thence to the knuckle of the first finger, then to that of the second finger, and then joins the inaction line at the little finger.

With the hand still prone, but drawn from the body, the thumb side is the inaction side, and is straight with the arm, while the little finger is at almost right angles with it. The inaction construction line now runs straight to the middle joint of the thumb, while the action line runs to the wrist on the little finger side, thence to the first joint, etc., etc.

These construction lines, six in number, are the same with the palm turned up. according as it is drawn in or out. They place the fingers and indicate the action and proportions of the hand.