A concise treatise on dislocations and fractures. : Being a selection from the most approved foreign and English surgical authorities. From the days of Celsus to the present time. Illustrated by eighteen plates, containing nearly fifty examples of the most approved methods of operation and bandaging, etc. etc. To which is now added, for the first time, Antonio Scarpa's Minute anatomy of the bones. Translated from the last Latin edition.

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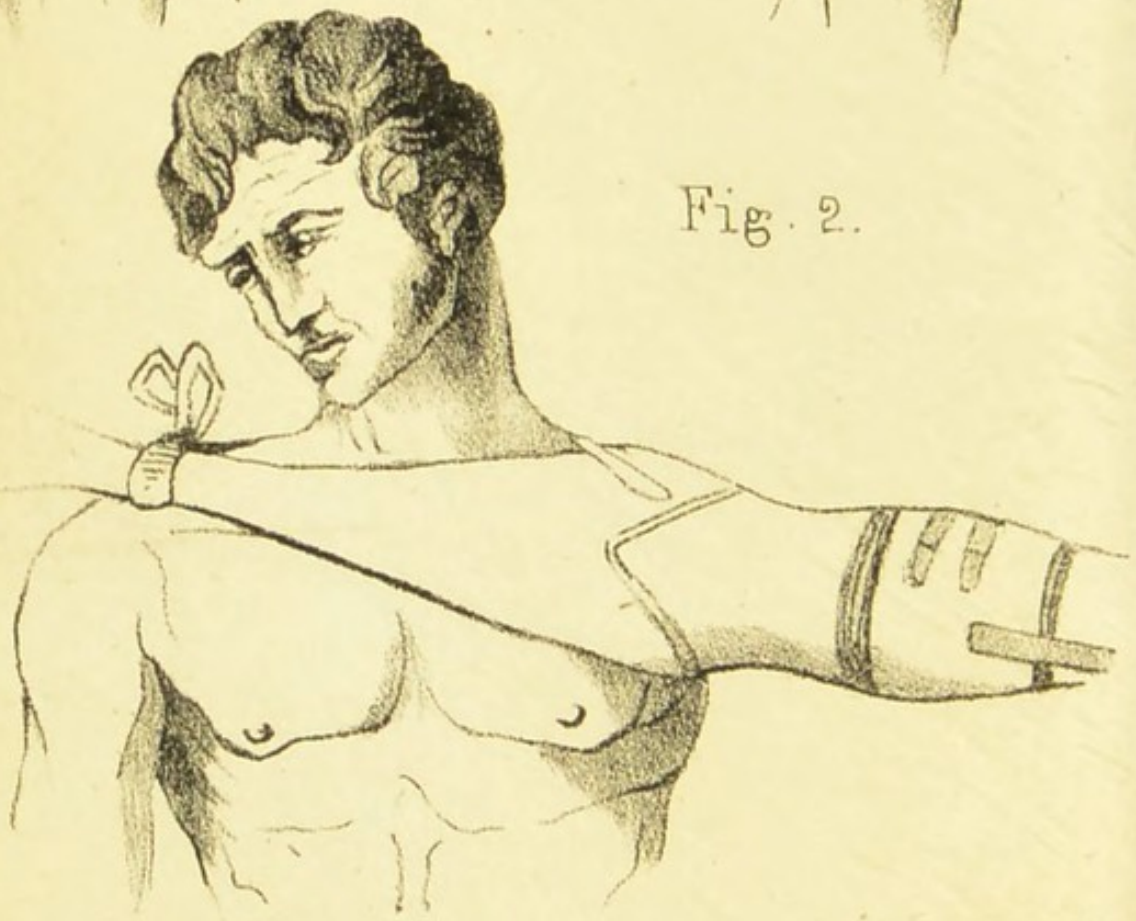
Fig. 1.

Fig. 2.



A

CONCISE TREATISE

ON

DISLOCATIONS AND FRACTURES.

BEING A

SELECTION FROM THE MOST APPROVED FOREIGN AND ENGLISH SURGICAL AUTHORITIES.

FROM THE DAYS OF CELSUS TO THE PRESENT TIME.

Illustrated by Eighteen Plates,

CONTAINING NEARLY FIFTY EXAMPLES OF THE MOST APPROVED METHODS OF OPERATION AND BANDAGING,
ETC. ETC.

TO WHICH IS NOW ADDED, FOR THE FIRST TIME,

ANTONIO SCARPA'S
MINUTE ANATOMY OF THE BONES.

TRANSLATED FROM THE LAST LATIN EDITION.

Fourth Edition.

LONDON:
PUBLISHED FOR THE PROPRIETOR;
SOLD BY SIMPKIN AND MARSHALL, STATIONERS' COURT;
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PREFACE.

This is a volume of very moderate pretensions; it lays no claims to originality; the chief aim has been to exhibit, within as limited a space as possible, all that is indispensably necessary to a proper acquaintance with the nature and treatment of Dislocations and Fractures, illustrated by Plates, representing the most approved methods of operation and bandaging, as well as other matters relative to this important branch of surgical art.

The hopes of the author will be fully satisfied if utility in design and fidelity in the compilation of this little work be conceded to him. In the choice of au-

thorities he has given a preference to those whose opinions have been corroborated by his own experience, whose particular views have coincided with his own, and whose descriptions have appeared to him the most lucid.

The price of the volume is moderate; and as it contains, in a very condensed form, notices of almost every circumstance contingent upon the subject on which it treats, it is presumed to be a useful elementary work of reference, for students who are unable to consult the various writers to whom the compiler is indebted for the information this work contains.

London, 1830.

A TREATISE,

ETC.

Dislocations in General.

Dislocation takes place every time that the articular extremities of bones abandon their natural relations, whether it be that the head of a bone escapes from a cavity destined to receive it, or that the surfaces of the joint cease to correspond one to the other. The dislocation may be either total or partial: hence dislocations are divided into complete and incomplete. Dislocations, taken in a general point of view, differ from one another, with respect to the articulation in which they take place; the extent of the dislocation; the direction in which the bone is displaced; the length of time they have

continued; the circumstances which accompany them, and which mark them out as simple or compound; and the cause that has produced them.

Every dislocation produces pain and incapacity in the limb, but these are only equivocal symptoms, and cannot distinguish the case from a fracture, nor even from a simple contusion. Our diagnosis ought to be found on the existence of symptoms manifest to the senses, such as an elongation or shortening of the limb, a change in its shape and direction, and an absolute impossibility of performing certain motions.

Partial Dislocation of the Lower Jaw.

The condyloid process on only one side is displaced; the mouth opened, but not so much as in the complete dislocations: the chin is directed to the side opposite the injury.

Subluxation.

The condyloid process of the jaw is sometimes displaced from the inter-articular cartilage of the joint slipping before its edge, fixing the jaw with the mouth slightly opened.

Complete Dislocation.

The mouth is more or less open. It is more so in recent dislocations than in those that have continued for some time. An empty space is felt before the ear, where the condyles were placed. The coronoid process forms under the cheek-bone an eminence which is felt through the cheek, or by introducing the finger into the mouth. The cheeks and temples are flattened by the lengthening of the temporal, masseter, and buccinator muscles; the saliva flows in large quantities from the mouth, irritated by constant exposure to the air, which increases its secretions.

The compression made on the salivary glands, and the irritation and friction they experience, contribute to render the secretion of the saliva still more abundant.

The arch formed by the teeth of the lower jaw is placed anterior to that formed by those of the upper, and the direction of their edges shows that this disposition is unnatural. The patient can neither speak nor swallow during the first days of the dislocation.

Treatment.

PARTIAL.—The jaw may be reduced by means of the cork or lever of wood.

SUBLUXATION.—It is necessary to apply some degree of force downwards and backwards, to separate the condyloid process from the temporal bone, and thus allow the cartilage to resume its proper situation.

COMPLETE.—In reducing the jaw we

must provide a protection to the thumbs, by wrapping a bit of linen round them, or by wearing a strong glove. The surgeon puts his thumbs deep into the mouth, so that they rest upon the grinding teeth; the fingers grasp the chin and base of the jaw. The back part of the jaw is to be forced downward by the strength of the thumbs, while the chin is lifted by the palm and fingers, *(Plate* i.*)* by which means the condyles become disengaged from their situation under the zygomas; at which instant the muscles draw those parts rapidly back into the articular cavities again.

Dislocations of the Vertebræ.

DISLOCATION OF THE HEAD FROM THE FIRST VERTEBRÆ, OR ATLAS.

Pain in the neck, becoming more severe at night, or in swallowing a large mouthful, or drawing a deep breath, is the first symptom. Pain on one side of the neck, espe-

cially when the head is moved towards the shoulder; it extends from the larynx towards the nape, and often to the scapula of the pained side:—pressure on the region of the first and second vertebræ produces considerable pain, and thus points out the seat of the disease. The head sinks towards one shoulder, the face being turned a little down. If both sides are affected, the head will incline directly forwards. The patient feels as if the head were too heavy, and he carefully supports it with his hands when he moves from the sitting to the lying position, or vice versâ. A peculiar expression of pain in the countenance.

In these cases nothing can be more obvious, than that there must be a destruction, or at all events, a thoroughly diseased state of the ligaments between the atlas and dentatus, and those connecting the dental process to the occiput.

Treatment.

Local blood-letting, by leeches, cupping, and the application of blisters, setons, and issues.

FIRST CERVICAL FROM THE SECOND.

WHEN the rotatory motion of the head is forced beyond its proper limits, the ligaments which tie the processus dentatus to the edge of the foramen magnum are torn; and supposing the head to be forced from the left to the right, the left side of the body of the vertebræ is carried before its corresponding articulating surface, while the right side falls behind its corresponding surface. Sometimes the tooth-like process, the ligaments of which are broken, leaves the ring formed for it by the transverse ligament and the anterior arch of the first vertebræ, and presses on the spinal marrow. Lesion of the spinal marrow at this point is quickly fatal. Dislocations of the fourth, fifth, and sixth, cervical bones are not always fatal.

Treatment.

We are to incline the head to the side towards which it is directed, in order to disengage the articulating process of the upper vertebræ:—this part of the operation is extremely dangerous, as it may kill the patient by causing a compression on the spinal marrow. When the process is disengaged, the head and neck are brought to their right direction, by making them perform a rotatory motion the contrary of that which had taken place in the dislocation. The head is kept free from motion by means of bandages, which are attached to the head and shoulders.

PLATE VI. FIG. I.—PLAN OF DISLOCATED VERTEBRÆ.

The articulating process of the upper and lower vertebræ should lie flat on each other, instead of which their points stand opposed, so that their bodies cannot come into their regular approximation, but stand with oblique surfaces.

FIG. 2.

This sketch represents a fracture of one of the dorsal vertebræ, the upper portion of which is forced in upon the spinal marrow.

Dislocations of the Clavicle.

It may be dislocated at its sternal extremity, forwards, backwards, and upwards. If the luxation be forwards, a hard circumscribed tumour is felt, or even seen, on the anterior and superior part of the sternum, which is made to disappear by carrying the shoulder forwards and outwards, and an empty space is found where the head of the clavicle should be placed.

In dislocation upwards, the space between the sternal ends of the clavicles is diminished.

Treatment.

The shoulders are to be drawn backwards, by which the clavicle is drawn off the ster-

num, when it falls into its natural situation; the shoulders must be kept in this position by means of the clavicle bandage and pads, and the arm must be supported in a sling.

Scapular Extremity.

If there be pain on the top of the shoulder, succeeding to a fall on the part, and if, on examination, the extremity of the clavicle be found projecting under the skin covering the acronium, we may be sure it has taken place. The patient inclines his head to the affected side, and moves as little as possible either the arm or shoulder, because he cannot move these parts without calling into action the deltoid or some other muscle, which would consequently extend the motion to the diseased part, and cause pain.

Treatment.

This dislocation is reduced by carrying the shoulder outwards. After the reduction,

a pad should be placed in each axilla, for the purpose of elevating the scapulæ, keeping them from the side of the thorax, and to defend the soft parts from the bandage, which should next be applied.

Symptoms of Dislocation of the Ribs, etc.

Symptoms of dislocation of the ribs are nearly similar to those produced by fracture, with the exception of the crepitus.

Treatment.

Bandaging and bleeding, if necessary.

Dislocation of the Os Humeri.

The humerus can be luxated in four directions, downwards and inwards into the axilla.

Second, Forwards, under the pectoral muscle, below the clavicle.

Third, Backwards, on the dorsum of the scapulæ, below the spine.

Fourth, Head of the bone rests against the external side of the coracoid process of the scapula.

In the axilla.

The affected arm is longer than the other. The arm loses its vertical position, and inclines obliquely downwards and outwards, and the elbow is very much separated from the body if the dislocation be recent.

When, in the healthy state, if the fingers are moved along the external part of the os humeri, an equal resistance is felt along its whole length; but, in a case of dislocation it is only at the middle part that this resistance is felt; on the upper part, the integuments, no longer supported by the superior extremity of the bone, yield to the pressure of the fingers. The acromion projects; an empty space is felt under it, in which the head of the humerus should be placed; the summit of the shoulder has lost

its roundness; and a hard tumour, formed by the head of the humerus, is found in the axilla. The motions of the joint are in a great degree destroyed, especially upwards and outwards, and the patient cannot raise his arm by muscular effort.

Treatment.

The patient must be placed on a sofa or table, near the edge, in a recumbent posture, and a wetted roller should be bound round the arm, immediately above the elbow, upon which a handkerchief is to be tied.

The surgeon places the heel of one foot in the axilla, and rests the other upon the ground, as he sits by the patient's side *(vide Plate* iv*)*.

The arm is then steadily drawn with the handkerchief for three or four minutes, at the end of which, the bone, in common cases, is easily replaced. The force of two or more persons may be employed

in extending, by means of the towel, if required.

Second Method.

The patient is placed in a chair, the scapulæ is fixed by a bandage, with a slit (*Plate* iii. *fig.* 2) in it which admits the arm; this must be secured by tapes over the acromion, so as to keep it well in the axilla.

A wetted roller is to be placed round the arm, immediately above the elbow, and upon it fix a very strong worsted tape, by what is termed the clovehitch. The arm is to be raised at right angles with the body, or a little above the horizontal line, to relax the deltoid and supra spinatus muscles. Two persons then holding the scapula bandage should keep it fixed, whilst two others draw from the bandage affixed to the arm, with a steady, equal, and combined force. After the extension has been kept up for a few minutes, the surgeon should place his knee in the axilla, (*vide Plate* iii.) resting

his foot on the patient's chair; he should then raise his knee, by extending his foot, and at the same time, with his right hand, push the acromion downwards and inwards, by which the reduction will be accomplished.

FORWARD.—The arm preserves nearly its natural length, unless the head of the bone be brought, secondarily, towards the clavicle, in which case it is shortened.

The elbow is placed outwards from the body, and carried backwards; a bony eminence is felt at the superior and external part of the breast, before the point of the shoulder, and below the clavicle; there is no tumour in the axilla; the point of the shoulder is more round, and the acromion is less prominent than in dislocations downwards; lastly, the motion of circumduction is impossible.

Treatment.

The scapula must be fixed, and the bandage and wetted roller, etc., above the elbow, must be applied as directed for dislocation in the axilla.

The biceps muscle must be relaxed, and the extension must be made outwards, a little downwards and backwards; if the extension be made horizontally in this case, the caracoid process of the scapula will prevent the head of the humerus from passing outwards into its proper situation.

In America, the humerus of a lady was reduced ten months and a half after the displacement. Gentle, and long continued, extension was made upon the member, the knee of the surgeon was then placed beneath the axilla, and the bone being employed as a lever, the head was, without much difficulty, conveyed upward into the glenoid cavity.

Dislocations of the Fore-Arm.

Backwards.—The radius and ulna may ascend more or less behind the humerus; but the coronoid process of the ulna is always carried above the articular pulley, and is found lodged in the cavity destined to receive the olecranon. The head of the radius is placed behind and above the external condyle of the humerus. The flexion of the joint is almost destroyed, and the fore-arm and hand are fixed in a supine position. The fore-arm is in a state of semiflexcon, and every attempt to extend it occasions smart pains.

Treatment.

The patient being firmly seated, the surgeon places his knee on the inner side of the elbow joint, in the bend of the arm, and, taking hold of the patient's wrist, bends the arm. Thus the coronoid process is removed from the posterior fossa of the

humerus, and the action of the muscles draws the bones into their proper situation.

After reduction, the arm is to be put in the bent position; a bandage, and cold lotions are to be applied, and the arm is to be supported in a sling.

LATERALLY—EXTERNALLY.—The olecranon forms a greater projection than in the dislocation backwards, as its coronoid process is seated upon the external condyle of the humerus, instead of being placed in its posterior fossa.

INWARDS.—The ulna may be thrown upon the internal condyle, so as to produce an apparent hollow above it, and the rotation of the head of the radius can be distinctly felt.

Treatment.

These dislocations are reduced by drawing the humerus and fore-arm in contrary di-

rections, and, at the same time, pushing the extremity of the humerus and the two bones of the fore-arm in opposite directions. Pass a roller round the part, and put the fore-arm in a middle state, neither much bent nor extended, and support it in a sling. If inflammation of the parts should supervene, the antiphlogistic measure must be enforced.

Dislocation of the Ulna backwards.

The prominence of the olecranon behind the joint, and the fore-arm and hand twisted inwards, accompanied with a painful rigidity of the arm, sufficiently distinguishes the nature of the accident.

Treatment.

The arm is to be bent; a handkerchief is put round the patient's arm, and firmly held by an assistant who stands behind; then with the left hand he takes hold of

the arm, and with the palm of the right hand on the olecranon, he endeavours, by pushing, to restore the bone to its place. An assistant may facilitate the reduction by taking hold and pulling by the wrist, and gently bending the arm at the same time.

Dislocation of Radius at the Elbow Joint.

The fore-arm cannot be bent, and the rotation of the wrist is painful. When an attempt is made to bend the fore-arm, the motion is suddenly stopped by the striking of the radius against the humerus (this arises from the radius having burst from the coronary ligament and capsule, and now stands prominently forwards).

Treatment.

In making the extension the humerus should be fixed, and the hand rendered as much as possible supine, to remove the head

of the radius from the upper part of the coronoid process of the ulna. The after-treatment consists in surrounding the part with compresses, wet with cold lotions, and in covering the entire limb with a roller.

Dislocation of the Radius backwards at the Elbow Joint.

A German professor has met with two cases of dislocation of the radius backwards at the elbow joint. The appearances were, —on an examination of the joints,—the head of the radius was found thrown a little backwards and outwards from the external condyle of the humerus, and could not be immediately detected. The peculiar form of the radial side of the fore-arm, with displacement of the ulna, chiefly indicated the nature of the mischief.

Treatment.

To reduce it, you have to pull it steadily at a half right angle, and to press back the os humeri at the same time.

Dislocations of the Wrist Joints.

Four kinds of luxations may take place in the articulation of the bones of the carpus with the inferior extremities of those of the fore-arm, viz. Dislocation forwards, backwards, inwards, and outwards.

Forwards.—It is rarely complete; the hand remains painfully extended, and cannot be restored to its natural direction without some difficulty. The tendons which pass over the wrist, and the annular ligament which confines them, being pushed forwards, render it difficult to discover the eminence formed by the bones of the wrist before the ends of those of the fore-arm.

Backwards.—A person falling, puts out his hand to save himself, and falls upon the palm, a dislocation is produced, the radius and ulna are forced forwards upon the annular ligament, and the carpal bones are thrown backwards. A swelling is produced

by the radius and ulna on the fore part of the wrist, and a similar protuberance upon the back of the wrist by the carpus, with a depression above it, and the hand is bent back.

INWARDS AND OUTWARDS.—They are never complete. The laceration of the ligaments, a tumour at the internal or external side of the joint, and distortion of the hand.

Treatment.

In dislocations of the bones of the wrist gentle extension must be made, while the two surfaces of the joint are made to slide on each other in a direction contrary to what they took when the accident occurred. The dangers of these dislocations depends less on the dislocation itself, than on the straining and laceration of the soft parts, which are always followed by more or less tumefaction, hence the necessity of bleeding, low diet, and giving opening and cooling medicines.

The hand and wrist must be covered with cloths kept constantly wet with water or the acetate of ammonia lotion. The fore-arm and hand must be kept in splints and a sling.

Dislocation of the Bones of the Hand.

As the bones of the wrist are of a wedge form, and in their union constitute an arch; the central bones are, by lateral pressure on this arch, liable to be forced from their place.

The os magnum has been frequently displaced and luxated backwards by two great a flexion of the bones of the first row on those of the second, and form a tumour on the superior part of the back of the hand.

Treatment.

If the wrist be extended, and pressure be made on the head of the os magnum, the reduction is easily accomplished. The extension and compression by means of splints,

bandages, and soap plaster must be persevered in for some time.

Dislocation of the Fingers.

It occurs either backwards or forwards, when the projections formed by the ends of the bones indicate the nature of the injury.

Treatment.

The finger is to be firmly grasped, and bending it we shall succeed in bringing the heads of the bones into their natural situations. The finger should be rolled with tape and surrounded and supported with pasteboard.—The fore-arm and hand must be kept in a sling.

Dislocation of the Thumb.

When a violent effort is made on the thumb from before backwards, its first phalanx slips behind the head of the first metacarpal

bone, and remains extended, while the second is bent, its flexor-muscle being thrown into action by the irritation. The distortion of the thumb, the impossibility of bending the first phalanx, and the pain, render this dislocation sufficiently evident. (*Vide Plate* vii. *fig.* 1.)

Treatment.

The hand should be soaked in warm water for some time, to relax the soft parts as much as possible, then a piece of soft leather, wetted, should be placed closely around the first phalanx, and over this a portion of tape, two or three yards in length, should be fixed by the clove hitch.

An assistant should next firmly hold the metacarpal portion of the thumb, by passing his fore and middle finger between the patient's fore-finger and thumb, whilst the surgeon draws the first phalanx from the metacarpal bone, in a direction somewhat inwards to the palm of the hand. The joint

must be supported by a small splint and bandage, and the hand must be kept in a sling.

Method of reducing Dislocations of the Second Phalanx of the Thumb.

Take a piece of bleeding-tape, and tie the middle part of it round the first phalanx, letting it cover a part of the end of the dislocated bone, and having the knot on the opposite side, let the surgeon twist both parts round his hand, and at the same time directing an assistant to support the patient's hand, and fix the thumb. If extension be now made by the surgeon the dislocated portion will readily pass into its place.

This mode of proceeding is applicable in dislocations of the wrist, knee-joint, ancle-joint, and thigh-bone.

In an old dislocation of the first phalanx of the thumb, on the posterior surface of the bone of the metecarpus, the extensor tendons were found on the dorsal surface

of the bone; but the tendon of the flexor proprius was situated on the internal side, and turned on the posterior part of the inferior extremity of the metacarpal bone, a circumstance which should not be forgotten in attempts at reduction of this kind of dislocation.

Dislocations of the Bones of the Pelvis.

None of the bones which form the pelvis are susceptible of a true dislocation. It is impossible that the os sacrum, enclosed between the two ossa innominata, can abandon the position in which it is confined by such powerful means.

The os coccygis, which has more motion, is easier fractured than dislocated. There are cases on record where the os ilium has been displaced forwards and upwards, and the bones of the pubis have been totally separated; but the force requisite to produce

these accidents is enormous; their usual causes are falls from a great height, the fall of a very heavy body against the sacrum, at a period when the body is fixed, and the pressure of the pelvis between a wall or a post and the wheel of a carriage or waggon.

Treatment.

In dislocation of the bones of the pelvis, a broad bandage of leather, softly quilted, and made to draw with buckles, ought to be put round, betwixt the spine of the ilium and the head of the thigh bone.

Any inflammatory symptoms are to be combated by means of the antiphlogistic plan.

Dislocation of the Hip Joint.

Dislocation of the femur may take place upwards and outwards, on the external face of the ilium, upwards and forwards on the body of the os pubis, downwards and in-

wards on the foramen ovale, and downwards and outwards on the ischium.

Dislocation upwards and outwards, and that downwards and inwards, is the most frequent. Upwards and forwards is very rare, that downwards and backwards is still more so.

UPWARDS AND BACKWARDS ON THE DORSUM ILII.—The affected thigh is shorter than the sound one, it is a little bent, and carried inwards. The knee and foot are turned inwards, the knee being a little advanced upon the other, and the great toe rests upon the tarsus of the other foot. (*Plate* viii. *fig.* 1.) The trochanter major is brought nearer the anterior and superior spinous process of the ilium, and is, at the same time, elevated and carried a little forwards. The head of the bone may be felt and seen to move upon the dorsum of the ilium, if the knee is rotated inwards. The attempt to stretch the limb is not suc-

cessful without much force, and is very painful.

Treatment.

For the purpose of facilitating the reduction, many surgeons endeavour to produce a temporary faintness, by a copious venesection immediately before the extension is begun. After taking away ten, twelve, or even thirty ounces of blood (that is if the patient's health does not forbid it), the patient is to be placed in a bath, heated to 100°, and gradually raised to 110°, until faintness is induced. While in the bath, the patient is to take a grain of tartarised antimony every ten minutes, until nausea is excited, when he is to be removed from the bath, put in blankets, and placed between two strong posts, in each of which a staple is fixed, or he may be placed on the floor, into which two rings may be screwed. A strong girth should then be passed between the thighs (*vide Plate* XI. *fig.* 5), close to

the upper and inner part of the injured limb, and the ends of this should be fastened to one of the staples. A wetted roller should be placed tightly on the lower part of the thigh, just above the knee of the injured limb (*vide Plate* xi. *fig.* 5), and upon this a leathern belt, with straps and rings affixed, for the attachment of the pullies, should be closely buckled. The knee should be slightly bent, and the thigh directed across the sound one, just above the knee. The pullies must be attached to the straps of the belt, and to the other staple. The surgeon should now, gradually and carefully commence the extension, and continue it until the patient begins to complain of pain, when he should rest a little, without relaxing so as to fatigue the muscles; having waited a short time, he should again draw the cord, and when the patient again complains, he should again suspend the extension, and so on, until the muscles yield, and he finds the head of the bone is brought near to the

acetabulum, when he should give the string of the pullies in charge to an assistant, with directions to keep up the extension, whilst he himself rotates the knee and foot gently, under which motion the reduction will be usually accomplished. Sufficient elongation of the thigh is all that is absolutely necessary to reduction, but the elevation of the head of the thigh bone over the brim of the acetabulum will be much facilitated by the rotation of the thigh, especially by a pretty forcible jerk of the heel outwards, when the head of the thigh bone is brought to the level of the margin of the acetabulum. When the bone is reduced, it is prevented from leaving its place by bringing the thighs together, by means of a bandage placed above the knees. In the generality of cases, it will be advisable to adopt the antiphlogistic plan for a few days.

DOWNWARDS AND INWARDS—*into the Foramen Ovale.* (*Plate* viii. *fig.* 2.)—The affected thigh is longer than the sound

one; the head of the femur being placed lower than the acetabulum, the great trochanter is removed to a greater distance from the anterior and superior spinous process of the os ilium, and the thigh is flattened, in consequence of the elongation of the muscles. When the patient is erect, the knee of the injured limb projects forwards, and the thigh is widely separated from the sound one, and it cannot be made to touch the knee of the sound extremity without great violence. The foot is widely separated from the other, but the toes are not either everted or inverted, but usually directed forwards. A hard tumour is felt at the inner and superior part of the thigh, formed by the head of the femur, which elevates the soft parts situated before the foramen ovale.

Treatment.

The patient is placed on his back, and the thighs separated from each other as much as possible. A girth is to be passed

between the scrotum and upper part of the injured limb, let the ends be fixed to a staple in the wall of the room, then grasp the ankle (*Plate* xi. *fig.* 6) of the dislocated extremity, and draw the limb over the sound one, and thus the head of the bone will slip into its proper cavity.

Another way.

The patient is set upright on his breech, his thighs placed on each side of a strong pillar (previously having placed some soft substance around it). The extension of the thigh is accomplished by extending it at right angles with the trunk. The head of the thigh bone, by this operation, is relieved from its unnatural situation, and lifted, as it were, into its proper cavity.

Dislocation on the Pubes.

(*Plate* ix. *fig.* 4.)

The limb is shorter, the great trochanter is raised higher, and the buttock sinks in; the

knee, the leg, and the foot, turn a little outwards; but what renders it so evident, is the readiness with which the head of the bone can be felt a little above the level of Poupart's ligament, upon the pubes, on the outer side of the femoral artery and vein, it there forms a round hard swelling, which moves when the thigh is bent.

Treatment.

Place the patient upon a table, on his sound side, then pass a girth between the pudendum and the upper and inner part of the injured limb, and fix this to a staple, rather before the line of the patient's body. The wetted roller, strap, buckles, and pulleys, should then be placed above the knee, (*Plate* xii. *fig.* 8) the extension is to be made backwards and downwards. The application of the towel at the upper part of the thigh, and lifting the head of the bone by it over the edge of the acetabulum, is also necessary in reducing this form of dislocation.

BACKWARDS, IN THE ISCHIATIC NOTCH.

(*Plate* ix. *fig.* 3.)

The dislocated limb is shorter than the sound one; the natural projection of the trochanter major is wanting, and is inclined towards the acetabulum; a hard tumour is felt at the posterior and inferior part of the thigh; the knee and foot are turned inwards, and the great toe rests against the ball of the great toe of the sound limb. If the patient stands erect, the toe touches the ground, but the heel does not quite reach it, and the knee is bent and projects a little forwards.

Treatment.

The pelvis being fixed, the extension is to be made downwards and forwards, across the middle of the other thigh (*Plate* xvii. *fig.* 7), so as to dislodge the head of the bone, while the surgeon, with a napkin, placed just below the trochanter minor,

pulls the upper part of the femur towards the acetabulum.

Displacement of the Head of the Femur,

from a partial or complete destruction of the brim of the acetabulum.

In this displacement the head and femur is removed some way from its natural situation, viz. the cotyloid cavity, and rests upon the external iliac fossa, being in fact, so far as position is concerned, strictly analogous to that which occurs in luxation of the femur backwards and upwards.

A case of congenital dislocation of the femurus is mentioned by one of the continental surgeons. The subject was an old man seventy years of age.

The thighs could not be separated from the body, without describing with the feet a segment of a circle; the trochanters were

more closely approximated to the ilia, and much more elevated than in its natural state; the heads of the ossa femorum were situated higher, the knees carried more inwards, and the thigh shorter than usual. A similar case is recorded by another continental surgical writer.

Dislocations of the Patella.

This bone may be dislocated upwards, outwards, and inwards.

The dislocation of this bone is easily ascertained by the unusual flatness of the knee on the fore-part, and the displaced patella being distinctly felt.

Treatment.

The bone is easily reduced by pressure, when the extensors of the leg have been completely relaxed, The inflammation, if any, is to be reduced by the application of leeches, cold water, or evaporating lotions;

and, in the course of a few days, a roller ought to be applied from the toes to the knee. A laced cap, for the knee, is frequently used after the reduction of the bone, to keep it in its natural situation.

Dislocation of the Knee.

The tibia, at its articulation with the condyles of the femur, may be dislocated anteriorly, posteriorly, and laterally, to either side of the knee.

Backwards.—The limb is shortened, a projection of the condyles of the os femoris; a depression in the situation of the ligament of the patella; a bending of the leg forwards; and a projection formed by the extremity of the tibia, is felt in the ham.

Forwards.—The tibia projects forward, the thigh bone is depressed, and thrown somewhat laterally, as well as backwards,

and the patella and tibia are drawn forwards by the rectus muscle.

LATERAL.—Those inwards and outwards are easily known from the deformity of the joint. In the first, the external condyle of the femur is lodged in the internal cavity of the tibia, and the internal condyle projects, and forms a tumour at the internal side of the knee, the contrary takes place in the second. When they are complete, which is extremely rare, the tibia is carried entirely to the internal or external side of the femur.

Treatment.

Gentle extension, and pushing the head of the tibia in the proper direction. The grand object, after the reduction, is to avert inflammation of the knee, and promote the union of the torn ligaments. The antiphlogistic regimen must be strictly observed, the other means of preventing and subduing inflammation had recourse to.

Dislocations of the Foot.

The foot may be dislocated inwards or outwards, forwards or backwards, and the dislocation in any of these directions may be complete or incomplete.

Inwards.—The sole of the foot is turned outwards, and the back inwards; pain, and inability of moving the foot; and lastly, from the eminence formed below the internal malleolus by the astragalus. The fibula is generally broken about two or three inches above the ankle.

Treatment.

The patient is to be placed on a mattress, on the side which corresponds to the injured limb, bend the leg at right angles with the thigh, so as to relax the gastrocnemii muscles; then fix the thigh whilst an assistant draws the foot gradually in a line with the leg, and at the same time press the lower

extremity of the tibia outwards towards the fibula, to force it upon the articulatory surface of the astragalus. The joint is to be covered with compresses, moistened with cold water or an evaporating lotion; and splints, which reach below the sole of the foot, are applied on the inside and outside of the leg.

It may be necessary to adopt the antiphlogistic measures to keep within bounds the subsequent inflammation.

OUTWARDS.—It is equally impossible to move the foot; the sole is turned inwards and the back outwards, and the astragalus forms an eminence below the external malleolus.

Treatment.

The reduction is accomplished by relaxing the muscles of the calf, making extension in the axis of the leg, and pressing the lower head of the tibia inwards towards the astragalus.

When reduced, apply the many-tailed bandage and padded splints with foot pieces. —A pad is to be placed upon the fibula, just above the outer angle and extending a few inches upwards, so as in some measure to raise that portion of the leg, and prevent the tibia and fibula slipping from the astragalus, as well as lessen the pressure of the malleolus externus upon the integuments.

Forwards.—Diminution of length in that part of the foot between the lower part of the leg and the anterior extremity of the toes, elongation of the heel, tension of the tendo achilles, and relaxation of the extensors of the toes. The foot cannot be bent or extended.

Treatment.

The patient is to be placed on his back upon a mattress, and the thighs being elevated towards the abdomen, the leg is to be bent at right angles with the thigh; the

foot is then to be extended in a line a little before the axis of the leg, the thigh being fixed, and the tibia pressed backwards to its natural position.

When the dislocation is reduced the same means are to be employed as directed in the former cases.

The position of the limb should be upon the heel, with the knee bent and the foot well supported.

Compound Dislocations.

Compound dislocations are those which are accompanied with a laceration of the integuments and muscles covering the joints. Sometimes the opening in the integument is caused by the protrusion of the bone, but sometimes by the part having struck against a hard, or an irregular body.

Treatment.

When the extremity of the bone pro-

trudes, and is smeared with sand or dirt, as frequently happens from its having touched the ground, it should be washed with warm water, as the least extraneous matter admitted into the joint will produce and support a suppurative process, and the utmost care should be taken to remove every portion of it adhering to the end of the bone. If the bone be shattered, the finger is to be passed into the joint, and the detached pieces are to be removed; but this is to be done in the most gentle manner possible, so as not to occasion unnecessary irritation; and if the wound be so small as to admit the finger with difficulty, and small loose pieces of bone even be felt, the integuments should be divided with a scalpel, to allow of such portions being removed without violence. The limb is to be placed in splints with the necessary pads, eighteen-tailed bandage, &c.

Fractures in General.

Fracture is defined a solution of continuity of one or several bones, resulting from a force of extension disproportionate to, and exceeding their natural extensibility.

Fractures differ from one another, as to the bone affected, as to the part of the bone, as to the direction of the fracture, as to the relative position of the fractured portions, as to the attending circumstances by which the fracture may be either simple or complicated. The causes of fractures are divided into predisposing and remote.

The symptoms of fractures are the crepitus;* the separation and inequalities of

* The stethoscope applied over the place of fracture, on the slightest motion of the part, conveys a much more decided crepitus than is perceived by the naked ear during the most extended movements of the part. In many cases, even the slight pressure of the ear on the stethoscope suffices to produce the crepitation; a circumstance of no small importance, as freeing the patient from the pain necessarily excited

the ends of the fracture, when the bone is superficial; the change in the form of the limb; and the shortening of it.

Treatment.

Reduce the pieces of bone into their natural situation. Secure and keep them in this state. And to prevent any unpleasant symptoms likely to arise, and relieve them when they have come on.

by the motion requisite in the manual examinations, The crepitus yielded by the more solid bones is sonorous, and resembles the sound produced by breaking a piece of wood across the knee; it is accompanied with a sensation of roughness unpleasant to the ear.

The sound yielded by the spongy bones is duller, and resembles the effect of a rasp on wood; except that, now and then, this noise is broken by sounds of a clearer kind, like those afforded by the compacter bones, only not so loud. The crepitus is loudest over the place of fracture, and gradually diminishes as we recede from this; but it may be heard at a great distance from the fracture, when this is in the compact part of a long bone. In the case of fracture of the femur, the crepitation may be heard even on the skull. From this it will appear that the precise place of the fracture is easily ascertained. The sound from ob-

Fractures of the Ossa Nasi.

These bones, from their prominent situation, are much exposed to fractures. The fragments are sometimes not deranged; but most frequently they are depressed.

Treatment.

The surgeon must pass a female catheter, a ring-handled forceps, or any such instru-

lique fractures is stronger than from those which are transverse; but when one end of the fractured bone rides the other, the sound is then obscured, and in some cases may not be perceived without slight extension or counter extension of the limb. If the fracture is comminuted the sensation, as of distinct portions of bone, is conveyed by the stethoscope. When fluids are effused around the fracture, a guggling is combined with the crepitation, and is compared to the sound produced by a shoe full of water. When the fracture is compound, there is conjoined with the crepitation, a sound of blowing, something like the sound of forced respiration, made with the mouth open. In dislocations the sound is dull and obscure, and conveys precisely the impression of two moist and polished surfaces sliding over one another.

ment, into the nostrils, and, using it as a lever, push the fragments outwards, while, with the index finger of the left hand, he prevents them from being pushed out too far. When the fragments are disposed to fall inwards again, some authors advise supporting them with an elastic gum cannula, or lint introduced into the nostril.

Fractures of the Lower Jaw.

Fractures of the lower jaw may be either perpendicular to its basis, oblique, or longitudinal; of the latter, examples have been known, in which a portion of the alveolar process with the teeth in it, was detatched from the rest of the bone.

To examine the jaw bone, we place the fingers of the left hand on the angles of the bone, and then take hold of the alveolar part of the jaw bone in front, and endeavour to move it laterally. We, in the meanwhile, keep the eye on the teeth, when we shall

easily discover whether there has been any fracture of the lateral part of the bone; or we feel and press along the base of the jaw. In boys, there is sometimes a splitting of the lower jaw at the symphysis, which is not so readily ascertained. The patient has perhaps fallen from a height; he has lost one or two of the front teeth, or they are loose, and a greater space than natural is betwixt them. By taking hold of the alveolar part of the jaw, with the finger and thumb on each side the symphysis, the fracture is at once ascertained by the usual symptoms.

Treatment.

Fractures of the lower jaw, whether simple or double, are easily set, by pushing the displaced part upward, and a little forward, and then pressing on the basis of the bone, so as to bring it exactly on a level with the portion which has preserved its natural position

Indeed, the correctness of the reduction can always be rightly judged of, by attending to the line which the base of the jaw ought to form, and observing that the arch of the teeth is as regular as nature will allow. The maintenance of the reduction, however, is difficult; and can only be well executed by supporting the lower jaw and keeping it applied to the upper one. As soon as the fracture is set, a piece of pasteboard is to be cut into such a shape as may be accommodated to the chin and jaw; it is to be notched round the edges, and then moistened, that being applied on the lower part of the chin it may be brought up on the base and sides of the jaw on both sides.

Over this is to be applied the four-headed roller, the centre being placed on the patient's chin, while the two posterior tails are pinned to the front part of the nightcap, and the two anterior ones fastened to a part of the same cap more backwards.

Until the bone is united, the patient should be allowed only such food as does not require mastication, and it may be given by means of a small spoon, introduced between the teeth.

Broths, soups, jellies, tea, and other slops, appear most eligible.

Fracture of the Spine.

The bodies of the vertebræ are not fractured by blows, but by falls, in which the whole body is twisted, as when a bank of earth falls upon and buries a man. This fracture will not be known by the crepitation, like a common fracture of the limbs, but only by the derangement of the projecting spinous processes; while yet they are not separated, as in dislocation (*vide Plate* vi. *fig.* 1); nor crushed and crepitating, as when they are themselves fractured (*vide Plate* vi. *fig.* 2); or, as when a blow upon them has crushed in the arch of the bone.

As the symptoms and result of the accident differ according to the situation of the fractured bones, these injuries may be divided into two classes; first, those which occur above the third cervical vertebra; and secondly, where the injury is below that bone.

In the first cases, death is generally the immediate result, if the displacement be to the usual extent.

In the second, death takes place at various periods after the injury, but is generally consequent upon it. The origin of the phrenic nerve, from the third and fourth cervical pair, is the reason of this difference; for, as the parts below are paralyzed by the pressure upon the spinal chord, if the accident be below the fourth cervical vertebra, the phrenic nerve retains its function, and the diaphragm supports respiration; but if, on the contrary, the fracture be situated above the origin of this nerve, death immediately ensues. It is true, that a small filament of the second cervical nerve con-

tributes to the formation of the phrenic, but is in itself insufficient to support respiration under fracture of the third vertebra. The effects which arise from a fracture and displacement of the spine, below the origin of the phrenic nerve, depend upon the approximation of the accident to the head. If the lumbar vertebræ be displaced, the lower extremities are rendered so completely insensible, that no injury inflicted upon them can be perceived by the patient.

Treatment.

Any attempt to set fractures of the bodies of the vertebræ, even were they known to exist, would be both useless and dangerous. For, in whatever way the vertebræ are broken, the danger of moving the body must be apparent, since, in every change of posture, or turn of the body, the broken bones may be thrust against the spinal marrow.

General treatment can alone be em-

ployed. Cupping, or leeches, will tend to prevent inflammation in the situation of the injury. In case of flatulent distension of the abdomen, vomiting, hiccough, &c. the belly may be rubbed with camphorated liniment, and purgative clysters, and antispasmodics given. When called to a patient in this situation, the surgeon must provide himself with a catheter to draw off the urine, because he knows that the sensibility of the bladder is destroyed, and that there will be, in a short time, an accumulation of urine.

Fractures of the Sternum.

A Fracture of the sternum is rendered obvious, by the inequalities perceptible when the surface of the bone is examined with the fingers, by a depression or elevation of the broken pieces, a crepitus, and an unusual moveableness of the injured part in respiration. The breathing is difficult, and mostly accompanied with cough,

spitting of blood, palpitations, and inability to lie on the back.

When the sternum is fractured across there is a perpetual grating of the broken parts of the bone, and this grating produces inflammation and suppuration under the bone, viz. in the anterior mediastinum. Fracture of the sternum, from muscular action only, is of very rare occurrence. A physician at Paris has met with two cases which took place during labour, and was followed by the death of the patients.

Treatment.

Fractures of the sternum, when mere solutions of continuity, only require common treatment, viz. a piece of soap plaster on the injured part, and a roller round the chest, quietude, bleeding, and a low regimen, with a view of preventing what may be considered as the most dangerous consequence, inflammation of the parts within the chest.

Fractures of the Ribs.

A Fracture of the ribs, which are not at all displaced, is very difficult to detect, particularly in fat subjects: the surgeon should place his hand on the part where the patient seems to experience a pricking pain in the motions of respiration, or where the violence has been applied. The patient should then be requested to cough, in which action the ribs must necessarily undergo a sudden motion, by which a crepitus will often be rendered perceptible.

Treatment.

When a rib is broken, we have only to keep it from moving, by preventing the motion of the chest in respiration; for this purpose, after a piece of soap plaster has been applied to the side, and over it proper compresses, a broad linen roller is to be firmly put round the chest, so as to impede the motion of the ribs, and compel the

patient to perform respiration chiefly by the descent and elevation of the diaphragm.

If there should be any disposition to inflammation of the chest after the accident, copious and repeated bleedings should be practised as soon as possible.

A compound fracture of the ribs will not readily happen, in consequence of the ribs projecting, for the ribs are, in truth, beaten in when fractured. Where the ribs are forced inwards, it is often accompanied with a puncture of the lungs, or rupture of the intercostal artery. If the patient complain of a difficulty of breathing, with oppression in the chest, and if a tumour on the broken rib succeeds to this, which crackles under the finger, it is the emphysimatous tumour, so peculiarly characteristic of this accident. A discharge of blood, mixed with froth, from the mouth, is a sure sign that the lung or lungs are wounded.

Fractures of the Sacrum.

This bone is not much exposed to be fractured; it is thick, and of a spongy texture, deeply situated, and covered by a great depth of soft parts, which deaden any force that tends to fracture it, by acting on its great diameter, or by transmitting that force to the ossa innominata, between which it is fixed as a wedge. Some powerful cause, such as the fall of a very heavy body, or the passage of a carriage wheel on the convex side of that bone, can alone fracture it; it may be also fractured by a fall on the same part from a great height. Thus we find that those fractures of it, which may have different directions, and exist in different parts, are always produced by a force which has crushed the bone. Fractures of the sacrum are more dangerous than those of the ossa innominata, because, in addition to the great degree of contusion and laceration, there is almost always great damage

done to the sacral nerves. Hence, retention of urine, inability to retain this fluid, involuntary discharges of the fæces, paralysis of the lower extremities, &c.

Treatment.

The treatment of these fractures consists simply in tying a napkin round the pelvis, an emollient poultice being previously applied on the fractured part. To prevent inflammation, copious bleeding should be practised, and, if necessary repeated; leeches to the vicinity of the sacrum, and the parts kept cool with water, or the acetate of ammonia lotion.

Fractures of the Os Coccygis.

The accident is known by the moveableness of the fragments, and the acute pain produced by walking, or moving the thighs, the fragments being then disturbed by the action of the glutæi muscles, some of whose fibres are attached to them.

Treatment.

This kind of fracture does not require any apparatus for keeping the broken pieces in a just position; although the levatores ani may draw the anterior fragment a little forward. Resolvents, or emollient poultices, as the circumstances may require, ought to be applied; it may be necessary to adopt the antiphlogistic regimen; perfect repose should be enjoined, in order that the action of the glutæi muscles may not interrupt the consolidation.

Fractures of the Ossa Innominata.

When a fracture occurs of the os innominatum, which extends through the acetabulum, the head of the os femoris is drawn upwards, and the trochanter major is turned a little forwards; thus the leg is somewhat shortened, and the knee and foot are a little inverted, resembling the appearances

produced by a dislocation in the ischiatic notch. When the sacro iliac junction is broken through, and the pubes and ischium are fractured, the limb is, in a great degree, shortened; but the position of the knee and foot is not altered.

Treatment.

The existence of the fracture being ascertained, the surgeon's first care will be to obviate the consequences of inflammation, by copious and repeated blood-letting.

If inflammation has already taken place, it must be combated by the same means; at the same time topical remedies are to be applied. The pelvis ought to be surrounded with a napkin folded in the shape of a bandage for the trunk; and in cases where the contusion is excessive, the bones splintered and loose, and the neighbouring parts disorganized, as it would be impossible for the patient to move or go to stool without suffering the most excruciating pain, it will be necessary to pass a piece of strong girth

web under the pelvis, the corners of which, collected into one, are to be fastened to a pulley suspended from the top of the bed: by means of this pulley the patient may raise himself with a very little effort.

Fractures of the Scapula.

of the acromion process.

In this accident, when the shoulders are compared, the roundness of the injured side is lost, and part of the attachment of the deltoid muscle being broken off, the head of the os humeri sinks towards the axilla as far as the capsular ligament will permit. On tracing the acromion from the spine of the scapula to the clavicle, just at their junction a depression is felt, from the fall of the fractured portion. If the distance be measured from the sternal end of the clavicle to the extremity of the shoulder, it will be found lessened on the injured side. If the surgeon raises the arm from the elbow, so as to put the deltoid muscle in motion, the

natural form of the shoulder is directly restored, but the deformity returns immediately the arm is again suffered to fall. The accident may be distinguished from a dislocation, if the surgeon raise the shoulder by pushing the humerus upwards, when a crepitus will be perceptible to the surgeon's hand applied over the acromion, on the limb being rotated.

Longitudinal fractures of the scapula cause very little derangement, because the muscles, which are attached to the surface of the scapula, prevent the separation of the fractured portions.

In transverse fractures, the derangement is not so trifling. The serratus anticus major draws forward the lower portion, to which it is principally attached. The rhomboides may also concur in producing this derangement, which is always great enough to be perceived by the fingers drawn along the base, or internal side, where the inequality will be produced.

ACROMION AND INFERIOR ANGLE.

The consequences are more important. The weight of the arm, and the contraction of the deltoid muscle draw downwards the acromion, at the same time that the trapezius and levator scapulæ draw the rest of the bone upward and backward. The serratus anticus major draws forward the lower angle, the rest of the scapula remaining in its natural situation: or if the angular portion be considerable, the teres major and some fibres of the latissimus dorsi contribute to its derangement forward and upward.

If the coracoid process is fractured, the pectoralis minor, the coraco-brachialis, and short portion of the biceps, concur in drawing it forward and downward.

Treatment.

In fracture of the acromion scapulæ we raise the arm, and relax the deltoid muscle, and examine and replace the pieces of the bone. The arm being allowed to fall gently

to the side, the fore-arm is to be suspended in a handkerchief, so that the head of the humerus may be made to rise and push up the extremity of the broken acromion, so as to preserve it in its place. As soon as the swelling has subsided the spica bandage may be put on. The middle of the double-headed roller is put under the armpit of the opposite side, then the ends are brought up and crossed on the top of the wounded shoulder; then they are crossed under the armpit of the same side; they are then carried across the back and breast, and the heads of the roller are again crossed under the armpit of the opposite side, and so are carried up on the injured shoulder again; and this is repeated until the shoulder and the broken bones are covered with a firm lacing of the bandage.

LONGITUDINAL OR TRANSVERSE FRACTURE of the body of the SCAPULA.—All that is requisite is to fix the arm to the side of the trunk by means of a bandage, which in-

cludes the arm and trunk, and which descends from the shoulder to the elbow.

Inferior angle.—It will be necessary to act on the scapula itself, to push it downward and forward toward the inferior fragment, which the serratus anticus major has drawn in that direction.

In this case too, it is on the arm that it will be necessary to act, in order to move the scapula.

The arm is to be pushed inward, downward, and forward, the fore-arm being half bent; it must be kept in this position by a circular bandage several yards long.

Of the Cervix

Fractures of the scapula most frequently happen at its cervix; and in this situation it has all the characteristics of a dislocation of the shoulder, for which it is not unfrequently mistaken. The shoulder is sunk, and a hollow is perceived under the pro-

cessus acromion. It is distinguished by rotating the arm with one hand, at the same time applying the other to the neck of the scapula; when both bones will partake of the rotary motion, and generally a crepitus may be perceived.

Treatment.

The shoulder must be firmly bound as directed for fracture of the acromion.

Fractures of the Clavicle.

The clavicle may be broken at any part; but its middle, where the curve is greatest, is most frequently the situation of the injury. The fracture of this bone is ascertained by remarking that the shoulder is fallen lower and towards the breast; and, on feeling along the bone, the crepitation of the broken ends is perceived, perhaps the broken ends are found to have passed each other. The outer extremity or scapular portion is

found to be most depressed. One of the principal signs of fracture of the clavicle, is the impossibility which the patient finds of applying the hand of the side affected to his forehead, or to touch the shoulder of the opposite side; for this motion twists the broken clavicle, and forces the broken ends into the cellular tissue.

Treatment.

The arm and shoulders of the patient are to be firmly drawn backwards by an assistant; when the fractured extremities of the bones immediately come in apposition. The parts are now to be covered with a piece of soap plaster, and a bandage is to be applied to retain them in their reduced situation; that called the stellate is usually employed; it is a single-headed roller of moderate breadth, and is applied by making it to pass under the axilla of one side, and over the shoulder of the opposite, describing on the back the figure 8. It should

be drawn with considerable tightness, and the arm should afterwards be supported with a sling.

Fractures of the Humerus.

Fractures of the humerus may be transverse or oblique, simple or compound.

Neck of the Os Humeri.

A depression is observed at the superior extremity and external side of the arm, and if we embrace the head of the os humeri with the fingers and fix it, then rotate the arm at the elbow, and it will be found that the head of the bone does not obey the rotatory motion, as it is separated from the body of the humerus by the fracture, which is, in this case, external to the capsular ligament. In fractures of the cervix humeri the limb is slightly shortened, and somewhat deformed; there is inability to raise the arm, though the underhand mo-

tions still remain; and, if the arm is raised and rotated at the same time, there is a crepitus; whilst, if the arm be simply rotated, there is very frequently none.

Treatment.

In fractures of the neck of the humerus, the arm is enveloped by a bandage, and the elbow pressed towards the breast, a cushion being first placed in the armpit: another circular bandage is then passed round the arm and trunk, splints are applied to the anterior, posterior, and lateral parts of the arm, and some compresses, wet with a resolvent liquid, are applied on the shoulder.

Middle Part of the Bone.

The head of the bone being grasped with one hand, and the elbow with the other, upon rotating the arm, no motion will be communicated from the lower to the upper

portion, and at the same time a crepitus will be distinguishable.

Treatment.

In this fracture be careful to adapt a splint to the inside of the arm, with such a pad as may fill the axilla without encroaching too much on the head of the humerus, or in the least pushing it from its place; then a piece of pasteboard is to be moulded to the shoulder, and the spica bandage applied and continued in the form of a roller on the arm. The elbow must not be supported; but, on the contrary, by supporting the wrist only, the weight of the arm counteracts the contraction of the muscles.

Fracture above the Condyles of the Humerus.

The appearances presented are like those occurring from dislocation of the ulna and radius backwards; but in fracture, all marks

of dislocation are easily removed by extension, but return again as soon as the extension is withheld, and by rotating the fore-arm upon the humerus, a distinct crepitus can be usually felt.

Treatment.

Bend the arm, and draw it forward, so as to reduce the parts, and then apply a roller. The best splint for this case is one formed at right angles, the upper portion of it being placed behind the upper arm, and the lower under the fore-arm. The splints are to be fixed with straps, evaporating lotions used, and the arm kept in a bent position in a sling.

Fracture of the internal Condyle.

The ulna projects backwards, the hand is turned towards the side during extension, and the crepitus, which can be felt upon bending and straightening the arm, points out the nature of the injury.

Treatment.

The same as directed for the fracture above the condyles.

Fracture of the external Condyle.

Swelling over the external condyle, pain on pressure, or during flexion and extension of the arm, crepitus readily felt during the rotatory motions of the hand.

Treatment.

A roller should be placed around the joint, which should pass also above and below it; then to support the limb in the splint, having two portions at right angles, to this the upper and lower arm are to be well secured.

Fractures of the Fore-arm.

The fore-arm is more frequently broken than the arm, because external force ope-

rates more directly upon it than the latter part, especially in falls on the hands, which are frequent accidents.

The existence of these fractures is easily ascertained from the history of the circumstance, from the pain, which is rendered more acute by moving the hand, from the impossibility of performing pronation or supination of the hand, and from the noise produced by the friction of the fractured surfaces whenever these motions are attempted; finally, from the change in the form of the arm, the anterior and posterior sides of which appear tumefied by the protrusion of the muscles, which the broken bones have displaced from the interosseous interval, the other sides being depressed, and from the mobility of the broken portions, and change in the direction of the arm.

When these bones are fractured near their inferior extremities, the inflammatory swelling might render a diagnosis less clear,

and cause the fracture to be mistaken for a luxation of the hand. But the two cases may be distinguished by simply moving the hand, by which motion, if there be luxation without fracture, the styloid processes of the radius and cubitus will not change their situation; but if a fracture do exist, these processes will follow the motion of the hand.

Treatment.

The fore-arm is to be bent to a right angle with the arm, and the hand placed in a position between pronation and supination. The fore-arm and hand being thus placed, an assistant seizes the four fingers of the patient, and, by pulling, extends the fractured parts, while another assistant makes counter extension by fixing the humerus with both his hands.

By these means the operator is enabled to restore the bones to their natural situation, and to push the soft parts into the

interosseus space, by a gentle and graduated pressure on the anterior and posterior sides of the arm. The splints should be laid, one on the inside, the other on the outside of the arm, so that both bones may be at once effectually compressed; that on the inside should be long enough to reach the palm of the hand, by which means the wrist will be kept steady, and the radius will be prevented from rolling.

They may be confined either by the application of a bandage, or by tying them with broad tapes.

Fractures of the Radius.

The nature of the injury will be ascertained by the usual symptoms of fracture; and, besides, it will be found that the hand falls prone, with much pain, because the weight of the hand bears so that the carpal bones and lower head of the radius turn on the small head of the ulna, while the upper part

of the radius, not following the lower in its rotation, the broken ends are separated, and the surrounding parts injured.

Treatment.

The elbow is to be bent, and the hand put in the mid state, between pronation and supination; that is to say, the palm of the hand is to face the patient's breast.

Having reduced the ends of the fracture, when they appear to be displaced, the soap-plaster is to be applied, and over this a slack roller. Only two splints are necessary; one is to be placed along the inside, the other along the outside of the fore-arm. The inner splint should extend to about the last joint of the fingers, but not completely to the end of the nails.

Fractures of the Ulna.

Fractures of this bone generally take place at the lower extremity, which is most slender and least covered.

On applying the hand judiciously on the inside of the fore-arm, this fracture is easily ascertained by the depression in that part, from the inferior portion being drawn toward the radius by the action of the pronator radii quadratus.

This derangement is in general less than that which takes place in fractures of the radius. The superior portion of the cubitus remains unmoved.

Treatment.

In this case the assistant, who makes whatever little extension may be necessary, should incline the hand to the radial side of the fore-arm, while the surgeon pushes the flesh between the two bones, and applies the apparatus, as in the preceding case.

Fractures of the Olecranon.

A swelling takes place at the back of the elbow, which, when pressed, feels soft, and

allows the finger to sink in towards the joint; this is between the two extremities of the fractured bone; the detached portion is drawn upwards from the head of the ulna, to the extent of from half an inch to two inches; it can be readily moved from side to side beneath the integument, and becomes further separated from its former connection when the arm is bent.

The patient can bend the arm with ease, but he cannot extend it without great difficulty, and the attempt gives him much pain; without exertion it remains semiflexed. No crepitus can be felt; and the rotatory motion of the radius upon the ulna is perfect. Considerable tumefaction from effusion of blood usually follows this accident.

Treatment.

Let the fore-arm be extended; yet not to the utmost stretch. Then the triceps is to be pressed, with a view to relax it, and the olecranon brought down to its place. Dossils of lint are then placed on the sides

and above the olecranon; and over these a roller is put on the arm and fore-arm.

A long splint must then be applied on it anteriorly, by which the flexion of the arm is prevented. This splint is fixed by the same bandage, rolled on downward from the shoulder to the wrist, and upward again if the bandage be long enough. The oblique casts of the bandage, which cross one another on the articulation, forming a kind of figure of eight, ought to be nicely applied, and drawn very tight; because, if but slightly braced, their action, which is oblique, will not be sufficient to confine the olecranon to its situation.

Fractures of the Carpal and Metacarpal Bones, and Phalanges of the Fingers.

BONES OF THE CARPUS.

Their smallness and spongy texture do not admit of their being fractured but by a cause which acts on them immediately;

and, in fact, fractures of them are always occasioned either by a gun-shot wound, or some very heavy body falling on the hand. It is obvious that, in cases of this nature, more attention is to be paid to the state of the soft parts than to the fracture.

Treatment.

When an attempt is made to save the part, the chief indications are to extract splinters of bone, and prevent inflammation, abscesses, and mortification.

The parts may at first be kept wet with a cold evaporating lotion; if there be any wound present dress it lightly and superficially; but, afterwards, as soon as all tendency to bleeding is over, emollient poultices over the dressings supersede the lotion.

It often happens that fractures of these bones render amputation at the articulation of the wrist necessary.

BONES OF THE METACARPUS.

THESE fractures are always the result of a force immediately applied. If the hand be forcibly pressed between two bodies, or if a heavy body fall on it, comminutive fracture will be the result; and almost always several of these bones are fractured at once.

Treatment.

The same kind of treatment is requisite as in the preceding cases. To preserve the bones in their natural situation, the palm of the hand is laid over a cushion or pad, accurately adapted to the hollow of the palm and fingers, and then a roller is to be brought down from the fore-arm, over the hand and wrist, including the pad.

FINGERS.

WHEN the bones of the fingers are broken, they are to be neatly set, with pieces of pasteboard moistened, over which a small roller of tape is to be applied. The hand

is to be placed on a flat splint or finger-board, always keeping the hand, fore-arm, and elbow well supported in a sling.

Fractures of the Thigh.

Neck within the capsular ligament unaccompanied with laceration.

Notwithstanding the existence of a fracture of this description, the patient might be able to exert considerable power in the limb. He might be able to bend it upon the pelvis, or roll it inward immediately after the accident; not, however, without giving himself pain. There is but little or no shortening of the limb. The foot may or may not be able to elicit crepitus. (*Vide Plate* x. *fig.* 1.)

Neck within the capsule, in which the covering of the bone is nearly or quite divided.

The retraction of the limb is usually from three quarters of an inch to an inch and a

half; commonly, however, in the recent state of the injury, it is not more than an inch. There is eversion of the foot, attended with great diminution of the powers of the limb; the patient, however, is still able to roll it inward, so far as to bring the foot from its everted position high enough to place the limb in that position which might be called supine, or in which the ball of the great toe and the superior anterior spinous process of the ilium are in a straight line with the long axis of the body.

The patient can also bend the limb a little upon the pelvis, but not without great pain when the fracture is in the recent state. The limb might be readily drawn down to its proper length, but, as soon as the extension is discontinued, it becomes again retracted; and might be passively moved in every direction, but not without producing pain.

Crepitus may generally be felt when the limb is drawn down, and then rotated, while

the head of the bone is fixed firmly in the acetabulum, by pressing upon it with the fingers over the front of the joint.

NECK, EXTERNAL TO THE CAPSULAR LIGAMENT.

In this accident the injured leg is a little shorter than the other; but the foot and toe on that side are everted, from the loss of support which the body of the thigh-bone sustains in consequence of the fracture; much pain is felt at the hip, and on the inner and upper part of the thigh, and the joint loses its usual roundness.

It may be known by the crepitus which usually attends it upon slight motion, for it is rarely necessary to draw the limb down, to distinguish the grating of one bone upon the other, and this happens from the less retraction of the limb.

Treatment.

The indications to be answered in the mechanical part of the treatment of frac-

tures of the cervix femoris, whether within or external to the joint, are, 1st, to keep the limb of its natural length; 2d, to keep the limb in the bent position; 3d, to prevent eversion or inversion of the foot; 4th, to keep the trochanter a little raised; 5th, to keep the fractured surfaces in close apposition; 6th, to prevent the fractured surfaces from moving upon each other.

FRACTURE WITHIN THE CAPSULE.

A PILLOW should be placed under the whole length of the limb, and a second rolled up and put transversely under the patient's knee, so as to keep the limb in an easy bent position. In a fortnight or three weeks the patient is allowed to sit upon a high chair, and in a few more days he begins to take exercise upon crutches.

FRACTURE ON THE OUTSIDE OF THE CAPSULE.

THE patient is to be placed on a mattress on his back, with the injured limb in a bent posture, supported on what is termed the

double inclined plane, composed of three boards, one below, which is to reach from the tuberosity of the ischium to the patient's heel, and the two others above have a joint in the middle, by which the knee may be raised or depressed on the sides: there are several pegs which prevent any change in the position of the limb. (*Vide Plate* xiii. *fig.* 1.) When the limb has been placed over this machine, in an easy bent position, a long splint, reaching above the trochanter major, is applied to the outer side of the thigh, and fastened to the pelvis with a strong leather strap, so as to press one portion of bone towards the other; and the lower part of the splint is to be fixed with a strap around the knee to prevent its position being moved; the limb must be kept as steady as possible for eight weeks, at the end of which time the patient may leave his bed, if the attempt should not cause too much pain; but the splint is to be continued another fortnight.

Fractures of the Trochanter major.

(Vide Plate x. *fig.* 2, 3, *and* 4.)

The limb is but little shortened, and sometimes its length is not altered; the foot is generally benumbed; the patient cannot turn himself without assistance, and any attempt to do so creates excessive pain. If the fracture be attended with a division of the soft parts immediately surrounding the bone, the trochanter becomes drawn up upon the dorsum of the ilium, by the action of the gluteus medius and minimus muscles; and the nature of the accident is very readily ascertained. The foot is greatly everted, and the patient is unable to sit, on account of the violent pain produced by the position. The surgeon might elicit crepitus by holding the trochanter firmly in the hand, while an assistant rotates and moves the limb in different directions.

Treatment.

The limb is to be put in the extended

posture upon a pillow, and evaporating lotions and leeches are to be used for the removal of the swelling and inflammation.

When this object has been effected, a roller is to be applied around the knee, and a piece of stiff pasteboard, about sixteen inches long, and sufficiently wide to extend entirely under the joint, and to pass on each side of it, so as to reach to the edge of the patella, is to be dipped in warm water, and applied under the knee, and confined by a roller. When this is dry, it has exactly adapted itself to the form of the joint, and this form it afterwards retains, so as best to confine the bones. In five weeks passive motion of the limb may be gently begun, to prevent anchylosis.

Fracture in the Middle.

The presence of a fracture in this part is to be discovered by carefully feeling along the upper side of the bone, when a projecting point will generally be discovered; and

if at the same time the joint be rotated, a crepitus and preternatural motion of the fractured part will be observable.

Treatment.

The bone being reduced to its usual position, by extension of the limb, rags wetted with a cooling lotion, or a plaster of ceratum saponis should be laid upon the part, and over this the eighteen-tailed bandage. Three broad splints should next be applied, one on each side of the thigh, and a third on the upper part, that on the outside being sufficiently long to reach from the hip to the knee, these being confined with tapes, the limb is to be laid over the cushions or mattresses, thus supported on their frame. (*Vide Plate* xiii. *fig.* 1.)

Fractures above the Condyles.

The limb is to be placed over the double inclined plane, and a roller applied round the lower portion of the femur.

Fractures of the Patella.

The patella may be fractured in two directions, longitudinally and transversely.

Transverse.—When fractured transversely, the superior portion of bone is separated from the inferior, being drawn up by the action of the rectus vasti and crureus muscles, which are inserted into it. The lower portion of the bone remains in its natural situation, connected to the ligamentum patellæ. Nothing can be easier than the diagnosis of fracture of the patella. If this bone be fractured transversely, by a forced extension of the leg, the patient falls, and remains without the power of rising. The fall may instantly succeed the fracture, or there may be some interval. The impossibility of rising exists also when the fracture is effected by a fall on the knee. If raised by the aid of others, the patient falls again if he attempts to advance; he

can, however, move backward, by drawing the soles of his feet along on the ground, and by taking care to bend the knee. There are several cases of simultaneous fractures on record of the patella, humerus, and femoris, from muscular action.

Treatment.

LONGITUDINAL.—Continued extension of the limb, and the application of a bandage to the knee, will be sufficient to effect a speedy union.

TRANSVERSE.—Let the surgeon avoid all motion in the limb, or, at least, bending of the knee joint, else there will be further danger of laceration. When the patient is laid in bed, we have to bring the fractured portions together; first, by position, secondly, by bandage. It will be manifest that the leg is to be laid extended, so that the lower portion of the patella may be raised on the fore part of the joint. The

trunk of the body must be brought forward, in the sitting posture, that the point of origin of the rectus from the pelvis may incline towards the knee, and relax the quadriceps muscle.

When the extensor muscles of the leg, which are inserted into the patella, are thus to the utmost degree relaxed, the pieces of the patella will have come into their natural position. A bandage should now be applied, the middle of which is to be placed over the upper or ascending part of the patella, and being carried round the thigh, just above the joint, it is to be crossed under the ham, and again on the upper part of the tibia; and, having thus described the figure eight around the joint, it is to be properly secured, and daily increased in tightness. Some surgeons are in the habit of using a leather strap, which is buckled round the thigh, above the broken and elevated portion of bone, and from this circular piece of leather, another strap passes

under the middle of the foot, the leg being extended, and the foot considerably raised. This strap is brought up to each side of the patella, and buckled to the leather band already applied to the lower part of the thigh.

Confinement, five weeks for an adult, and six if advanced in years.

Fractures of the Leg.

Change of direction and shape of the limb, pain and incapability of motion, mobility of the fractured pieces, and crepitation always distinct, &c.; all these circumstances render this fracture so evident, that it is impossible to be mistaken respecting its existence.

Treatment.

In the fracture of both tibia and fibula, the knee should be moderately bent, the thigh, body, and leg, being in the same po-

sition as in the broken thigh. If common splints be used, one should be placed underneath the leg, extending from above the knee to below the ankle, the foot being properly supported by pillows, bolsters, &c. and another splint of the same length should be placed on the upper side, comprehending both joints in the same manner; which disposition of splints ought always to be observed as to their length, if the leg be laid extended, in the common way, only changing the nominal position of them, as the posture of the leg is changed, and calling what is inferior in one case exterior in the other, and what is superior in the one, in the other inferior. Soap plaster and the eighteen-tailed bandage are generally used in fractures of the leg, prior to the application of the splints.

Fractures of the Tibia.

The fingers are to be moved along the anterior side of the tibia, the slightest ine-

quality in which may be easily perceived, on account of its being covered only by the skin; and the motion of the pieces may be perceived, by seizing the opposite ends of the bone, and pushing them in contrary directions. This motion, however, and the crepitation which should accompany it, are very indistinct, on account of the fibula not allowing the fractured portions to be sufficiently moved on one another.

Treatment.

Cooling lotions and soap plaster will be proper, and over this the eighteen-tailed bandage. The splints to be applied are, first, one strong splint of wood and leather, or of tin, which is to reach from the outside of the knee to the side of the foot. It must be made to receive the upper and lower heads of the fibula, and hollowed to receive the prominent muscles of the outside of the leg. Another splint, shorter than the last, is to be adapted to the plane surface of the

tibia, on the inside. This splint should be straight, and reach only to the head of the tibia.

Fractures of the Tubercle of the Tibia, with laceration of the ligamentum patella.

Diagnostic Marks.—The tubercle of the tibia is moveable, and affords a distinct crepitus, the projecting body being far below the natural situation of the inferior part of the patella, as compared with the opposite tubercle of the tibia, and the lower part of the patella not having the abrupt surface of a fracture.

Treatment.

Similar to that recommended in fracture of the knee-pan.

Fractures of the Fibula.

These fractures, which are not usually attended with deformity, and, in some cases,

even do not hinder the patient from bearing upon the foot, cannot for the most part be ascertained, unless attention be paid to the manner in which the accident was produced, and to the presence of ecchymosis, and of more or less pain in the part which has been struck or pressed upon, together with a degree of irregularity of the fibula, perceptible by the fingers, and a more or less distinct moveableness and crepitus of the ends of the fracture.

Treatment.

A splint, which will reach from the knee along the outside of the foot, is prepared. In the hollow of the splint soft lint is placed, so that it equally supports the limb, an eighteen-tailed bandage is put under the splint, and this apparatus is so placed on the mattress, that when the patient's leg is laid upon it, it rests on the outside of the leg and foot. Having laid down the leg on the splint, we examine again the degree of prominence of the inner ancle, and see that

there is no twist or obliquity of the foot. We are careful to notice that the lower head of the fibula, and the side of the foot, is neither allowed to hang over the end of the splint, nor too much pressed up, the bandage is then applied.

Fractures of the Bones of the Foot.

Os Calcis.—The existence of this fracture is discovered by the circumstances of the case; a fall on the sole of the foot; a crack heard in the moment of the fall; pain, which is increased by the motion of the part; the absolute impossibility of standing or walking; a greater or less swelling of the heel; the mobility and elevation of that part of the os calcis, into which the tendo achilles is inserted; finally, the crepitation and interval between the fractured portions.

Treatment.

The end of the bandage is placed on the superior surface of the foot, where the bandage is reverted on the sole, and the end is

made fast by circular casts round the foot, this bandage is then drawn along the posterior side of the leg to the ham (the foot being previously extended), on which part it is fixed by other circular casts, it is thence brought downward forcibly, and the application of it terminated by rolling along the leg what remains. The other bones of the tarsus, as well as the metatarsus and phalanges of the toes, are susceptible only of comminutive fracture. They require the same plan of treatment as adopted for fractures of the bones of the hand.

Fractures occurring in the Limbs of Children, and not immediately discovered.

In the bones of young people, there is little earthy matter in proportion to the soft matter; the lime, constituting the solidity of the structure, may be broken through, and yet the soft parts not divided. You may bend the bones of children

very much without fracturing them; and this induces me to state a case which may be useful for you to attend to as young men. A child may be running across a carpet and fall down with his thigh bent under him; he is taken up by his mother, or nurse, but it is found that he cannot stand; you may be sent for to examine the leg, you feel it over, but you do not detect the usual signs of fracture; there is no crepitus produced on twisting the limb about, and, perhaps it is not much displaced. Well, you are asked what you think of it, and perhaps you may say, "I think it is only a sprain, madam, and I will send you some Goulard's wash, and you are to wet some linen rags, and apply to the part." The child becomes restless and uneasy, and tosses himself about; the thigh becomes painful and swollen; it is clear that your Goulard's wash is not doing all that should be done. The friends, perhaps, are dissatisfied, and call in another person, and he, being better acquainted with these sort

of things, says, "Whether the limb be broken or not, a state of rest is necessary for the recovery of the part, and the child must be kept in bed." He, very properly, applies a splint to steady the limb, and gives strict injunctions that the child shall be kept quiet in bed; he may direct the wash to be kept on the part, and now it does good. The swelling subsides, the pain goes away, and in about a week there is nothing left of the swelling.

Non-union of Fractures.

It is evident, that if the slightest degree of motion be allowed between the broken extremities of the bone, that an ossific union cannot take place. Finding that the degree of reparation cannot be made that she wishes, nature sets about procuring a flexible union. The ends of the bones become smoothed over, the ragged particles are absorbed, and the motion allowed between the bones perhaps assists in this smoothing

process. There is a sort of joint formed, and the union is effected by ligaments.

Sometimes, however, bones will not unite, although you may keep the broken surfaces in perfect opposition, and preclude the least degree of motion; and, I am satisfied, that the cause of this is a certain state of the constitution, which renders the vascular system of the injured part incompetent to secrete the ossific matter.

The Operation for Non-union of Fractures.

It is necessary to have a needle, strong and round, and with a point calculated to make way through a portion of bone; a common seton needle might be broken in the attempt to pass it.

The situation of the principal vessels and nerves must be well determined, and the tract of the seton calculated to avoid them.

An assistant draws and stretches the limb, while another sustains it, and makes counter extension. This, by separating the ends of the bones, gives more room to pass

the needle through the elastic substance which is betwixt them.

When the seton is passed, the wounds may be bound up without any regard to position or restraint, for three weeks; but at that time the splints ought to be put on, and the motions restrained as for a recent fracture. The first symptom of amendment is a painful stiffness in attempting to bend the limb. We have seen that three or four months are necessary to the cure.

Note to page 4.

CORK AND LEVER OF WOOD.

The corks generally employed are those used for stopping the common quart bottles. They should be placed one on each side of the mouth, behind the molares teeth, after which the chin is to be raised in the manner already described.

A long piece of wood is sometimes employed in these cases as a lever, introducing it between the molares, first on one side, and then upon the other, and each time raising the extremity of the wood furthest from the mouth, so as to depress that part of the lower jaw beyond the molar teeth, and with it the condyloid process, when the action of the muscle will draw it into its articular cavity.

EXPLANATION OF THE PLATES.

Plate I.

Dislocation of the Lower Jaw.

Plate II.

Fig.

1. Fracture of the Cervix Scapulæ.
2. Fracture of the Acromion.
3. Fracture of the Cervix Humeri.
4. Fracture of the Shaft of the Os Humeri.
5. Fracture of the internal Condyle of the Os Humeri.
6. Fracture of the external Condyle of the Os Humeri.
7. Separation of the Condyles from the Shaft of the Os Humeri.
8. A successful Union of the Humeris after Application of the Seton.
9. Fracture of the Olecranon.
10. Fracture of the Ulna.
11. Fracture of the Coronoid Process of the Ulna.

Plate III.

Fig.

1. The mode of reducing the Dislocation downwards by the Knee in the Axilla.
3. Reduction by means of the Pulley.

Plate IV.

The Mode of reducing Dislocations of the Os Humeri by the Heel in the Axilla.

Plate V.

1. Splints for Fractures of the Elbow Joint.
2. Bandages for fractured Patella.
3. Splints for Fractures of the Condyles.
4. The Method of bandaging a fractured arm.
5. Splints and Bandages for Fracture of the Olecranon.

Plate VI.

1. Dislocation of the Vertebræ.
2. Fracture of the Vertebræ.

Plate VII.

1. Dislocation of the Thumb.
2. Dislocation of the second Phalanx of the Finger forwards, and of the first backwards.
3. Compound Dislocation of the Thumb.

Plate VIII.

Fig.

1. Dislocation, upwards, upon the Dorsum Ilii.
2. Dislocation, downwards, into the Foramen Ovale.

Plate IX.

1. Dislocation into the Ischiatic Notch.
4. Dislocation on the Pubis.

Plate X.

1. Fracture of the Cervix Femoris within the Capsule.
2. Fracture of the Trochanter Major.
3. Fracture of the Trochanter Major and Minor.
4. Fracture of the Trochanter Major.
5. An altered State of the Neck of the Thigh-bone from Disease.
6. Union of an oblique Fracture of the Thigh-bone.

Plate XI.

5. The Mode of reducing Dislocation on the Dorsum Ilii.

Fig.

6. The Mode of reducing Dislocation into the Foramen Ovale.

Plate XII.

7. The Mode of reducing Dislocation into the Ischiatic Notch.
8. The Mode of reducing Dislocation on the Pubis.

Plate XIII.

1. The inclined Plane for Fractures of the Thigh.
2. Splints for Dislocations and Fractures at and near the Ankle Joint.

Plate XIV.

1. Dislocation of the Tibia, inwards, at the Ankle Joint.
2. Dislocation of the Tibia, outwards, at the Ankle-joint.
3. Opposite View of partial Dislocation of the Tibia, forwards, at the Ankle Joint.
4. Partial Dislocation of the Tibia, forwards, at the Ankle Joint.

INDEX.

A TREATISE

ON

THE MINUTE ANATOMY

OF THE BONES.

ALTHOUGH the osseous system has for a long time been carefully studied, and every thing peculiar to it is thought to be well known; though we possess both learned and laboured treatises on the human bones, with most beautiful engravings, delineating them, as is said, "to the life;" and though there are many anatomical teachers, who (on account of the immense quantity of minutiæ gradually accumulated) hang over them during whole months, exhibiting to their auditors all their inequalities, and pursuing every individual depression and

spiracle to its termination; nevertheless, without sneering or arrogance, it may be stated, that an addition may be advantageously made to our knowledge of their minute anatomy. Relinquishing and rejecting the hypothesis published by Gagliardi* concerning the corrugated lamina, and the quadruple order of hooks joining these lamina together, as well as what Havers has written relative to the spiracles conveying an oily fluid into the bones, we

* Gagliardi minutely remarks the different appearances of the laminæ which compose the sides of the bone, and as the internal plates separate from the more external ones to form the lattice work, and according to these appearances has imposed different names on them. As for instance, when they make the first turn or wrinkle, he stiles them cancelli corrugati, which he divides into two sorts, from their being more or less wrinkled. The next species is called perforati or cribriformes, because the fibres of the plates separating more, leave small holes in their interstices: this sort is also subdivided. When the fibres come to be so divided and interwoven so as to form a network, they obtain the name of reticulares; these are again distinguished by an epithet of majus and minus.

shall find that the more recent doctrines relative to their minute anatomy are neither more correct nor more useful.

Teachers say, as with one voice, announcing it as a thing thoroughly investigated and clearly established, that the bones are composed of fibres,* layers, or tables, placed upon, or so connected and joined with each other, as to have their strata intermingled.

* The whole substance of a bone is not only fibrous, as appears outwardly, but is truly laminated, and consisting of many distinct and delicate plates of bone, which lie over each other, in regular order, and might suggest the notion of successive ossifications of the periosteum forming bone.—*Bell's Anat.* vol. i.

Lasône describes laminæ formed of ossified fibres, connected with each other by oblique filaments.

Reichel, after several experiments with bones in mineral acid, saw that they might be divided into laminæ, and then into fibres, forming a porous and tabular whole, which is continuous with the spongy substance.

Medici has observed, that the compact substance of the long bones, deprived of earthy salts by the action of a weak acid, divides into several laminæ or layers, adhering to each other by fibres.

They say, moreover, that the fibres are stretched out in cylindrical bones according to their length, but in flat bones are disposed from the centre to the periphery; and, lastly, that the strength of the bones depends on the size, number, and length of the layers. Those who attempt to support this doctrine, seem to have very slightly studied the nature and truths of the fact, when they produce calcined bones, which split into leaves and tables, and add the testimony of surgeons who daily see caries removing layers and plates from sound bone; thus yielding their belief to deceptive appearances instead of making anatomical researches. An attentive examination of the minute structure of the internal surface of young, as well as of the harder part of the adult bones, will convince any one, from the first step, that the former doctrines have been too hastily advanced and too rashly adopted.

A careful observer would find that the

whole of what is called fibre* in bone is a mere mistake, and the short lines, to which name fibre is incorrectly given, occupy a very small space, and join, at different angles, with other very short tracts of the same kind, and by their successive apposition, easily impose on the careless observer, as if they were filaments continued throughout the substance of the bone. By the use of good microscopes every one will readily perceive that these tracts are branched,†

* In their organic arrangement, the fibres of the compact tissue differ from those of the muscles, in as much as they are united together by frequent prolongations, whilst these are hardly possessed of any other means of union than the cellular organ, the vessels, and nerves. Such is the intimate position of these fibres, that their interspaces are not discernible without the assistance of the glass, and which are filled with the medullary juice and that of the vessels.

Bichat, vol. ii. p. 32.

† These filaments are not all parallel to each other, hence short appendices are given off, without being bound together, forming a net, differing very little from the nature of bark, the area of which being larger,

unite with the nearest portions at angles of different degrees of acuteness, and being interwoven in a multiplex way, constitute a reticular structure, which may be plainly seen throughout the whole superficies of a bone, whether it be flat or cylindrical.

In relation to the layers and tables stratified in bones, every proper observer will understand and confess, that calcination is too rude a process to give anatomists any right to conclude that bones naturally are formed of many strata, or by the coalescence of superimposed layers. Although these are the hardest organs of animals, yet they are not, throughout the whole of their peculiar structure, of the same density, and held together at all points by an equally cohesive force; when acted on by heat, they

and the whole compages of fibres expanding, swells with an osseous juice.—*Malpighi.*

Havers is pretty much of Malpighi's opinion, and admits laminæ formed of fibres, and connected by the bony juice.

must necessarily separate unequally and split in strata, although this is very far from being the natural structure of the bone. Because, during life, caries separates plates from the bone, it is not, therefore, fair for anatomists to assert, that the bones are naturally formed by superimposed tables—since sometimes the softest parts of the human body, and particularly the skin, are removed in gangrenous crusts and layers, from the supposed sound parts, while there is nothing better ascertained in the whole human structure, than that the substance and texture of the skin differs as much as possible from lamination.

Not only is the outer surface of the bone, which may easily be seen by any one, of this character, but I pronounce and affirm, that even the greatest part of the whole osseous system is reticular or cellulous. To demonstrate this, I do not impose a very severe task on myself. It will be sufficient to show all the bones split as Chiselden did,

and I was accustomed to do during many years before my class.

By this simple method of treating the whole skeleton, it is made evident at a glance, even to the most inexperienced, that the largest portion of the bone is cellulous or reticular; the residue being a hard concrete and stony substance which surrounds the reticular structure like a bark. The quantity of this cortical matter, in proportion to the spongy part, is very small in the scapula and ilia, and is still smaller in the bodies of the vertebræ, when a large mass of spongy substance is but slightly covered by a thin bony crust.

The lower jaw clavicle, and especially the sternum and ribs are in great part spongy. The bones of the carpus, metacarpus, tarsus, and metatarsus, and joints of the fingers and toes, have a quantity of spongy, loose, and cellular texture, so far exceeding their external crust, that the bones of the hands and feet may, without impropriety,

be termed spongy. In relation to the rest of the joints, it is very commonly known, that the middle of the cylindrical bones, as the arm and thigh bones, the radius, ulna, tibia, and fibula, are very hard and firm; but as we gradually approach their extremities, the texture becomes looser, and they swell out in light and spongy protuberances, covered by a thin external osseous sheet. Not only do we observe this in all the bones of the skeleton, but in the cartilages, as those of the ribs and of the larynx, which sometimes, though rarely, do ossify.

When these are split through the middle, there will be perceived nearly the same proproportion as in the true bones, between their external compact crust and their reticulated alveolar substance.

The whole controversy, therefore, relative to the minute anatomy of the bones, as far as I can judge, returns to this;—not whether the structure of the greatest part of the bones is generally cellular or not (as this is

sufficiently proved by the sections made with the saw before mentioned), but whether the hard and almost rocky walls of the bones, and their compact external crust, no less than their internal substance, partake of this cellular texture.

That I may answer this question as satisfactorily as possible, I have thought it best first to investigate the subject synthetically, and then analytically.

Hence I began by examining the bones in the first rudiments of animation, that is, when the cartilage first changes, and the earliest traces of the future bone begin to appear at the same time.

Then I deprived the hardest bones of an adult of their earthy particles, and reduced them to their original softness and pellucidness, thinking, as was proved by experiment, that however entire the maturity of these bones might be, their minute structure would exhibit the same order and relation as was seen in the embryos.

I, therefore, repeated Haller's experiments on the formation of bone, in the incubated egg, the chief of which I subjoin entire, as they are recorded in my notes.

Eighth Day of Incubation.

The femur and tibia were properly formed, but entirely cartilaginous, flexible, and pellucid, in which no dissimilar point could be observed with the most powerful glasses. When dried they had the appearance of desiccated gum.

Ninth Day.

A yellowness begins to appear about the middle of the femur and tibia.

The cartilage in that place begins to be somewhat wrinkled and crisped, but the rest light and pellucid.

Tenth Day.

The femur and tibia much more yellow and wrinkled in the middle than yesterday. These wrinkles, magnified by a good micros-

cope, exhibited a very beautiful network, the lines mutually concurring at acute angles; yet this network was still cartilaginous and flexible, differing in nothing from the rest of the cartilage of the future bone, except in opacity, yellowness, and a slight degree of roughness.

Eleventh Day.

In the middle of the femur and tibia the roughness, or network, begins to harden.

Being dried, both sustain themselves by the middle, while the rest of the cartilage of the tibia and fibula collapses and appears like a gummy substance. The middle portion, which is not destroyed by drying, is a bony, rough, reticulated crust, which is only a little thicker in the middle than at the extremities.

Moreover, near the lower part of the tibia and fibula red spots begin to appear, which show the situation of the inferior nutritious artery.

Twelfth Day.

About the middle of the tibia, the network, or original ossification, is terminated by two red points, one above, and the other below.

The superior nutritious artery begins to be visible. The bone, when dried, preserves its cylindric form in the middle.

Fourteenth Day.

The opaque, reticular, and anteriorly osseous middle of the femur and tibia is perceptibly extended towards the extremities, and terminates, in both directions, in zones, very full of red blood, surrounding both ends. These very delicate beginnings of ossification are very plainly discoverable by microscopes of ordinary power, and show that the structure of the bone is by no means fibrous, but altogether reticular, cellulous, and flocculent, and is manifestly formed from very short lines or tracts running together at acute angles.

Fifteenth Day.

The whitish reticulated osseous substance, is much more extended towards the epiphysis.

The zones of blood-vessels situate at the extremities of the ossification, were broader, and exhibited a more vivid redness. The reticulated osseous structure was very conspicuous to the naked eye. Splitting the femur and tibia in their length, the internal part of the bony tube was formed of reticulated matter; the walls of the tube, throughout their whole length, were downy or flocculent, having no vestige of tables or lamina arranged over one another. But the blood-vessels, which went from the zones, from the beginning, both in giving and receiving the litle twigs, follow precisely the same order, and exhibit the reticular structure.

Sixteenth Day.

The reticular osseous structure of the femur and tibia reaches nearly to the epiphysis; even on the cartilage, which tips the extremity of the bone, a rough surface is visible, which is the rudiment of the future bone; and nothing is wanting to change this roughness into real bone, but the deposition of earthy particles.

The redness of the zones is greater than on the fifteenth: from either extremity of the bone, towards the middle it is increased and expanded, so that the whole bone seems suffused, as with a sanguineous dew. The femur, being split through its length, gave no indication, in any part of the bony tube, of a lamellated structure, but every where appeared flocculent, reticulated, and cellular.

Eighteenth Day.

The reticulated osseous crust occupies the whole of both bones, except a small part

of the cartilage on the extremities of the tibia and fibula.

The superior and inferior vascular zones are very much expanded, and nearly meeting and intermixing with each other in the centre, tinge the whole femur and tibia with redness.

Both bones being split in their length, their walls throughout appear alveolar and cellular, and also stronger than in the sinuosity of the femur of the opposite side. The tube of both bones was here and there interrupted and confined by cartilaginous partitions. The internal periosteum exhibited the appearance of many blood-vessels collected together, and was intensely red. But near the epiphysis, the cartilage, which remained of the diaphysis of the whole bone, was elongated in the form of a cone in the medullary tube, or bony pipe, which cone gradually terminated in a point near the middle of the bone. Through this cartilaginous cone, on the extremities of the

bones, some vessels passing from both zones reach to the epiphysis with a bifurcated termination. The frontal bones were still very flexible, and almost cartilaginous, yet were in no point fibrous, being in all parts manifestly reticulated.

Twenty-first Day.

A CHICKEN NEAR BEING HATCHED.

The femur and tibia were not so red externally as on the former days.

In the middle of both bones the reticular structure was more close and compact than usual, and the lines appeared to run together at more acute angles than on the first days after incubation; hence it happens that those small tracts concurring at acute angles readily deceive superficial observers, as if they were fibres extended in the length of the bone. The femur and tibia being vertically divided, the internal periosteum presented, covered by an oily mucus, and the

medullary tube was filled by small cartilaginous tubercles.

But in the extremities of the same bones, the cartilage which rose in the form of a cone through the bony tube, was changed to a pellucid sponge of cartilaginous elasticity, grooved by oblong depressions and sinuses. It necessarily follows, from the evolution of this conical cartilage, and from the separation of the same into pits and cells, that the proportion of these protuberances is very much increased at the diaphysis of the bones, on account of their greater amplitude, and the swelling of this conical cartilage, which far exceeds the diameter of the bony tube.

A Chicken two Days before being hatched.

There was nothing of cartilage in the extremities of the femur and tibia, except the epiphyses. When the periosteum was removed, the blood-vessels appeared every

where mixed and interwoven with the bony net-work. Both bones being divided as usual, the internal periosteum was very red, and the vessels of the marrow, bedewed with much oily mucus, were extended from the extremities towards the centre of the bone. In the middle of the femur and tibia, where, from the commencement of the ossification, the whole external surface of the bony tube was downy and flocculent, was now seen a hardened covering, manifestly drawn and crowded together in tracts and areolæ of reticular structure. The cartilaginous cone which I saw on the former days in both extremities of the bone, drawn out into depressions and little circles, and very tumid, I find has become a fragile, bony sponge, forming the protuberance of the bones.

Moreover, I again see red vessels pass from both extremities of the bone to the epiphyses, to form the ossification of their cartilaginous appendages in the usual way.

Thus far the observations were made on the incubated egg, and the original structure of bone in human embryons when about twenty eight lines long. For in these, as in the chick about the fourteenth day of incubation, the middle of the femur and tibia, which scarcely equalled two thirds of the whole length of the bone, was osseous, the remainder was cartilaginous.

The external surface of both bones stripped of the periosteum, and examined with the best glasses, appeared beautifully reticular, very short branching lines running together at acute angles, altogether resembling the first evolutions of the bones in the incubated egg. The embryon bone, split through the middle, exhibited the downy and flocculent substance both internally and externally. Although the frontal and occipital bones were so pellucid and flexible that they appeared entirely cartilaginous, yet the minute structure was manifestly reticular;—both the whole of the scapulæ and ilia

were spongy, being still unprovided with any harder external covering.

The conclusions which are to be drawn from these observations, unless I am very much deceived, are the following:

1. That the cartilages* were the models of the future bone, and all the parts of the bone visible existed in the form of cartilage.

2. The reticular or cellulous bony structure, which first began to appear about the middle of the cylindrical bones, was always

* The cartilages, when they are divided, seem to be homogeneous, and without any appearance of fibres, vessels, or nerves; but when they are carefully prepared, a fibrous texture becomes apparent, and the phenomena which they exhibit in health and disease prove the existence of a vascular and nervous structure.

The proper cartilaginous texture consists of an immense number of whitish fibres, which can be seen in the articular cartilage after it has been macerated during six months; they are also rendered apparent by boiling, provided it be not prolonged so far as to cause a solution of the animal matter.—*Grainger*.

immediately preceded by a wrinkling of this part.

3. That the cartilaginous model is changed to bone* by the action of the sanguiferous vessels, and the addition of earthy matter, in the rugose cartilaginous tracts, by which means the osseous net-work is made.

4. In the incipient state of ossification, the whole height and thickness of the bony pipe of the cylindrical bones, both without and within, is light, downy, and cotton like, having no trace of hard covering externally.

5. When the ossification is perfected,†

* According to Howship, some parts of the osseous system, such as the bodies of the long bones and the broad bones of the cranium, pass immediately from the mucous to the osseous state.

† Bone, according to Fourcroy, consists of

Animal matter	51
Phosphate of lime	37.7
Carbonate or lime	10
Phosphate of magnesia	1.3
	100

the walls of the cylindrical bones receive an increase of density about the middle of the bone, with a diminution of breadth, as the reticular texture is more closely drawn together than before, and compacted in the tracts and alveoli. What forms the external crust, or cortex of the bone, is nothing more than the light, reticulated, cellulous structure brought into a hard body near the surface of the bone; and this, both in the cylindrical and flat bones, does not appear about their middle or centre, before the entire ossification of the cartilaginous model.

6. The sponginess, which is greatest in the extremities of long bones, is by no means derived, as many anatomists teach, from those lamina, or tables, which pass from the walls of the bony tube, and go into the medullary cavity, but it is to be referred to the primordial cartilage, which at first stretches the cones upwards through the medullary cavity, and at length the areolæ and cancilli being removed, expands more

fully, and swells very much like tuberous sponge in the extremities of the long bones.

7. Finally, the original more minute texture of the cylindrical and flat bones, both in the incubated egg and the very early human fœtus (when, indeed, both bones, scarcely begun, are still flexible and light), are nothing but a slightly reticulated or cellular substance; and, moreover, if sometimes distinct little spots, remote from the centre of ossification, occur in the progress of ossification, they are, at length, consolidated, and peculiarly interwoven with the portions next them, the whole bone being thus formed of retiform structure.

In the next place, since we find this to be the fact in the first evolution of bone, let us consider the more minute structure of the bones in detail—especially the nature of the cortical substance of the bone, which is most manifestly made up from the compacted osseous network. This, which has been detected by the synthetic method, I

felt sure of confirming by analysis, as the hard external of bones could be wholly cleared of their earthy particles, and then might be gradually loosened, until their peculiar structure could be fairly shown.

Therefore, I kept the tibia of an adult, in dilute muriatic acid sufficiently long to extract the earthy particles; by this process, common to anatomists, the very hardest bones are converted into a cartilaginous substance of great flexibility and translucency, without, in the slightest degree, changing their natural forms.* When I

* Beclard says, in this state, if it be softened by maceration in water, the compact substance, which presented no apparent texture, divides into laminæ, connected together by fibres.

The laminæ themselves, somewhat later, or with more difficulty, divide into fibres, which, by a more prolonged maceration, swell, and become areolar and soft, like cellular or mucous tissue.

The animal substance obtained by this process has the character of cartilage, and is capable of being reduced by continued maceration, into common cellular tissue.—*Grainger.*

had reduced these bones to this state, I macerated the cartilaginous residue in pure water, in the same manner as is done when we wish to reduce membranes, viscera, skin, tendons, or aponeuroses to cellular substance. By a long continued experience I have, at length, learned to reduce the external covering of the tibia of an adult to a downy reticular texture, similar to that which is found in the extremities of the bone, except that the close and much compressed texture of the cortex, appears loose and dissolved, in the meditullium and tuberosity of the same tibia. In fact, when the parenchyma of the tibia was cut perpendicularly, no vestige was found either externally or internally of fibres, not the slightest indication of lamination, or plates, in the thickness of the bony tube; but the whole of the hardest crust of the tibia throughout its extent, appeared to be formed of cellulous structure, so disposed in cancelli and tracts of net-work, that what belong to the super-

fices of the tibia was much compressed and gathered on itself. The cancelli gradually relaxed, and enlarged more and more, until they were swelled out to that sponginess found in the medullary cavity and extremities of the bone.

I have, with much pleasure, observed that the compact substance of the tibia*, now under consideration, is of a cellulous reticular structure, when this cortex has been deprived of its earth and moisture, and afterwards placed in oil of turpentine.

For on account of the high degree of pellucidness of a bone thus treated, the slight net-work of which it is ultimately composed, may be clearly seen, and the naked eye can discover, without error, that the very hard crust of bone is really of a cotton-like texture, and made up of very short branching tracts, variously joined and interwoven.

* The osseous texture is nothing but cellular tissue, hardened by its combination with a gelatino-calcareous substance.

The same circumstances were manifested by a section of the very hardest portion taken from the middle of an adult tibia, suspended in spirits of wine after the earthy matter was removed, and carefully examined by reflected and refracted light. The soft cellulous texture was shown, in which small cones of the same soft substance of different figures adhering together, formed here and there larger and smaller areolæ, nearly like the soft cellular texture.

The reticular structure is not only to be seen in the cylindrical, but also in the compact tables of the flat bones in adults. Thus the internal and external crust of the frontal and occipital bones, being made flexible and pellucid, and suspended in oil of turpentine, the whole is found to be in every part reticular. So great is the resemblance of this crust to the structure of cellular texture, that it might readily be mistaken for a membrane reduced to a cellular web, by long continued maceration. However,

I have remarked the form of the cells in the crust of flattened bones to be different from those peculiar to the net-work of cylindrical bones; that, for instance, the areolæ in flat bones are more oblong than in the cylindrical—as if the cellulous spaces and areolæ of the flat bones had been drawn in different directions, while the bones were yet soft and cartilaginous.

Hence analytic examination of the cortex of hard adult bones shows that there is almost the same disposition of principles in the construction of the hardest parts of their bones, as in the embryo at their first evolution; and the conversion of cartilage into bone, that all the bones, even the very hardest, are composed of a collection of small tracts, which extend through very short spaces, and unite at different angles, forming a net work. It is not from conjecture, therefore, but the force of positive observation, that we declare the opinion hitherto taught in anatomical schools, that

bones are formed by tables, laminæ, and filaments, is unfounded, and must be rejected as untrue; and we affirm, that all the bones, whatever be their figures, are in their minute structure cellulous and reticular, sometimes very close and compact, as in the cortex of very hard bone; at others loose and free, as in the cavities and tuberous extremities of cylindrical bones. Those short tracts which anatomists have mistaken for bony fibres, can neither be followed in the length nor breadth of the bone, nor do they ever attain any notable length.

In fact, as often as I attentively examine the minute cellular texture under consideration, and observe that it is very close and compact at the surface, and grows gradually looser and looser as it approaches the internal part, and the spaces and cells become very much larger, and, at length, form the spongy structure of the meditullium and extremities of the bones, I can-

not avoid concluding that there is, in this construction of the bones, a great resemblance with the texture of the true skin of animals. For this corium, which is, beyond doubt, of a cellular texture, where it covers the external surface, has its cells drawn together, and closely compressed, is very firm and compact, but its internal surface has its cellular structure more and more relaxed and enlarged, till at length, by the introduction of air, it is easily swollen, and the subcutaneous net-work is loosened and enlarged. Thus in bones I see a cellulous net-work, very close and firm on the outer surface of the bone, forming a hard crust, and the same substance gradually becoming loose toward the centre of the bone, enlarging and swelling out to an osseous sponge.

Since then it is demonstrated, that the minute structure of the crust and meditullium of bone is entirely of the same cellular structure, it will not be difficult, unless I

am much mistaken, to understand why the cylindrical bones of very young fœtuses, which in the beginning, throughout the whole extent of the walls of the long tube, are equally light and cotton-like, should, with increase of age, be externally covered by a hard and compact crust. Also, why it happens that the cortex of the bone is uniformly in inverse proportion to the meditullium, or, what is more remarkable, why the cortex should be thick and very hard where the spongy substance is in smallest quantity; and, on the contrary, the cortex is slightest where it covers the greatest quantity of spongy texture. From what I have advanced relative to the commencement of ossification in the incubated egg, and in the human fœtus, it appears that, perhaps, a greater quantity of osseous substance does not exist in the middle of cylindrical bones than in their extremities, that, such is the condition of the cartilaginous model of the future bone, that the

portion of this cartilage belonging to the extremities, which hardens latest, is more extended and spread out over larger spaces, alveoli, and depressions, than the middle portion of the cartilaginous model.

Therefore, since the texture of the cortex and meditullium is entirely the same as before stated, reticular and cellulous, nature in her own way, and at the proper place, as in the middle of the cylindrical bones, constringes and compacts it to form a hardened cortex, but, in other parts, as in the tuberous extremities of bones, she loosens and spreads the same material like a sponge. In fact, no one should think this compaction and change of a lax cellular texture into a solid and hard body to be the only example occurring in the animal economy, and merely contrived and designed for giving strength to the bones, since nature employs exactly the same means in all animals, and in all organs composed, in a great degree, of soft cellular texture, for

keeping them in their places, and giving them more solidity and strength. If this should appear doubtful, nature herself teaches that the soft membranes of the embryon are changed and hardened into firm tunics, elastic ligaments, and tendons, articular capsules, and vascular coats. Those who have, hitherto, supposed the minute structure of bones to be formed in strata and tables, have been accustomed to support their notion by imagination, fancying that the middle of every cylindrical bone, when it is hardest and firmest, is composed of numerous tables, and as we gradually recede from this tabulated centre towards the extremities, that they become diminished in length, and those that are turned towards the medullary cavity, become so inclined, that at length, meeting together in the middle of the bone, they are, in a multiplex manner, admixed and interwoven with each other, and changed into the spongy substance of the meditullium and tubers. The

whole of this hypothesis falls of itself, if the facts are properly weighed, which we have demonstrated relative to the minute primordial cellulo-reticular textures of bone.

Moreover, even this tabular structure admitted, it would be impossible to understand how the same strata of bone could be driven, as Haller thinks, by the dilatation of the arteries, from the superfices of the bone towards it medullary tube, till at length, by their meeting, the form and condition of a spongy mass is produced.

But, although the natural course and order of ossification is, that the cellulo-reticular substance which is placed in the middle of the bones, should change with the maturation of the animal, gradually contracting its cells, and hardening the little portions of cellular texture; and, while solidifying, the cellulo-reticular structure of the extremities and tuberosities, should, at the same time, extend the cancelli, and enlarge the net-work, so as to increase the

whole size of the bone; nevertheless, observations furnished by pathology are not wanting to show that a faculty and aptitude exists in the very hardest cortex of adult bones, which enables them, under certain circumstances, like the cellulous structure of the extremities, to swell and enlarge beyond their natural condition. Although I had suspected that this remarkable power of nature, in relaxing and enlarging the external covering of the hardest bones, was often resorted to by her in curing diseased bones, yet I never was so clearly and undeniably satisfied of it, as in the case of a puppy, whose leg I had freely broken.

I opened the tibia of this dog, down to the meditullium, and, by this opening, introduced a probe, and destroyed the marrow of the bone, filling up the cavity with lint, not without much injury to the inner wall of the tube. On the following day the whole leg swelled violently.

About the sixth day a free discharge of

pus ensuing, the tumefaction of the soft parts about the wound subsided; the tibia, at the same time, was found to be very tumid, and gradually to increase in size, until about the fortieth day, it had the appearance of a great exostosis The dog was killed, and this tibia was examined by cutting through its length, when the whole of the cortex was found to be expanded to cellulous texture, and, moreover, the walls of the tibia of this puppy, that were scarce half a line in thickness, were now changed into a spongy substance, of more than six lines in thickness throughout the length of the bone.

Similar circumstances are frequently found in the human race, as when any cause injures the meditullium of bones leaving the cortical part untouched, or when the nutrition and increment of the bone from the internal texture is injuriously hindered by the presence of some foreign body. For in either case nature provides for the

preservation of the continuity and strength of the diseased bones, relaxes with great effort their compact external surface, which, enlarging to a spongy consistence, and being prolonged internally compensates for the loss of the meditullium—or, swelling outwards, increases the height and breadth of the bony tube, or, at length, by surrounding the injured bone with the sponginess from the cortex, receives and contains it in a sort of sheath. This spongy sheath in the beginning is light, flexible, and cotton-like, but gradually hardening by the acquisition of earthy matter, it comes at last to perform the office of the sound bone, the primitive bone wastes away, and, at length, loses its continuity with the osseous case.

We may reasonably demand of those who teach that the hard walls of bones are made from many plates or tables superimposed, how they can reconcile such facts with their hypothesis? For it is certain and manifest, under the circumstances men-

tioned, that the bones neither separate into layers, nor, properly speaking, does nature generate a new bone to replace the meditullium, or to include the injured internal wall in the bony sheath, but only allows the compact and much compressed texture of the outer part of the bone to become freely enlarged and expanded. But while engaged in writing this essay, I have before me another most excellent example of this change and transition of the compact substance of the bone into a cellular mass, furnished by the bones of children, in whom the hardest parts of the bone, and especially of the joints, are reduced by disease to the softness of wax, and become almost pellucid. In consequence of this disease the bones, being deprived of their earthy particles, or the necessary deposit of earth withheld, grow at last so soft and pellucid, as to be easily cut with a knife, exactly like those bones which have long been macerated in diluted mineral acids. Diseased bones

of this kind have their substance like cartilage, very light and flexible, and more delicate and spongy within than it is possible to describe. Having cut one of them through its length, and suspended it in spirits of turpentine, it was translucent like jelly, exhibiting the minute structure throughout reticulated, and particularly evinced and confirmed the fact of the cellular nature of the external crust of bone.

While speaking of bones deprived of their earthy matter by disease, it presents a fair opportunity for observing what happens sufficiently often, that bones, from some peculiar virus, may become diseased, not throughout the whole body, as in general rachitis, with softening, but are deprived of their earth in a particular spot, and are affected by a local rachitis, making them soft within certain defined limits. Where this occurs, the cellular texture of the bone loses its character and rigidity as bone, at the point whence the earthy matter is re-

moved, and assumes the flexibility and ductility of cartilage, becoming subject to distension and swelling, like the soft organs, such as membranes, tendons, ligaments, vessels, and other parts composed of cellular substance. Under such circumstances, if the softened bone is exposed by the want of an outlet to the action of acrimonious fluids, it swells, becomes violently distended and red, and soon forms an irregular fungous mass, similar to excrescences of diseased flesh.

The phenomena of spina ventosa and pædarthrocace are well known to surgeons, the bones, at first, softening so slightly, as by no means to allow of the introduction of a probe; at length, becoming a sort of fleshy matter, the skin is burst up, and presents a wretched spectacle; the tumour bleeds on the slightest touch, and pours out a fœtid discharge.

This change of the bone into a substance similar to flesh, and its easy distension,

shows that there is much similitude between the cellular texture of the substance of the bone, and the common cellular texture, whose great ductility, and the facility with which it forms fleshy tumours, is equally well known to physiologists and pathologists. Sometimes it happens fortunately, that the bones swell to an extraordinary size, from the softening of their cellular structure, without injury to the animal.

In fact, we think, in opposition to the common opinion of surgeons, that this peculiar softening and germination, like fleshy substance from bones, is determined and promoted by a salutary effort of nature, to repel injuries done to the bone, or to restore the continuity when it has been broken.*

* The first appearance which presents itself after fracture is an extravasation of blood, extending along the whole limb, and covering the muscle and the fracture. The blood thus extravasated has been supposed, by some, to have some part in the reproduction of the bone, and the formation of the callus.

After fracture we see the points of broken bones first grow soft by the absorption of the earthy matter; afterwards, from these

The blood appears to come principally from the medullary structure of the bone, not from the vessels of the osseous substance itself; because the blood is not found on the edges of the bone. Exuded blood is thus supposed to be the basis of union; the red part becomes absorbed, and the remaining portion converted into gelatine. The periosteum inflames, and becomes thickened; and in the gelatine effused beneath it, the first points of ossification may be observed, not close to the fracture, but at some distance from it, on the surface of the periosteum, and not on that of the bone. The central portion of the callus, between the fractured extremities, becomes ossified last, and not until the new periosteum, as it appears, has formed from the cellular membrane of the circumjacent muscles. The new periosteum is at first thick and loose, but connected with the callus.

The points of bone appear, at first rather externally than in the middle of the gelatine.

It appears, then, that the ossification of the callus stands in close connexion with the formation of the periosteum, and that the developement of the latter precedes that of the former.

The regenerated bone runs through the same stages as the original bone.—*Lancet*

points, already of a cartilaginous flexibility, we perceive a red substance to sprout forth, called by Celsus caruncula, and this caruncle, extending according to the displacement of the broken bones, assuming various sizes and forms, connects the points together, and fills up the vacancies caused by any loss of substance. In the living state this caruncle is red, but after death, being freed from blood and macerated, has the appearance and character of cartilaginous substance. In the living body this caruncle is well supplied with blood-vessels, which, depositing earthy particles, gradually impart greater consistence, and proper osseous character, when the name of callus is bestowed on the mass by the surgeon. In relation to the organic nature of callus, my own experiments, after those of Detlef, Haller, Bonn, and Bohmer, do not allow me to doubt.

Those who have hitherto taught that callus was something similar to gluten con-

creted with earthy matter, always appear to me to have very rude notions of the animal economy, and have not remarked that callus, once formed in young animals, grows, as it advances in age, in the same proportion as the other bones, and is changed in colour by the use of madder, just as they are. The blood-vessels of callus may be minutely injected; and, in short, callus, when acted on by mineral acids, is deprived of earthy matter, and resolved into a cartilaginous substance, similar to the other undoubted bones. Such teachers, moreover, seem not to have observed, if it has happened before them, that when bones, formerly joined and restored by callus are seized by rickets and softening, this callus, like the other bones of the animal, becomes softened and preternaturally tumid. I have removed from the surface of the tibia in a full grown man, soon after death, a portion of callus almost four inches long and one broad, still soft, altogether cartilaginous,

and easily cut with a knife; this specimen is preserved in spirits of wine. Its external surface has the appearance and form of the osseous crust, but the internal surface, that adhered to the tibia, exhibited a most beautiful network, which, at first sight, could not be distinguished from common cellular substance.

By examining this structure with a microscope of high power, it was plainly demonstrated to be cavernous, and altogether cellular, having many very minute earthy particles in it, especially in its external surface, which was firmer and more rigid than the opposite side. It is wonderful to see the celerity with which the soft caruncle, filled with blood vessels, shoots forth on the bones of birds that have been stripped of periosteum, first changing to cartilage, afterwards into a light downy bone, delicately reticular, both externally and internally.

I have made the same experiments on

the bones of kittens, which, though not effected with the same celerity, yet terminated in a similar manner. The tibia of a cat, from which a soft callus had grown after the periosteum had been removed from two-thirds of the whole circumference of the bone, was macerated in muriatic acid until the whole bone became pellucid and flexible. By placing this bone in oil of turpentine, I found that the caruncle, or rudiment of the future callus was continued from the cartilaginous model of the bone, and was nothing more than a germination and intumescence of the cartilaginous substance of the tibia. I have seen the same thing plainly in the tibia of an adult man, who had suffered a vast laceration of the soft parts and periosteum, two months before death; the caruncle was sufficiently produced, and part of it had begun to change to bone. When the whole tibia was freed from earthy particles by the aid of mineral acid, and rendered pellucid, it

appeared that the perfect callus, as well as the caruncle, formed one and the same substance with the whole parenchyma of the tibia; that is, the cartilaginous nucleus of the tibia was expanded into the callus, and was prolonged and stretched out uncommonly. In another cat, whose tibia was deprived of a long and broad portion of periosteum, a recently formed callus swelled out; when I had filled the arteries very minutely with red wax, this callus was handsomely tinged red, and the colour was distinct from that of the rest of the tibia. But when I had removed the earthy matter by acids from the whole tibia, and rendered it soft and pellucid, and examined it opposite to the light, I discovered an immense number of blood-vessels scattered through the callus. Besides, the proofs heretofore given, that the callus is formed by the intumescence, or germination, of the parenchymatous cellular texture of the bones, we may add, that whether we consider the for-

mation of callus, and the process of ossification, or look to the minute structure when the bone is perfected, we shall find all the circumstances of the original ossification and formation of callus are alike.

The caruncle does not harden by the whole quantity of earth being deposited at once, but receives the earthy substance as in the formation of bone in the incubated egg, where the blood-vessels appear, carrying red blood, and supplying, at the same time, the necessary earthy particles. Since this condition of the vessels takes place unequally, as well in the cartilaginous model of bones as in the rudiment of future callus, it hence necessarily happens, that in both small distinct spots appear at the commencement of ossification with any order, which finally unite together in the cartilaginous model of the embryon, or after fractures cover up and take place of the caruncle. As soon, however, as the caruncle is wholly ossified, we find the callus, like

the original ossification in the incubated egg, entirely cotton-like, reticular, spongy, and equally light and delicate throughout its whole extent. It appears as if forcibly compressed, and becomes more and more condensed, until it hardens, and is covered with an external crust or bark, which substance, as in the bones of embryons near the full time, increase more in length in proportion to the diminution of the cellulo-reticular structure.

The origin of exostosis is, undoubtedly, similar to the formation of callus.

For in such cases, the surface of the bone being, for ever so small a distance, deprived of the periosteum, becomes softened, is followed by a germination of the caruncle from this spot, which is lengthened and increased from the fluids circulating in it, hardens, finally, by the deposition of earthy matter, and produces a tumour, whose minute structure does not differ, in the slightest degree, from that peculiar to the bones, if

we except this circumstance, that the tumour is sometimes harder than the bone itself, in consequence of the greater quantity of earthy matter it has received. I speak now of the true and legitimate exostosis, which may have been originally caused by some virus, and, although this has, by treatment or spontaneously, been removed, still the exostosis does not cease, because the caruncle, shooting from the surface of the softened bone, obtains the nutritious gluten along with the earth from the common cement, and assumes the osseous character. A few years since I had occasion to remove the tibia and fibula near the knee, where a great exostosis swelled out, in a man of about forty years. I amputated the leg at the usual distance from the patella, through the exostosis.

The wound, in a short time, was healed without being affected by the exostosis, the cut bones adhering to the integuments were covered by a firm cicatrix.

Caries is separated from the sound bone

almost always in the same way that callus is formed.

At the extremities of a bone suffering under caries, the earth is absorbed by the action of the proper vessels, and from this spot the caruncle shoots forth, which, being treated with bland and emollient applications, separates the carious bone in every direction, and throws it off from the sound. When this happens, the caruncle which, as we have demonstrated, is very vascular, before it wholly ossifies, forms anastomoses with the surrounding soft parts, and even with the skin itself. On this account, after the cure has been entirely effected, we find about this caruncle, that the integuments are attached to the subjacent bone, and that there is a dense concave cicatrix formed thereby.

Therefore, in addition to the anatomical researches and observations made relative to the formation of fœtal bones, and their structure in adult animals, various morbid affections, the chief of which I have men-

tioned above, show that the minute structure of the hardest of these organs differs very slightly from the structure and properties of cellular texture, if we except that the common cellular substance is very soft and juicy, and the cellular texture of bones in consequence of the earth it receives, begins early to harden, and has its strength and density increased by the daily addition of earthy matter. It is, nevertheless, equally certain, where the cellular texture of the bone is first deprived of its earthy particles, it becomes flexible and ductile, like many other parts of animals which are called soft and distensible, having as great an aptitude to swell or enlarge as the common cellular substance.

As sometimes it happens in ulcers which are treated by an unskilful surgeon, by oily and relaxing remedies longer than is proper, the cellulous subcutaneous texture swells and rises above the skin like a fungus tumour, so it naturally occurs when the

cellular texture of bone is deprived of its earthy matter, the same vital action forms and germinates the caruncle, which sometimes only unites the points of a broken bone, and at others wonderfully replaces the material that has been lost. The celebrated Haller formerly taught, that the cellular texture was the great foundation of the animal structure, because all the membranes without exception, the vessels which are hollow membranes, the greatest part of the viscera, tendons, aponeuroses, ligaments and integuments of the whole body, are made of this cellular texture. This is not only true, but an addition of the bones may be made to this catalogue, on the authority of the most careful observations. I have taken care to examine the minute anatomy of the bones in other animals, as in amphibia, reptiles, and fishes.

In the great whale, called balæna mysticetes, the cellulo-reticular structure is most fully evident, both in the bones of the head

and shoulder blades, and in the cortex of the lower jaw, and the longest of the ribs.

There is no great acuteness of sight requisite to detect the same structure in the bones of the delphinus phocæna, because the reticular structure in this animal is more visible, since there is but a small quantity of earthy matter concealed in it. The same structure is very manifest in the bones of the sea turtle, and in reptiles of every kind.

In cartilaginous fishes, as the shark, frog-fish, sting-ray, and others of the same kind, whose bones contain even less earth than those of the dolphin, the reticular texture of the cortex is also far more conspicuous. In the scaly fishes, as in the pike, although the bones are very hard and contain much earth, yet the cellulous texture is very perceptible, and the branching tracts concur at acute angles, wonderfully and beautifully reticulated. The salutary changes which we have mentioned heretofore as occurring

in the bones, being effected and continued by the vital power and action of the vessels, it follows, evidently, that the bones, besides the great quantity of lymphatic vessels, are also possessed of a vast number of blood-vessels, and are really more vascular than any one not accustomed to minute anatomy can have any idea of. The celebrated Albinus, indeed, taught a long time since, that a vast number of vessels passed from the periosteum into the cortex, through the numerous spiracles of Havers, and these vessels with others of the same character running through the meditullium, properly called nutritious arteries, anastomosed, and passing by particular openings through certain parts of the bony crust, enter the medullary cavity, bestowing the most minute ramifications on the marrow and its membranes. But Albinus, when he wrote this, thought that the blood-vessels immediately after entering the pores of the cortex, went in right lines between the strata of plates and tables.

This I certainly know to be far from the truth, and foreign to the structure of the bones and the real distribution of the blood-vessels. When I had filled the vessels of the bone in a young and immature fœtus with most minute injection, I found the vessels of the periosteum, immediately on entering the pores of Havers, not going off in right lines, but giving and receiving frequent branches, encircling the reticulated structure of the cortex, and joining each other at the shortest intervals, following the course of the osseous net-work. Where the cortex of the bone internally began to loosen to the spongy substance of the meditullium, the blood-vessels of the cortex also inclined to the centre, and their trunks joined at certain places, with those going to the marrow, as before stated.

This seems to be a wise provision of nature, that at the same time the external crust of the bone is supplied with a large quantity of blood, a full and manifold com-

munication should exist by these almost innumerable anastomoses, between the external and internal structure. I pointed out the mode of distribution of the blood-vessels in bones, as shown by injections, in the incubated egg of the sixteenth day, when the red zones which surround both the extremities of the tibia, being broadly expanded, meet in the centre of the bone. Under these circumstances, even should the external periosteum be removed, the cortex of these delicate bones is suffused with so great a redness by the abundance of vessels, that it seems to be covered with a sort of sanguineous dew.

Since the bones enjoy vitality, are nourished, and grow like other parts, it is in perfect agreement with analogy to believe, that besides the great number of blood-vessels, they are supplied with nerves, although these can scarcely be demonstrated, not only on account of their tenuity, but perhaps, because, as in many other parts,

the very small nerves enter the foramina of bones in coalescence with the arteries.*

But if pathological observations may be allowed any weight, I may state, that I have more than once produced a sense of pain by scraping and abrading living bone. I have also observed that the caruncle which shoots from the substance of bones is endowed with sensibility, and have lately had a most excellent opportunity of confirming this statement.†

On a part of the tibia of a man, five inches long and one broad, that had been removed by the natural process, I wet the

* The nerves, which accompany the vessels of the medullary membranes of the long bones, cannot be discovered in the osseous tissue itself.

† By the experiments of Du Verney on men and brutes, which I have likewise made, the sensibility of these parts, and consequently their being supplied with nervous filaments is sufficiently proved; the racking pain with which suppurations within bones are frequently attended, gives a woeful conviction how sensible these membranes are.

caruncle with camphorated spirits of wine, of which the patient, who was by no means timid, complained much. Shortly after I wet the point of a soft pencil with spirits of sal ammoniac, and when it was applied to the caruncle, the patient cried out.

Now that the caruncle, which is nothing but the bone itself deprived of earthy matter, is entirely insensible and destitute of nerves, it is altogether absurd to assert.

The following questions may be asked relative to the minute anatomy of the bones.

Is the diploe present in the cranial bones of the fœtus or not? Are the pituitary sinuses altogether wanting in the bones of the fœtus at full time? that is, are the frontal, æthmoidal, maxillary, and sphenoidal sinuses present? relative to which anatomists are yet undecided. In relation to the first question, if any one attentively examine a perpendicular section of the cranial bones in an immature fœtus, with the aid of a good glass, he will find a very

singular and remarkable circumstance. The reticulated cellulous texture of the fœtal cranium on the inside is already solid, smooth, and compact, and has already formed that table which is called vitreous, but the external surface of the cranium still remains light, reticular, and flocculent, as it were surrounded by an osseous down. After birth, and especially in childhood, this reticular down is in greater quantity, the cancelli and areolæ are more and more drawn together, and solidified into a thin crust under the pericranium.

This crust, moreover, envelopes the whole reticular substance of the cranium, and whatever remains after the formation of the two tables is confined between them, and receives the name of diploe.

If the ossification advanced beyond the middle, the portion of the reticulo-cellular substance between the two tables would be added to either the external or internal, and then the adult cranial bones would be

entirely without diploe, but would constantly acquire a hardness and thickness beyond what is common. Wherefore, so far is it from fact that the diploe is wanting in the fœtus, that it should rather be stated that all the external surface immediately under the pericranium is nothing but diploe. In relation to the pituitary sinuses of the nose, among the dissectors who affirm these cavities to be entirely wanting in the fœtus at nine months (for many anatomists are of this belief), some teach that these receptacles in adults are to be attributed to the action of absorbent vessels. For, say they, the material is absorbed from the middle of the frontal, sphenoid and maxillary bones, and is replaced at the margin, forming new and large cavities. I freely confess that there is much excellent testimony to prove the great power which the absorbent vessels possess in removing both fluids and solids. Nevertheless, granting all this power to the absorbents, I do not understand why they

do not equally remove the whole substance of the bone, as well as make local excavations at certain points.

But, passing over these disquisitions and doubts, we cannot withhold our admiration at some of the recent writers on osteology, who deliver it as thoroughly investigated and certainly established, that these sinuses are wanting in the fœtus at birth, not recollecting that the celebrated Albinus has described many of these sinuses in the fœtus of nine months, and illustrated them by plates. In fact, I have before me, in a fœtus of this age, the æthmoid cells as delineated by Albinus, and also the maxillary and spheno-basilar sinuses, proportionably as distinct as in the adult. The spheno-basilar sinus, at this tender age, is not only begun, but it is already fairly divided into two parts by an interseptum. The frontal sinus is the only one whose rudiments are obscure in the fœtus of nine months, yet it is not entirely wanting; but at that age

the frontal sinus is not sufficiently distinct from the æthmoid cells, as is shown by the flatness above the nose in the fœtus, and the formation of a continued series between the frontal sinus and æthmoid cells in the adult. The pituitary sinuses of the nose, like many other parts which are delineated in the embryon, are only evolved with the increment of the whole body. For the purpose of effecting this, in addition to the remarkable powers through whose action the nutrition and increase of the animal organs are kept up, I think that faculty of the animal economy, by which the primordial, light, reticular, and cellular texture, at certain places and different periods of time becomes more condensed, or relaxed and spongy, as may be necessary, does much in the increment and evolution of the pituitary sinuses.

Indeed, in the first instance, it follows from mechanical necessity, that the cavity surrounded by the osseous sponge, which is

contracted and changed into a hard thin crust, should be increased. This is certainly manifest in the cylindrical bones, which are spongy and cotton-like throughout their whole extent in the embryon, and, as soon as they begin to harden and form their cortex in the middle, the tube of the bone becomes apparent. In addition to the causes stated above, it is very probable that another circumstance takes place in the increment and evolution of the pituitary sinuses, that is, as the body increases, the capacity of these sinuses gradually enlarges, and the extent of the spongy bone surrounding them is increased, at the same time its thickness is diminished, until this bony sponge forms the walls of the pituitary sinus.

There will be less doubt in relation to this, if skulls of all ages, from the fœtus at birth to the adult, be carefully examined, in which it is very manifest that the amplitude of these sinuses are in the inverse ratio

of the spongy cellulous substance of the bone, which in the fœtus surrounds these cavities.

But to these causes, promoting the increment of the pituitary sinuses that may be properly called primary, I think that those secondary causes should be added, depending from the change of figure and position which the surrounding bones of the embryon are subject to. The convexity of the superior and middle turbinated bones being increased towards the septum narium, favours the expansion of the æthmoid cells, and the appearance of the molar teeth in the child, with an increased convexity of the alveolar process, aids much in developing the maxillary sinus, in proof of which, the maxillary cavity is much lessened when the molares fall out and the alveolar arch is removed. When the root of the nose and outer surface of the frontal bone is raised in children, this causes the æthmoid cells to be raised upwards along with

them, so that the superior cells get a new place and name, and are called frontal sinuses.

Should any one suppose the air during respiration to be impelled throughout these sinuses, I should not be much disposed to object. I will end this essay by pointing out the propriety, in similar researches, in order to understand the most interesting articulations of the body, of employing a recent subject, in which the bones are held together by their own peculiar ligaments. Experience has taught me that dissectors have often fallen into error, from want of a recent subject before them to examine and correct their notions.

In dried bones, for instance, deprived of their ligaments, any one would say, judging from the appearance of the head of the bone and the acetabulum, that a man could readily move the thigh bone in every direction, could flex, extend, adduct, or draw

one thigh to the other. Notwithstanding, I venture to assert, that it is most certain we have not the power of extending the femur, that is, to carry it behind the perpendicular line of the whole body. If we stand on one foot, and attempt to move the thigh behind the perpendicular line of the body, we find that we are altogether unable to accomplish it; and, if we appear at all to succeed, it is only in proportion as we bend the trunk forwards above the hip joint. The unequal thickness of the capsular ligament of the hip joint, and the peculiar disposition and insertion of this ligament into the neck of the femur, prevents the extension.

The capsular ligament below the psoas magnus and iliacus internus is very thin, and is thinnest behind, where it is covered by the quadratus femoris. But on the outer part, where the capsular ligament is thickest and densest, it does not go directly

downwards, but passes obliquely from the outer part of the brim of the acetabulum, and is inserted in the interior surface of the root of the neck of the thigh bone. On account of this insertion, as we attempt to carry the femur backwards, the anterior, which is firmer and denser than the posterior part, is strained to the utmost, and forcibly extended, preventing entirely the tension beyond the perpendicular line.

That this principally depends on the unequal thickness of the capsular ligament, is shown and proved by opening this ligamentous capsule on the side of the foramen ovale, and thence introducing a knife, so that the round ligament may be divided; nevertheless, although in the most recent subject, we cannot, perceptibly, move it backwards beyond the perpendicular line. How much these facts will assist in more clearly understanding the circumstances which, in health, pertain to the mechanism of standing, walking, leaping, or in disease,

to the diagnosis and removal of luxations of the thigh, it is unnecessary for me to point out to any one at all acquainted with the subject.

FINIS.

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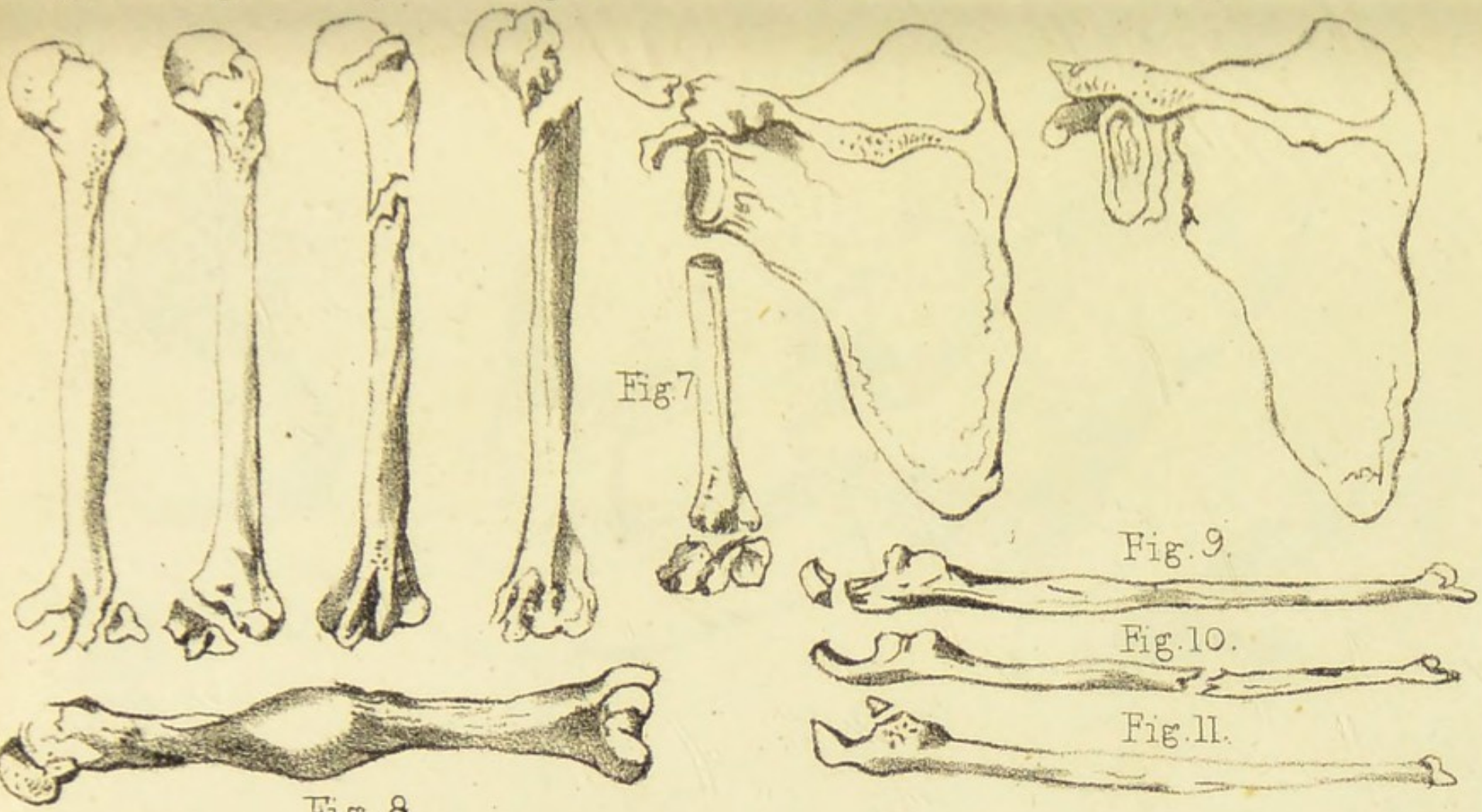

Fig. 7

Fig. 9.

Fig. 10.

Fig. 11.

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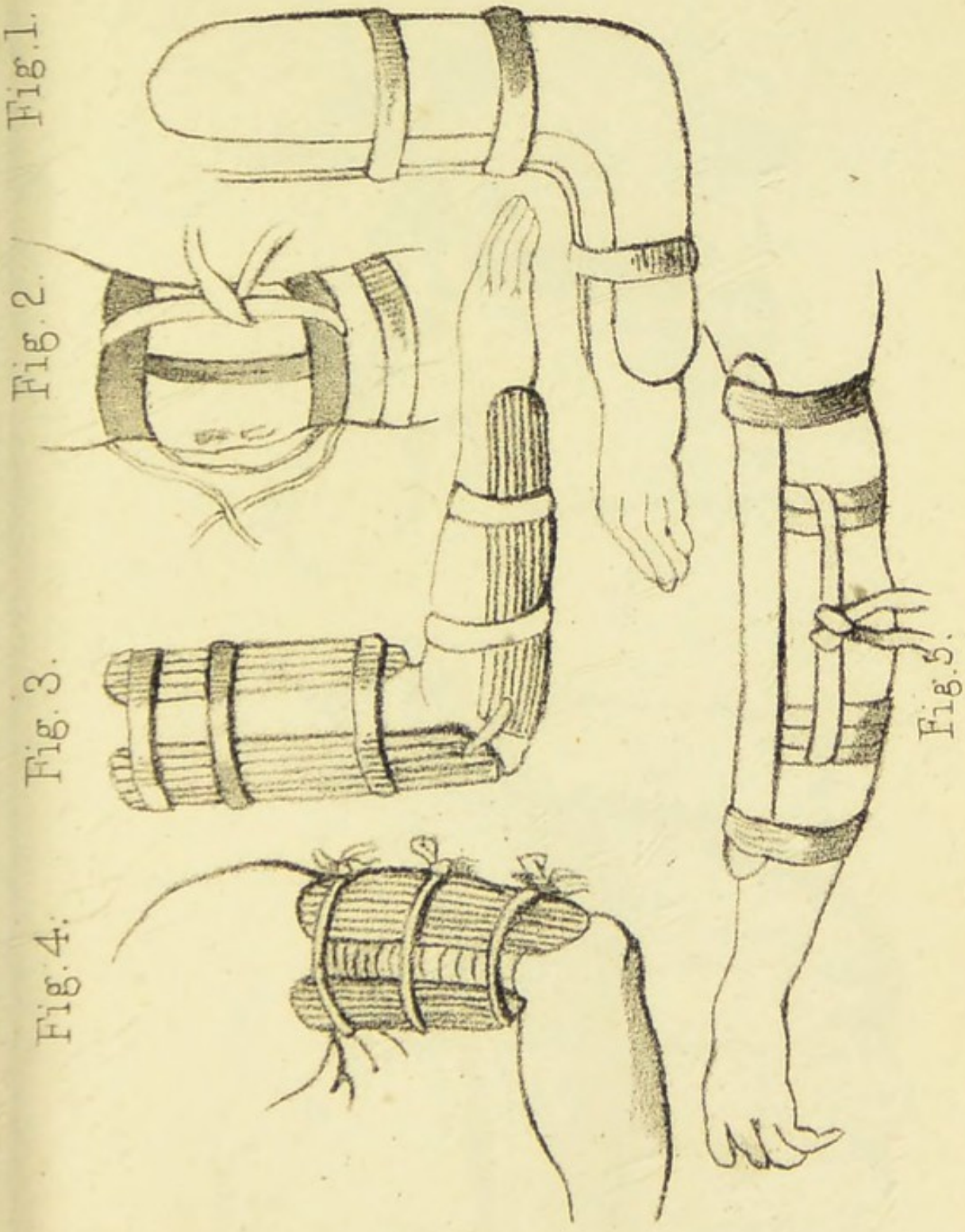

Fig. 1.

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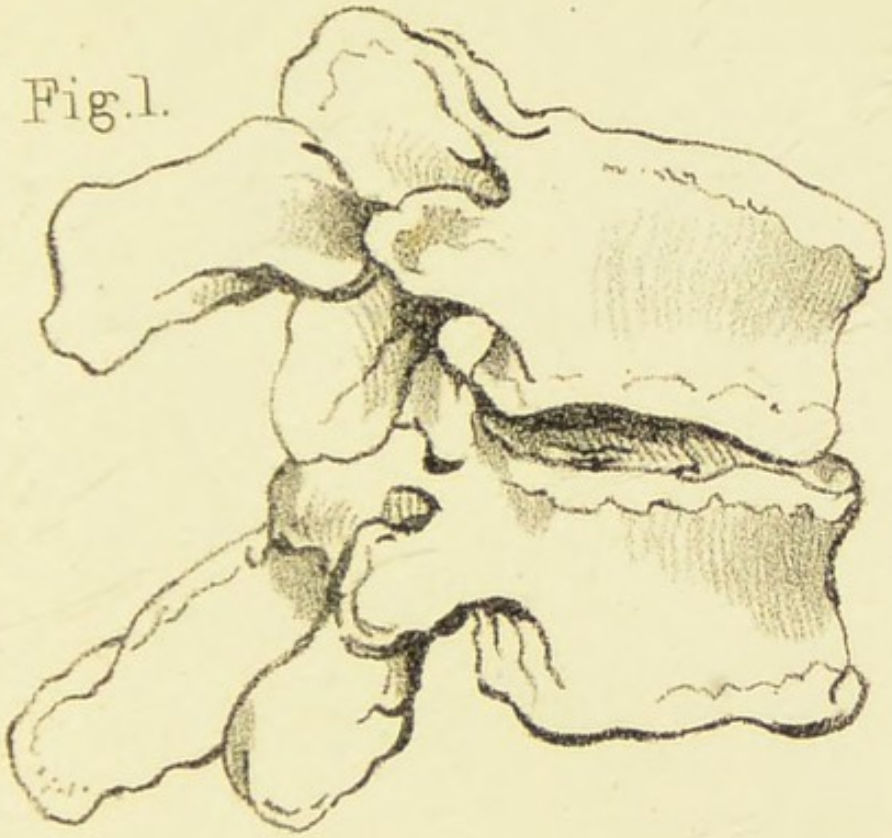

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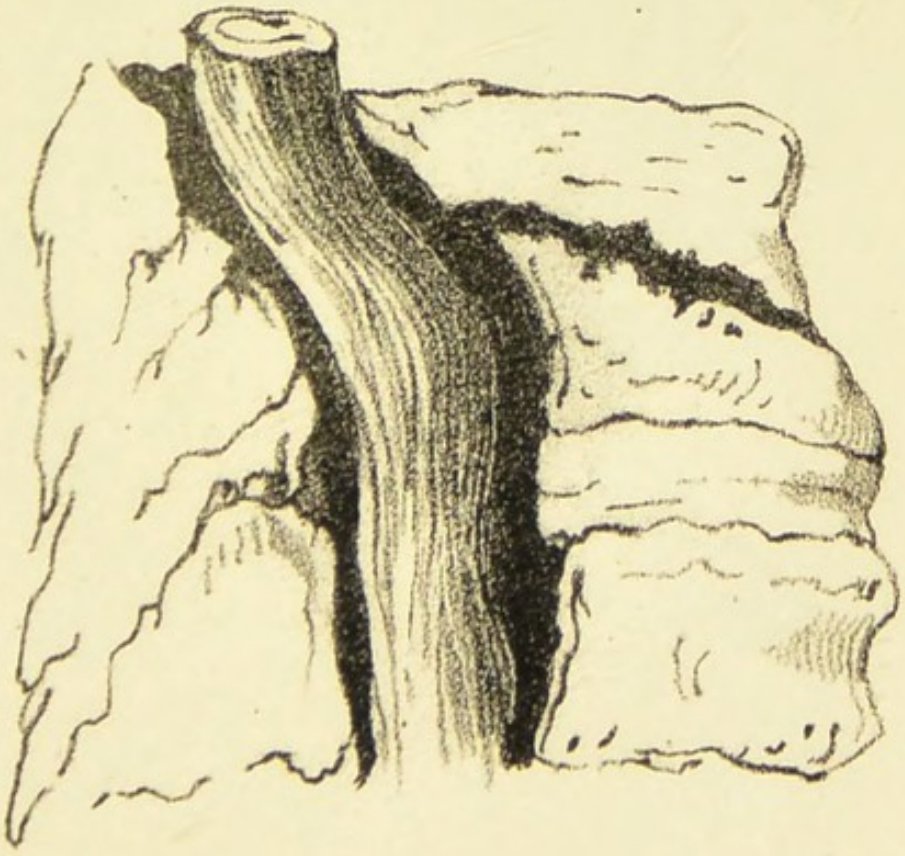

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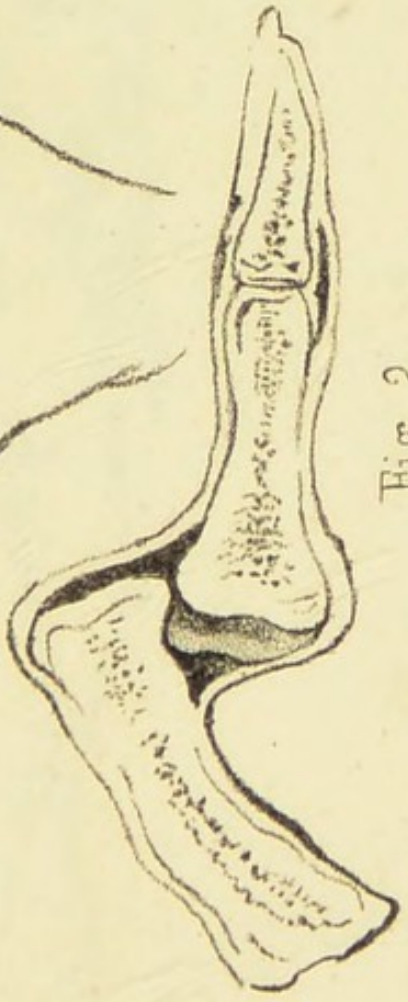


Fig. 2.

Upwards. Dorsum Ilii

Pl. 8

Fig. 1.

Downwards. Foramen Ovale

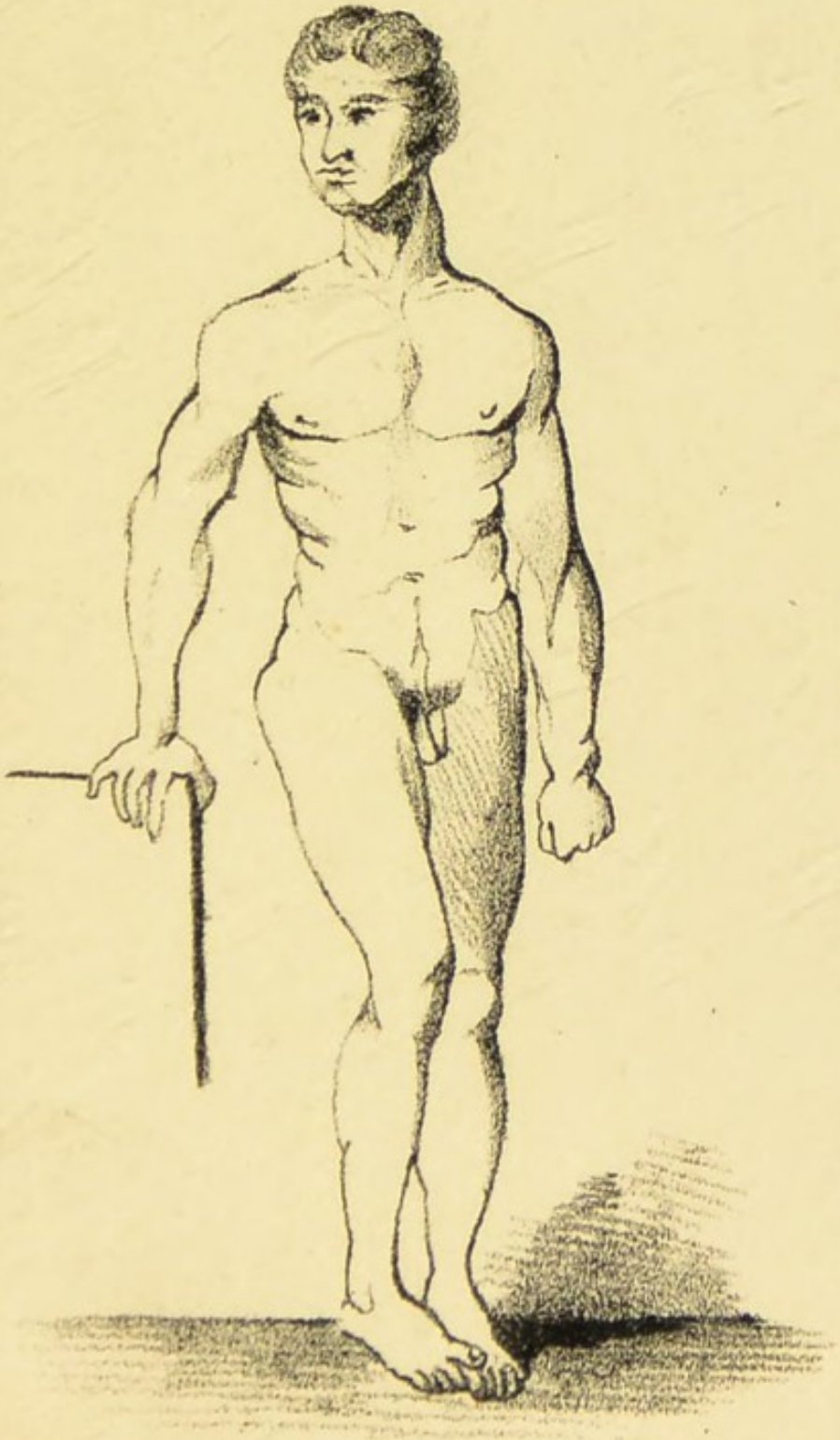
Pl. 8.

Fig. 2.

Ischiatic Notch

Pl. 9.

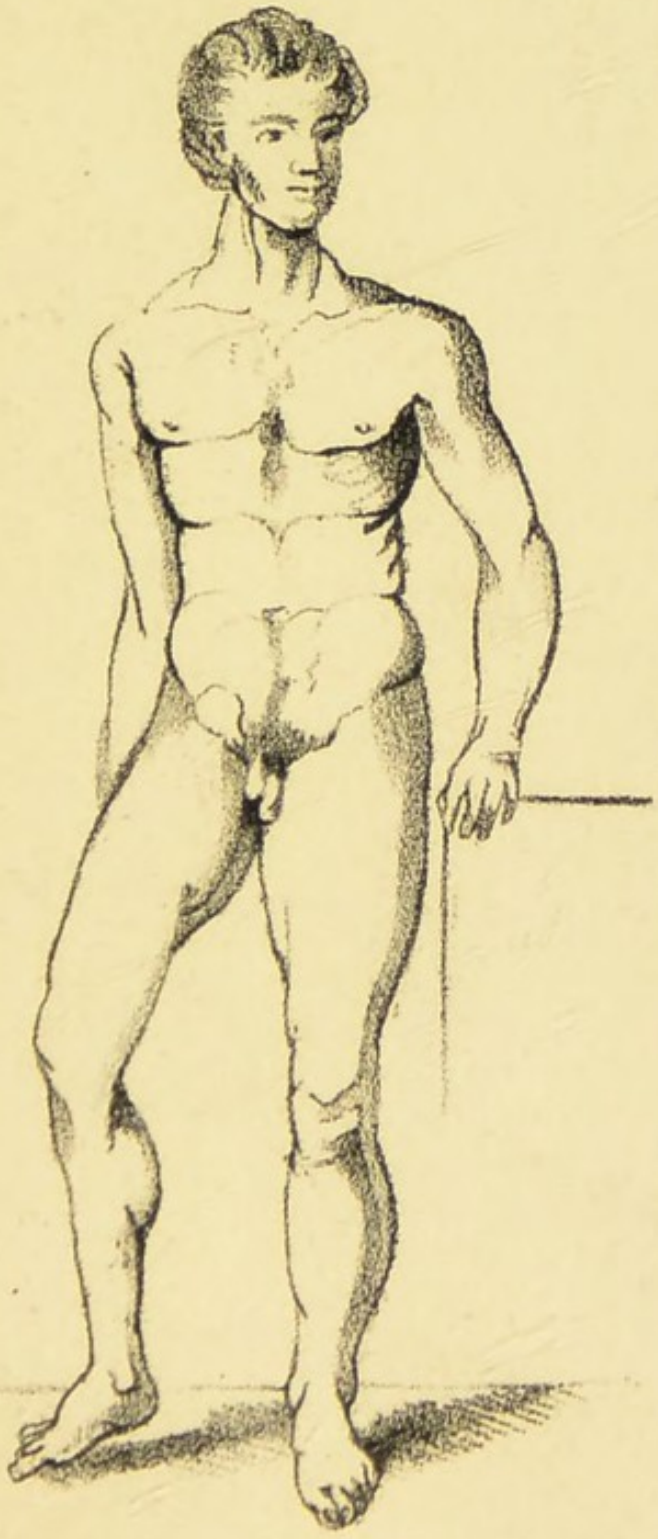
Fig. 3.



On the Pubis

Pl. 9.

Fig. 4.



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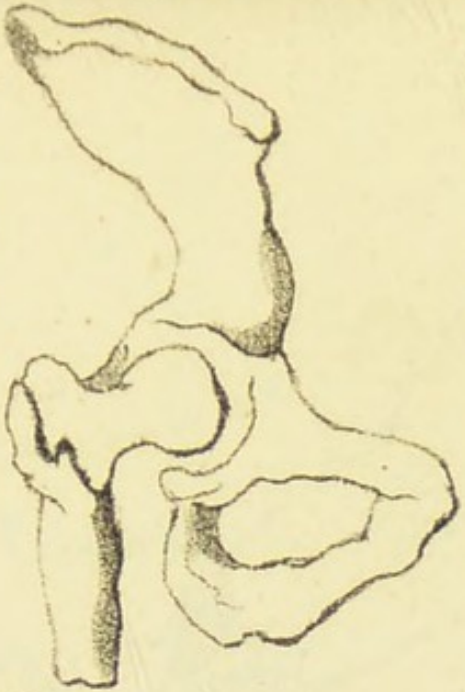

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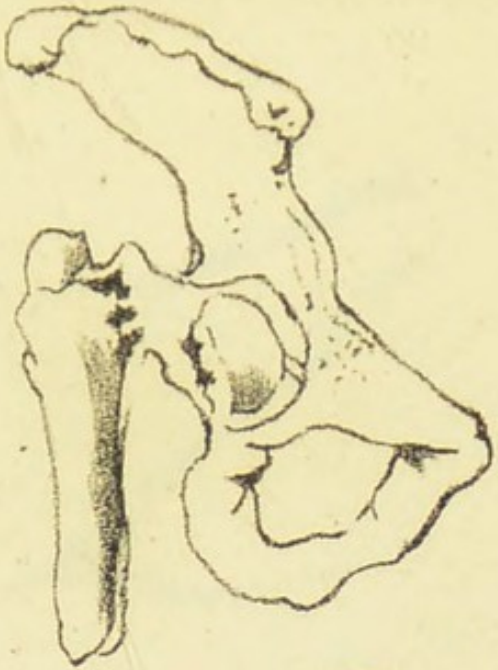

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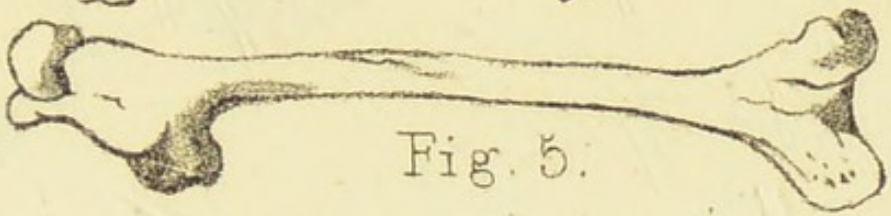

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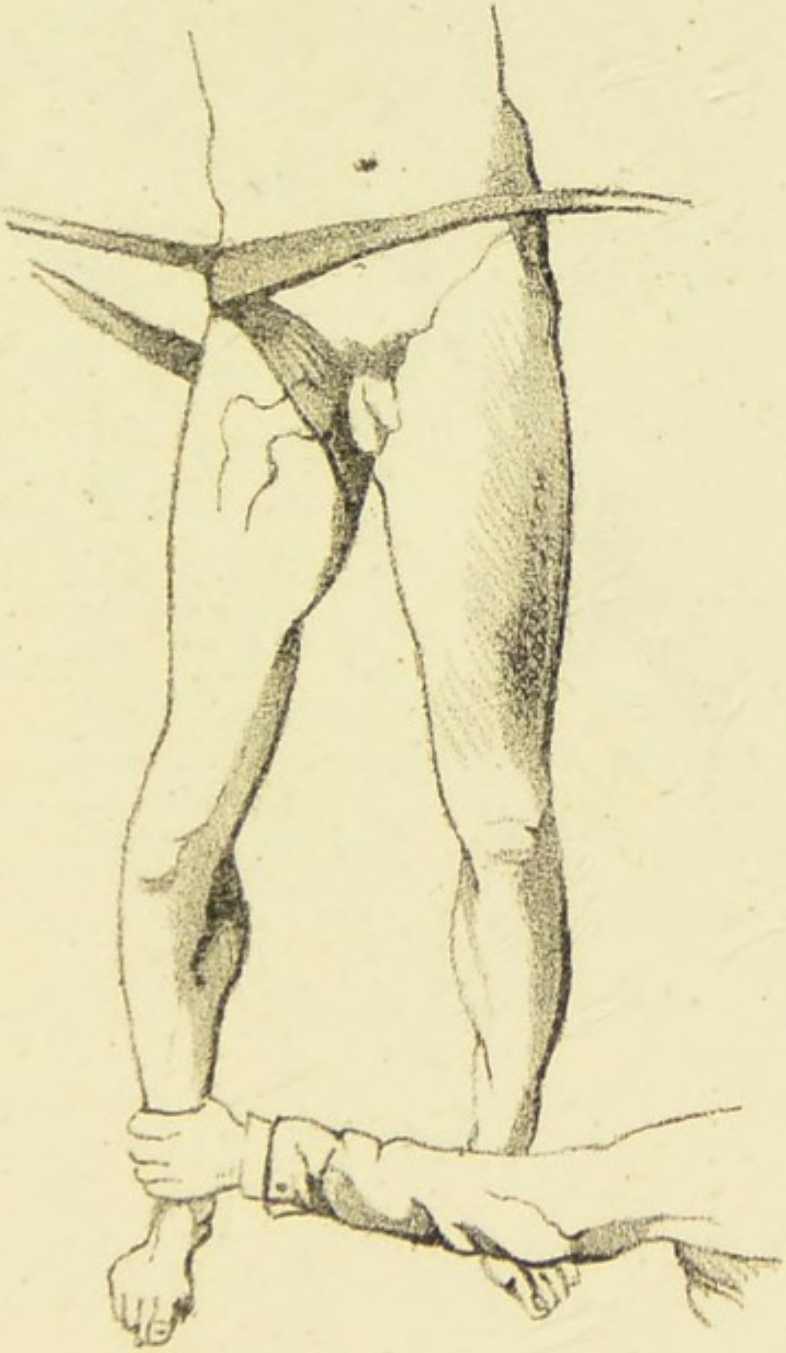

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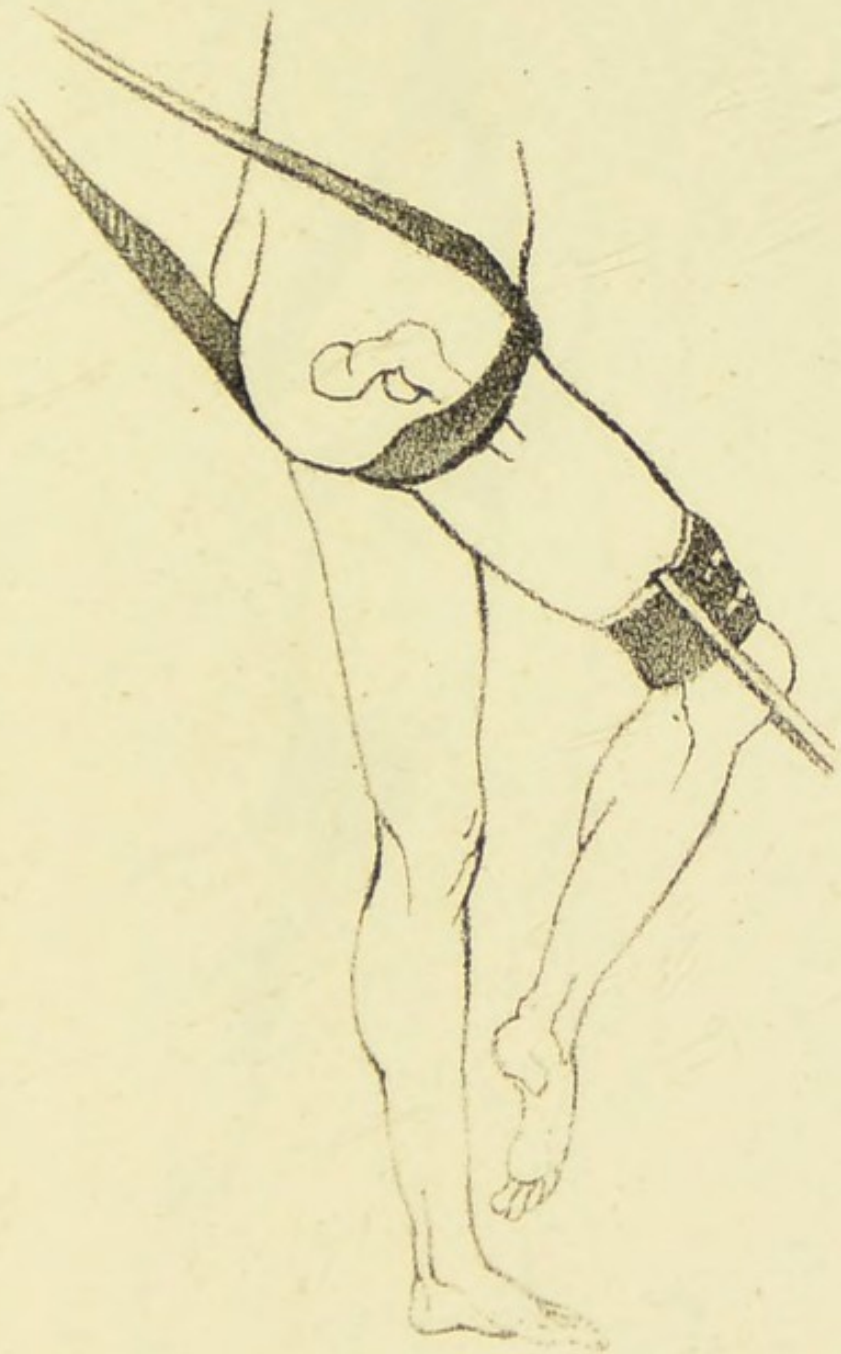

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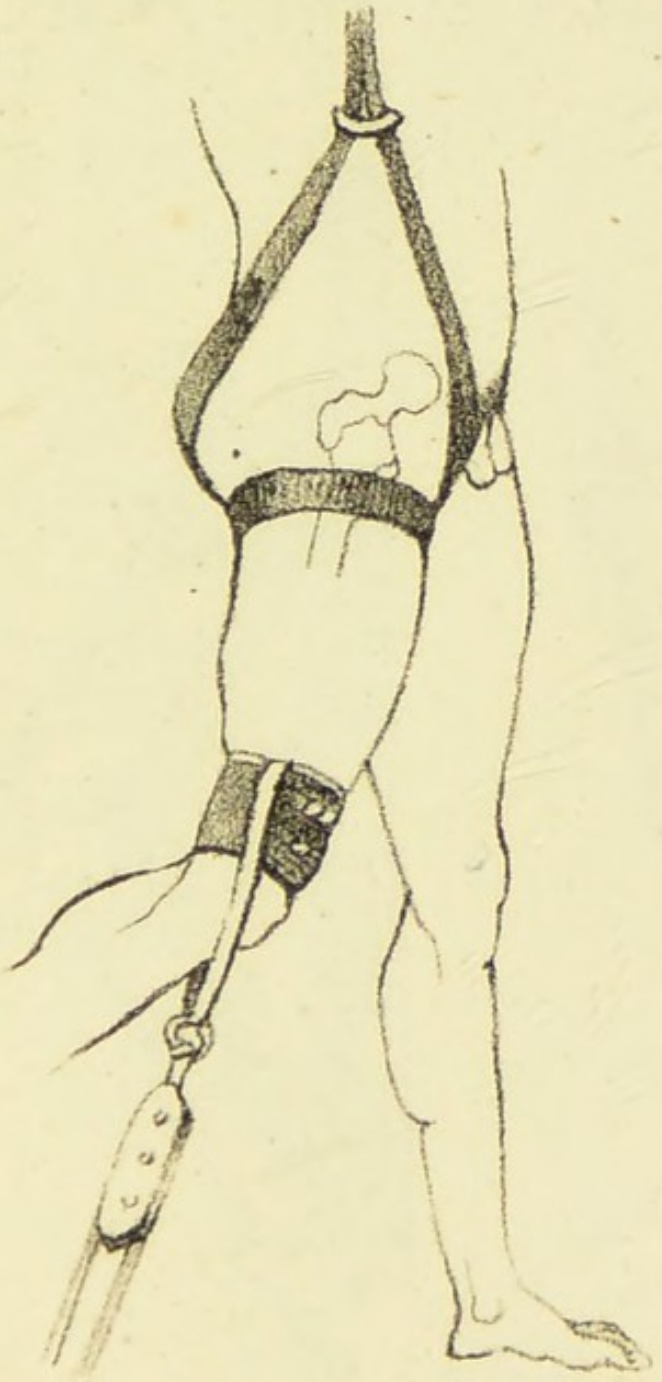

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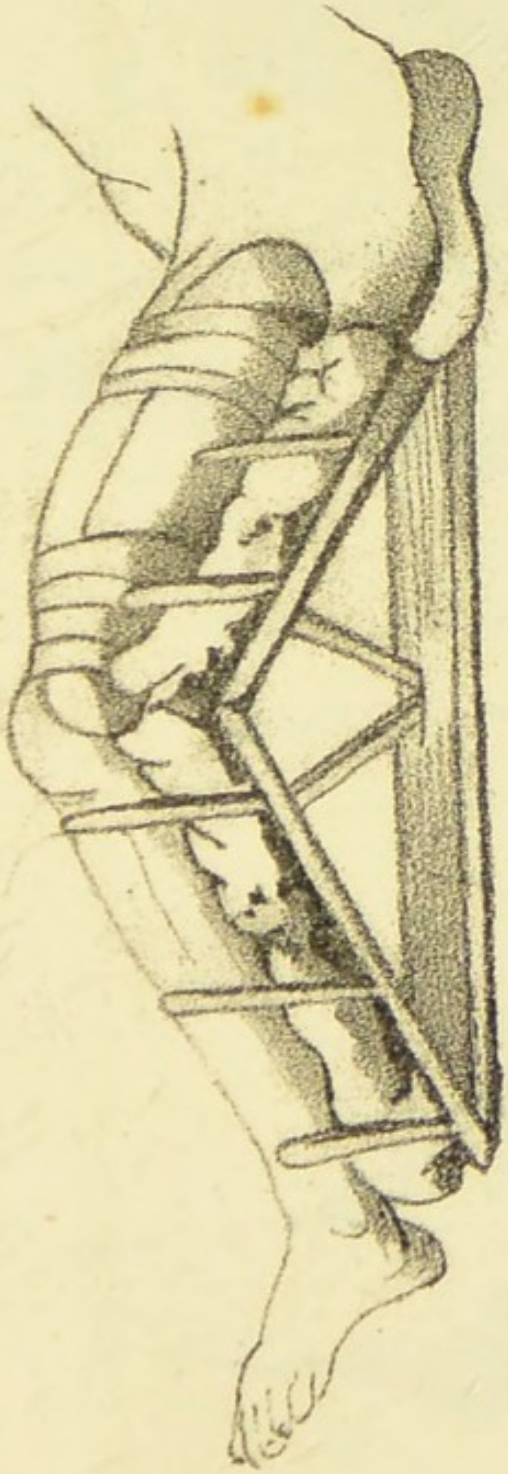

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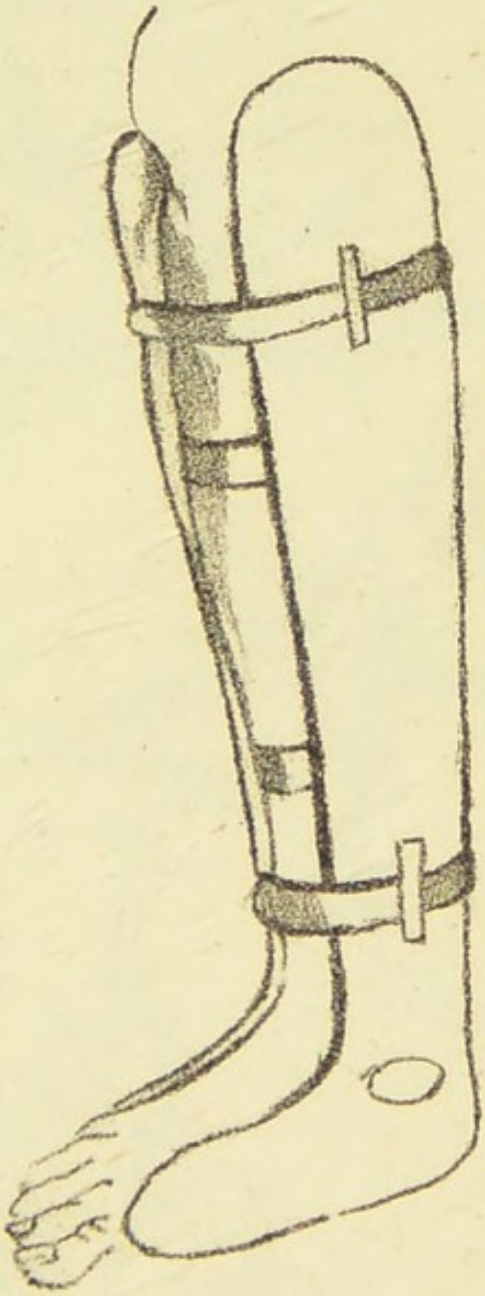

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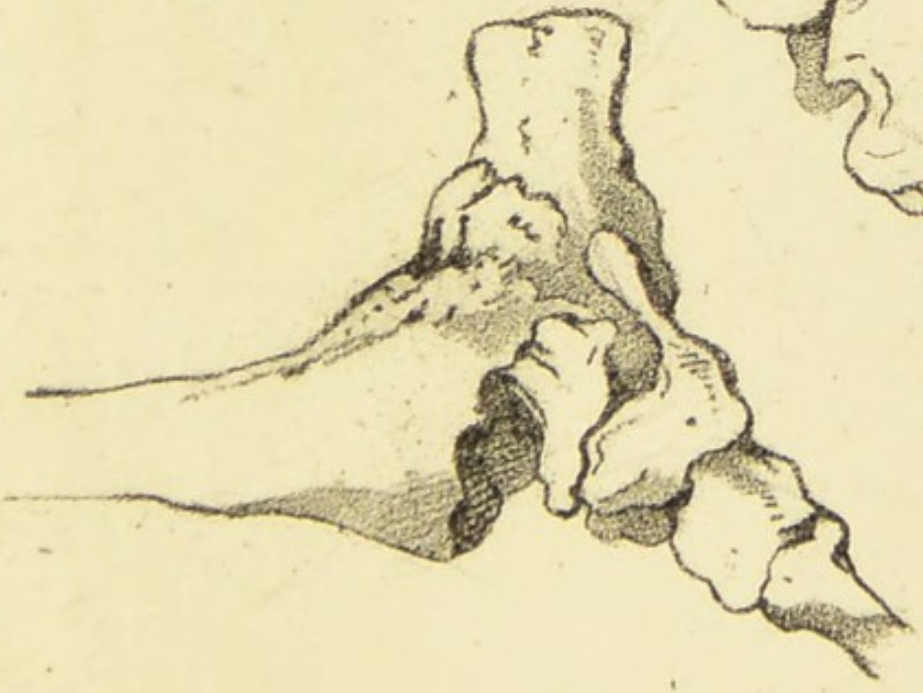

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