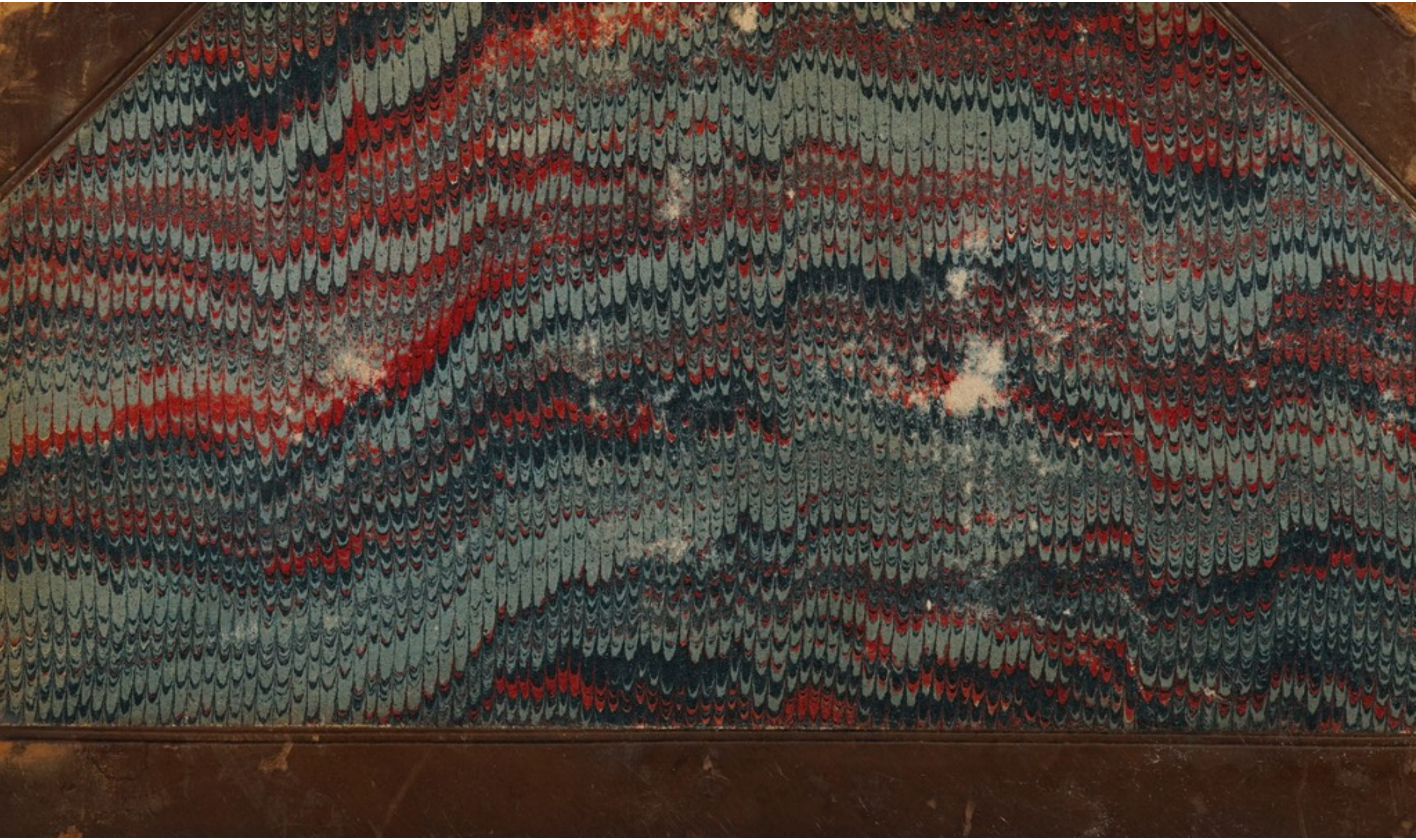
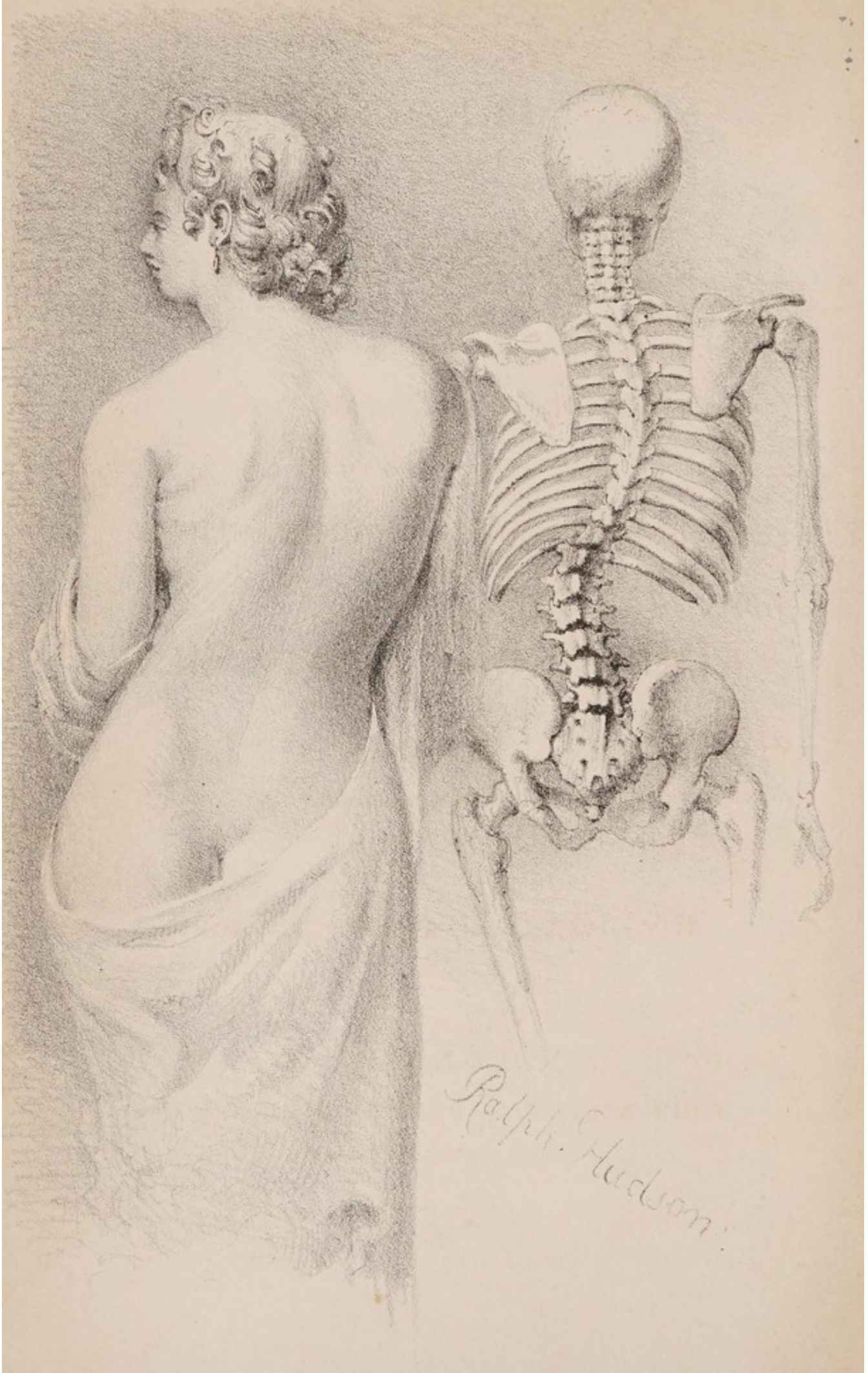
A treatise on deformities; exhibiting a concise view of the nature and treatment of the principal distortions and contractions of the limbs, joints, and spine / [Lionel John Beale].



TREATISE

ON

DEFORMITIES.


Ralph Hudson

A

TREATISE

ON

DEFORMITIES;

EXHIBITING

A CONCISE VIEW OF THE NATURE AND TREATMENT

OF THE PRINCIPAL

DISTORTIONS AND CONTRACTIONS

OF THE

LIMBS, JOINTS, AND SPINE.

ILLUSTRATED

WITH PLATES AND WOOD-CUTS.

By LIONEL J. BEALE, Surgeon.

LONDON:

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TO

ANTHONY WHITE, Esq.

AS

A SMALL TOKEN OF GRATITUDE

FOR

MANY VALUABLE PRECEPTS:

AND OF

HIGH RESPECT FOR THE TALENTS AND URBANITY,

WHICH

HAVE JUSTLY PLACED HIM AT THE SUMMIT OF

HIS PROFESSION,

THIS WORK IS INSCRIBED

BY HIS FORMER PUPIL,

THE AUTHOR.

31, Bedford Street, Covent Garden,
March 4th, 1830.

PREFACE.

My attention having been directed to the subject of Deformities, I was surprised to find that there was no work in the English language, which professed to treat generally of these maladies. We have some excellent works on particular varieties of spinal distortion, but with regard to deformities of the limbs, excepting a few scattered papers in our periodicals, I can find no good description of these maladies, nor is there any English writer on surgery, who enters into a detailed account of their nature and treatment. Even in our Dictionaries and elementary works on surgery, the subject is barely noticed. Of late years, several eminent continental surgeons, have interested

themselves in these truly surgical maladies, and I have collected much valuable matter from their writings. How far I may have accomplished the task I have undertaken, of bringing together and condensing the observations which have been recorded, on the subject of distortions, in the writings of various authors, I must leave others to judge. I have endeavoured, by consulting all the books I could find, connected with the subject, together with some experience of my own, to give a concise account of the nature and treatment of the principal deformities, to which the human frame is liable.

Much unfounded prejudice prevails among English surgeons, with regard to the employment of mechanical apparatus in the treatment of distortions of the limbs: certain it is, that many cannot be removed without such means, and the impressions entertained against their utility are quite unaccountable. To those

who have any doubt of the efficiency of instruments in producing a change in the form of limbs, I beg to recommend the perusal of Mr. Bransby Cooper's account of the osteology of a Chinese woman's foot, in the Philosophical Transactions for the present year. In the beautiful engraving of the bones, with which the paper is illustrated, the os calcis will be seen completely reversed in its position, for instead of its long diameter being horizontal, it has become quite vertical, in the same axis with the tibia, and does not extend posteriorly from this bone, the heel being perpendicular to the back part of the leg. All the other bones of the foot will be found distorted. Now, if such deviations may be effected contrary to Nature, we may confidently apply mechanism to place parts in those situations which Nature intended they should occupy.

Although this branch of surgery has been strangely neglected and committed to the

hands of mechanics, it is nevertheless one of great importance, when we consider the influence which civilization, and the aggregation of mankind in large towns, have on the human form. It is quite evident, that the farther we are removed from a state of nature, the more numerous do cases of congenital deformity become. Animals in a wild state very rarely indeed produce monstrosities, and those which have been long domesticated and have completely relinquished their natural habits, present the most frequent instances of malformation. Dogs, cats, and the domestic fowls, more especially illustrate the truth of these observations.

If we would prevent the increase of deformities among our children, we must pay more attention to their physical education, than has been the fashion in this country. Nor need we apprehend, that more attention

to physical, will interfere with mental improvement: on the contrary, if the body is sound, the mind will more readily receive good impressions, than under opposite circumstances. The instances which occur of powerful and intelligent minds, connected with feeble and debilitated corporeal frames, are but exceptions to the general rule. For a corroboration of this opinion we need only refer to the patriots and philosophers of Athens and Rome, who were at least equal in intellectual capacity, to the less vigorous denizens of any modern state.

The following is a list of the principal works on the subject of Deformities; to many of which I am indebted for hints and extracts.

Andry de l'Orthopédie, 1741.
Le Vacher de la Feutrie, Traité du Rakitis, ou l'Art de Redresser les Enfans Contrefait, 1772.
Pott's Works, Vol. 3.
Petit Maladies des Os.
Portal, Observations sur la Rachitisme.

Palleta Exercitationes Chirurgicæ.
Desbordeaux Nouvelle Orthopedie.
Scarpa, Memoria sui Piedi Torti.—This has been translated by Mr. Wishart of Edinburgh.
Baynton on the Spine.
Copeland on the Spine.
Wilson's Lectures on the Skeleton.
Brodie on the Joints.
Bell on Injuries of the Spine.
Shaw on Distortions of the Spine.
Jarrold on Curvatures of the Spine.
Dr. Dods on Rotated, or Contorted Spine.
Ward on Distortions.
Bampfield on Diseases of the Spine.
Wenzel über die Krankheiten am Rückgrathe.
Iörg Ueber die Verkrummungen.
Dr. Harrison on Spinal Diseases.
Pravaz des Deviations de la Colonne Vertebrale.
Delpech de l'Orthomorphie.
Lafond sur les Principales Difformités.
Cruveilheir Anatomie Pathologique.
Encyclopédie Methodique, Art. Orthopedique.
Dublin Hospital Reports, Vol. I.
Gerdy sur les Bandages.
Dictionnaire des Sciences Médicales, Art. Orthopédique, et Pied-bot.

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TREATISE ON DEFORMITIES,

&c. &c.

INTRODUCTION.

Of the Formation and Growth of Bone. Of Cartilage. Of Ligaments. Of the Skeleton. Structure of the Foot. Structure of the Vertebral Column. Of the Muscles.

OF THE FORMATION AND GROWTH OF BONE.

BONE is composed of two substances, independent of the blood, marrow, and membranes contained in it. One of these is animal jelly, or gelatine, which forms the basis, or primary rudiment; the other is an earthy substance, composed of phosphoric acid and lime.

In the embryo, the situation of the bones is first pointed out, by a more dense state of the mucus, or gelatinous matter, of which the infant animal at this period consists. This element of bone gradually hardens into gristle, or cartilage. As the fœtus grows, the earthy salt, or phosphate of lime, is de-

posited in the cartilage, and is arranged in it by fibres, which extend from one, or many common centres, in each bone. The fibres are divergent in flat bones, and parallel in long ones. As a general rule, it may be said, that the organization of those parts, is most promptly finished, which are first called into use: thus, the bones of the ear, are perfect at birth, in all animals.

The tissue of the bones differs in different animals; it is fine in man, more gross in quadrupeds, relaxed and rude in the cetacea, thin, firm, and elastic in birds. Marine animals, as seals, cetacea and tortoises, have no medullary cavity in their bones, whilst the cavities in the bones of birds are large, but without marrow.

The bones are soft and flexible, in young animals, acquire hardness and rigidity, as growth ceases, and become fragile in old age. Cartilaginous fishes, as rays, sharks, &c. are said to grow all their life, no stop being put to their extension, by the solidity of the skeleton, as in other animals. The slower the process of ossification in an animal, the longer is the period of its growth and life, since, as the organization becomes rigid, the vital functions are carried on with increasing difficulty.

The degree of hardness, is greater in some bones than in others, and varies in the different parts of the same bone. Where it is considerable, there is more of earthy matter, and more of animal sub-

stance, where it is less so. Soft bones, having more animal matter, are more vascular than harder bones. The bones of young growing animals, possessing more vessels than those of full grown animals, are therefore softer.

The strength, thickness, and muscular impressions of bones, differ in skeletons of the same height. In women, and men of inactive lives, the bones have a less degree of these qualities, than those whose lives have been active and laborious.

The phenomena of the formation and growth of the antlers of the stag kind, are perfectly analogous to ossification in the bodies of animals, for the antler is a true bone.

The bones from the frame-work of the animal system, support and defend the more important organs. They offer most resistance to external influences, remaining unchanged for ages: their imperishable nature bearing records even of the antediluvian world.

The form of the future bone, is represented in the fœtus by cartilage, the vessels of which gradually enlarge until they are capable of carrying the red globules of the blood, when ossification begins. The arteries increase, and form a complete network, at the centre of ossification, from which fibres proceed, according to the intended form of the bone. The bone is first red, but as the earthy matter increases, the number of vessels diminish, the centre

assumes a white or yellow hue, the redness retreating to the ends of the bone, and entirely going off, as this acquires its full development. As ossification proceeds, it buries the vessels by which it was formed, the appearance of vascularity being entirely concealed, by the hardness and density of the bony fibres. The great vascularity of the living bone, may be familiarly illustrated, by holding the hand before a strong light, when the phalanges of the fingers appear perfectly transparent. This is also seen in preparations of injected bones, where the earthy matter having been removed, by maceration in acid, leaves the gelatine traversed by vessels, in such profusion, that it may bear comparison in point of vascularity, with any of the softer parts of the body.

The quantity of osseous matter in the bones at the time of birth, is only sufficient to give them firmness, without preventing flexibility, and thus the fœtus is better fitted to pass through the pelvis, than it would be if ossification was more perfect.

The heads of the long bones are, in all young animals, separated from the shaft by cartilage; in the human subject, they are not consolidated before the age of 15 or 20. The structure of these parts is always more spongy than the rest of the bone, and, in rickety and scrophulous children, they exhibit to the experienced eye, early indications of disease.

Bone is a secretion from the blood; it contains in

its structure arteries for nutrition, and absorbents for the removal of worn-out particles, like other parts of the frame. Health depends on the regular deposition, absorption, moulding, and forming of parts. Nothing can be more worthy our admiration than the continual renovation and change of particles, even in the hardest bone. Changes, which we conjecture by fair analogy with respect to the soft parts, we know by direct experiment to occur in the bones. It was by accident discovered, that animals, fed on the refuse of madder, employed by dyers, had their bones tinged of a deep red colour. This led to experiments, and it was found, that when madder was given to animals, withheld for some time, and then given again, the colour appears in the bones, and goes away with such rapidity, as proves a deposition and absorption truly wonderful. All the bones are tinged in twenty-four hours, in two or three days the colour becomes very deep, and if the food be changed, in a few days the red colour will be entirely removed. By the microscope it was easy to distinguish, that the colour was mixed with the bony structure only, the vessels, like those of the rest of the body, having no tinge. The earthy matter, which constitutes the hardness and all the useful properties of bone, is dead and inorganic; it lies in the interstices of the gelatine, which gives it consistence and strength. In a broken limb, there is first a thin effusion, then a tremulous jelly, then radiating

vessels, then ossifying spots, which running together form perfect bone. During all the process of ossification, the absorbents proportion their action to the stimulus which is applied to them : they carry away the serous fluid when jelly is deposited, they remove the jelly as bone is secreted, they afterwards continue to remove the bony particles, as new ones are deposited by the arteries.

Bones are supplied with nerves, as well as with arteries and absorbents, they usually pass in with the nutrient vessels, and yet bone is quite insensible. We suffer no pain when periosteum is scraped from the bone, nor when the bone is sawed in amputation ; even the actual cautery produces but a slight feeling of itching and heat. In a healthy state, these nerves appear to send no sensations to the brain ; but when bone is inflamed, its sensibility is roused. Soft parts have their sensibility increased by disease; so bones, ligaments, and cartilages, all parts which in health have very obscure feelings, are roused to a degree of sensibility even exceeding that of other parts. There is no pain greater than that of a wounded joint.

Ossification, which begins in the human embryo seven or eight weeks after conception, is at first rapid, but advances more slowly after birth, and is not completed before the twentieth year. It is forwarded by health and strength; retarded by weakness and disease. In scrophulous children, it is imperfectly

carried on; their bones are spongy and soft, and often incapable of supporting the weight of their bodies.

The process of ossification differs, according to the form of the bone. In the long bones there is one central ring first ossified; the body extends towards either head; the heads, ossifying each in its centre, extend towards the shaft, but they are not completely united before the twentieth year; about which time the body, heads, and processes, are finally consolidated into one bone. In flat bones, ossification begins at one, or more central points, and the radiating fibres join the radii of other ossifying points, or meet the edges of the next bone. The thick round bones of the wrist and tarsus, have each an ossifying point in their centre, which is surrounded by cartilage. The processes of bones are generally distinct ossifications, afterwards united to the bone, in the same manner as the heads. There is no distinction between the heads and body of the bone, while it is in a cartilaginous state: they appear as separate parts at that stage when the body is ossified, and each of the heads beginning to form, they continue as three distinct bones, during all the early part of life, and are easily separated by maceration.

In the original cartilage, there is no cavity; this begins to appear with ossification: as ossification proceeds in the long bones, a cylinder is formed,

which in young subjects is filled with a reddish serous fluid, and in adults with marrow. The use of the marrow has not been determined: in herbivorous animals it is hard when cold, but always remains fluid in those which are carnivorous: it is contained in fine membranous cells. The branches of arteries ramify on these cells as well as the internal periosteum. In the centre of long bones the cavity is almost circular, the bone is very solid, and its fibrous matter condensed; but at the extremities the cavity is irregular, and intersected with shoots of bone across it, forming a complicated net-work. The ends of bones are always of a more spongy texture than the shafts; where, although the bone is smaller, the substance is so much more condensed, that an equal length of the two parts will be found of nearly equal weight. This spongy reticulated structure of the ends of bone, consists of what have been termed cancelli, these are lined with a delicate membrane, and this membrane covers every division of the lattice-work, forming each cell into a distinct cavity.

The bones are every where covered with a tough fibrous membrane, called periosteum; it adheres closely to the bone, communicates with it by innumerable vessels, and forms a medium of attachment for the soft parts, all the muscles being inserted into it, either directly, or by tendons, and not into the bone itself.

Thus we find no essential difference of organization in bones, and in the softer parts of the body: in every bone there exists arteries for the deposition, and absorbents for the removal of the earthy and gelatinous matter, which constitute it; cellular substance for the connexion of its parts, and nerves to animate the whole. Bony fibres are formed and renovated, undergo change and removal in the same manner, and from the same causes as other parts. The extraordinary alterations of form in the bones of the cranium, is a fact too well established to admit of doubt. Models have been taken of the form of the cranium of the same individual at different ages, and the changes have been found to be very remarkable: nor is this alteration of form confined to the period of growth, for after that has long terminated, the form of the bones of the cranium will continue to change. How far this alteration depends on growth of brain we shall not here discuss, but however we may doubt many of the general conclusions of the phrenologists, we must acknowledge to them a debt of gratitude, for the establishment of this, and many other interesting facts.

The articulating extremities of the bones, are in every instance covered with a thin crust of cartilage, having its surface most exquisitely polished, by which all friction is avoided, the ends of the bones glide over each other with facility, and suffer less

from jars than they would do without the covering of this elastic substance.

Cartilage is a semi-pellucid substance, holding a middle rank in point of firmness, between bone and other parts of the frame. When cut, its texture appears homogeneous; there are no cells, cavities, or pores, but it resembles in section, a piece of glue. It is very elastic, and on this account, it enters into the formation of all parts, the functions of which require a combination of firmness, with pliancy and flexibility, the preservation of a certain external form, with the faculty of yielding to external force, or pressure.

Cartilage is covered by a membrane similar in texture and appearance to periosteum: nutrient vessels are supplied by its intervention. Absorbents cannot be demonstrated in cartilage, but their existence is proved by many phenomena, as the conversion of cartilage into bone, and the removal of this substance in diseased joints. All the bones, except the teeth, are formed in a nidus of cartilage.

The bones are tied together by strong unyielding cords and membranes, called ligaments: these keep the surfaces of joints in proper apposition, and restrict their motions to certain directions. The internal surface of the capsular ligaments is lined with a membrane, which secretes a fluid called synovia, calculated to promote facility of motion, and obviate friction.

There is a peculiar substance, partaking of the properties of both cartilage and ligament, placed between the bodies of the bones of the spine, which permits a sufficiency of motion of the vertebral column, without weakening the support it is destined to afford to the upper parts of the body in general, and to the head in particular. These fibro-cartilages give to the spine a high degree of elasticity, by which the concussion of any violent motion is weakened or destroyed, before it can be communicated to the head.

OF THE SKELETON.

The skeleton is the frame work, serving for the support and protection of the soft parts of animals. In man and in the higher classes of animals, it is symmetric, the two sides of the mesial line being exactly similar. The skeleton is divided into three parts; head, trunk, and extremities. The head consists of cranium and face. The trunk is divided into vertebral column, thorax, and pelvis. The spine is a column of bones called vertebræ, piled on each other, and united together by fibro-cartilages. It is divided into the regions of neck, back, loins, sacrum, and coccyx, which last, in quadrupeds, is prolonged into a tail.

The bones of the chest consist of a sternum and twenty-four ribs, twelve on each side. The sternum

placed in front of the chest, is a flat bone, which in youth consists of several pieces: the ribs are all articulated with the vertebræ of the back, form an irregular circle forwards, and, with the exception of two, are united to the sternum by cartilages.

The pelvis is formed by the iliac or haunch bones, the sacrum, and the coccyx.

The upper extremity consists of the clavicle and scapula, or shoulder-bones; the humerus, or arm-bone; the radius and ulna, or bones of the fore-arm; the eight small bones of the carpus or wrist; the five metacarpal bones; and the phalanges of the fingers.

The bones of the lower extremity are analogous. The femur, or thigh-bone, articulated with the pelvis; the tibia and fibula, forming the leg; the patella, or knee-cap: the foot is formed by the seven bones of the tarsus, the five metatarsal bones, and the phalanges of the toes. The bones of the tarsus are the astragalus, to which the leg is articulated, the calcis or heel-bone, the scaphoides or naviculare, the cuboides, and the three cuneiform, or wedge-like bones. We shall often have occasion to refer to these bones in speaking of club-foot.

There are no less than twenty-six bones in the human foot, and almost as many joints. Each articulation is covered with cartilage, the surface of which is smooth: there is a delicate membrane from bone to bone, secreting a lubricating fluid. Exter-

nal to this, we find strong ligaments, from point to point of the bones, binding them together, without preventing proper motion. We may imagine the spring and elasticity of twenty-six bones thus united.

In walking, the heel first touches the ground. If the bones of the leg had been perpendicular over that part of the foot which first touches the ground, we should come down with a sudden jolt, instead of which we descend in a semicircle, of which the point of the heel is the centre.

The number of parts which constitute the foot, prevent any violent shock to the frame, in the various kinds of action in which it may be used. In leaping, we endeavour to alight on the toes, in order to break the force of the fall, by dividing it among the numerous articulations of the tarsus and metatarsus. When the entire sole of the foot strikes the ground, in falls, it is not a very uncommon occurrence to have the neck of the thigh-bone fractured, in consequence of the succussion not being arrested by the small bones of the foot.

As the vertebral column is the seat of the principal deformities of the human frame, it will be proper to dwell on its structure with some minuteness.

The spine is composed of numerous bones, but from their compactness and continuity it is spoken of as a single bone, and acquires its common name from the ridge formed by projecting parts of each

vertebra. There are twenty-four of these small bones: they support the whole weight of the head, arms, and trunk; by their combined motion, the turnings and bendings of the body are principally performed; and in their centre is a canal, containing that elongation of the brain, which distributes, through the medium of the nerves, sensation and motion to most parts of the body.

There are seven vertebræ of the neck, twelve of the back, and five of the loins. The bodies of the lowest vertebræ are large and broad, they gradually decrease in size up to the neck, and the whole forms a lengthened pyramid. The lumbar vertebræ have large bodies and thick interstitial cartilages, their processes afford space for the attachment of very powerful muscles, they bear the whole weight, and perform the chief motions of the body. The vertebræ of the back have smaller interstitial cartilages, their spinous processes fall one over the other, their articulations are very limited, each rib is attached to the body of one, and the transverse process of the next dorsal vertebræ; so that Nature has here much restricted motion. The vertebræ of the neck, having less weight to support, have smaller bodies, and their articulations permit considerable motion. The first and second cervical vertebræ differ much from the rest, there is no fibro-cartilage between them, the second has a vertical process designed for the rotatory motions of the head, the articulation be-

tween the head and the atlas permitting only a hinge-like motion. Perhaps there is no instance more illustrative of design, than the structure of the two first vertebræ, their connexion with each other, and with the head.

The conjoined vertebræ form a large canal, through which the spinal marrow passes, giving off nerves as it proceeds, to all the lower parts of the body; these nerves pass out in pairs, through holes formed by the junction of two vertebræ.

The intervertebral substance, which is interposed between the vertebræ, may be compared to gum elastic; it readily yields to whichever side we may have occasion to turn, and in a moment recovers itself. During the day, it gradually sinks under the pressure of its burden, and we are said to be an inch shorter at night than when we rise in the morning. In old age we are shorter than in youth, and it is by the yielding and condensation of this substance, that the bent back of senility is produced. The bones of the spine are also kept together by many strong ligaments. The anterior vertebral ligament connects the fore part of the bodies, and extends from the neck to the upper part of the sacrum; it is narrow in the neck, broader in the back and loins. In this ligament there are three sets of fibres, the superficial, fixed superiorly to the body, or fibro-cartilage of one vertebra; and, inferiorly, to the

body or fibro-cartilage of the fourth or fifth beneath: the middle fibres extend from one vertebra or fibro-cartilage to the third beneath; and the deeper ones extend from one vertebra to the next. The posterior vertebral ligament is within the medullary canal, at the back part of the bodies of the vertebræ, and is similarly distributed to the anterior. The articulating processes are connected by capsular ligaments. The plates of the vertebræ are united by the yellow ligaments, each inserted above, into the inner surface of the superior plate, and below, into the upper border of the inferior plate: these ligaments are formed of dense yellow fibres, elastic and resistant: they complete the vertebral canal posteriorly, by filling up the vacancies between the several bones. The spinous processes are connected by the inter-spinous ligaments; these occupy, in the dorsal and lumbar regions, the intervals of the processes; they are wanting in the neck: the supra-spinous ligaments extend from the summit of one spinous process to that of another, in the whole line, from the seventh cervical vertebra, to the middle crest of the sacrum.

The intervertebral substance being composed of concentric laminæ, dense and elastic towards the exterior, very much softer towards the centre, where it becomes a soft pulpy tissue, a kind of motion is permitted between each vertebra, similar to that which would be produced by a spherical body and

an exactly correspondent cavity: and there would be much greater latitude of motion, were it not controlled by the yellow, and other ligaments.

Such are some of the means, employed by Nature, in the construction of this most important part of the animal frame, for we have not yet mentioned the muscles, which contribute to the establishment of this beautiful chain of joints. Various difficult, and almost inconsistent offices, were to be executed by the vertebral column. It was required to be firm, yet flexible; firm, to support the erect position of the body; flexible, to permit the trunk to be bent in every degree of curvature. It was also to contain a cavity, to contain and defend an essential part of the nervous system, the spinal brain, a substance not only of the first necessity to sensation and motion, but of a nature so delicate and tender, and so impatient of injury, that the smallest unnatural pressure, or any considerable obstruction in its course, will produce paralysis or death. It was also to furnish a basis for the insertion of the important muscles spread over the trunk, and also to form a support for the ribs.

The breadth of the bases of the several bones, and the closeness of their junction, give the chain its firmness and stability; the number of parts, and frequency of joints, its flexibility. The flexibility varies in different parts of the column; is least in the back, where strength, more than flexure, was

required; greater in the loins, and greatest of all in the neck, to allow the free motion of the head. In order to afford a passage for the spinal cord, each bone is perforated, and the perforation corresponds with others, so that an entire, close, uninterrupted canal is formed from one end to the other. The contrivance to prevent the bones shifting, and breaking the line of the canal, and also to prevent gaping between them, is very admirable. The vertebræ, by means of processes and projections, some of which articulate with those of the next bone, are so confined that their bases remain nearly unaltered, the whole pressure produced by flexion is thrown on the intervening cartilage, formed of a substance so springy and elastic, as to allow the requisite motion, without any chasm between the bones.

The number of vertebræ, and consequently of joints, so divides the chain, that the motion of each bone is trifling, although we bend our backs to almost any degree of inclination: had the joints been fewer, the spinal cord would have been endangered at every angle.

The oblique processes add much security against luxation: these so lock into and overlap each other, that the bodies of the vertebræ are secured from slipping, and no degree of violence short of that, which will fracture the bones, can force them out of their places. The ligaments, connecting the roots of the spinous processes, are strong and highly

elastic, and contribute to restore the column after flexure. The general result of all this admirable construction is, that not only the motions required for the ordinary purposes of life are performed with safety, but that the gesticulations of posture-masters, and the most extraordinary contortions of the body, are exhibited to the admirers of such performances, without any frequent occurrence of accident.

OF THE MUSCLES.

The muscles are the active organs of motion attached to the skeleton; the tendons are cords, passing from muscles, to be fixed to the bones. The muscular fibres derive their contractile energy from the nerves; for if the branch of a nerve supplying a particular muscle or set of muscles be divided, those muscles lose their power of contractility and become paralysed. Each muscle is made up of fibrillæ, which are connected together by cellular membrane, to form fibres; these are collected into fasciculi, and a congregation of the latter constitutes a muscle. The fibres all contract at the same time, shorten the belly of the muscle, which is at the moment enlarged and hardened. In the contraction of a limb, the whole bulk is less, although the muscles swell: this is proved by the experiment of Glisson, of contracting the muscles of the arm, while in a

vessel of water, when the surface will be found to sink.

There is always an exact relation between a joint and the muscles which move it. Whatever motion the joint, by its mechanical construction, is capable of performing, that motion, and that only, are the annexed muscles capable of producing. For example, if there be, as at the knee and elbow, a hinge-joint, the muscles and tendons are placed in directions parallel to the bones, so as to produce that kind of motion and no other. Whereas, at the shoulder and the hip, where the ball and socket-joint allows a rotatory motion, muscles are placed in such positions, and pull in such directions, as to effect that motion which the joint admits. In the head and fore-arm, there is a specific mechanism in the bones for rotatory motion; and we accordingly find, in the oblique direction of the muscles belonging to them, a specific provision for putting this mechanism of the bones into action. The oblique muscles would have been inefficient, without that particular articulation, and that particular articulation, would have been useless without the appropriate disposition of the muscles.

It often happens that the action of muscles is required in situations, where their bulk would have been inconvenient. In such cases, the body of the muscle is placed at some distance, and communi-

cates with the point of action by a slender tendon. If the muscles which move the fingers had been placed in the palm, or on the back of the hand, those parts would have been of an awkward and clumsy thickness: their beauty would have been destroyed. They are therefore disposed on the arm, and act by long tendons passing under ligaments at the wrist, to the several joints of the fingers, which they move. In the same manner, the muscles which move the toes, and many of the joints of the foot, are gracefully disposed in the calf of the leg, instead of forming an unwieldy bulk in the foot itself.

Each set of muscles, has generally an antagonist set, having an opposite action; as the flexors and extensors, adductors, and abductors. The extensors are not weaker than the flexors, but these latter, act under more favorable conditions, than the former. The flexors increase in power as their action continues: they are in the most unfavourable condition for power at the beginning of their action; their fibres being parallel to the bone which is to be moved, in the course of action they gradually become oblique, and at last form the most favourable angle for action. The reverse is the case with the extensors; these being in the most favourable condition for power at the beginning of action. The preponderance of the flexors is greatest in the fœtus, and continues after birth: in mature age there is more equality of power, and again, in advanced life,

the flexors greatly preponderate. This accounts for the greater number of deformities in the sense of flexion: for one case of valgus, that variety of club-foot, in which the extensors of the leg draw the dorsum outwards and upwards, we meet with a hundred of varus, in which the foot is drawn inwards by the flexors.

The presence of arterial blood is essential to muscular contraction; the more healthy, the more highly aerified it is, the greater is the vigour of the muscles. Thus birds, having blood abundantly charged with oxygen, from their extended respiration, possess great muscular energy. Frigate birds have been seen on the ocean, at a distance of five hundred miles from any land or rock, and many remarkable facts, connected with the muscular power of birds, must be familiar to all. Insects have even greater muscular energy than birds, which may arise from the extension of their respiratory organs: it is well known that the bodies of insects are entirely permeated with the ramifications of their tracheæ, so that the air penetrates every part like the pores of a sponge. On the contrary, animals with respiratory organs of inferior development, have much less powerful muscular contractility. The lungs of tortoises are mere vesicles: their blood is very imperfectly oxygenated, and the torpidity of the whole class of the animal kingdom, to which they belong, is implied by the name reptilia.

The temperaments have much influence on the vigour of muscular action. The phlegmatic and lymphatic, among men and animals present muscles which are soft, flaccid, and pale ; their motions are slow, heavy, feeble, and they are incapable of any great exertions. On the contrary, persons of bilious and athletic constitutions, exhibit muscles greatly developed, hard, of a brown colour, quick and vigorous in motion. The sanguine temperament is remarkable for vivacity of motion and facility of excitation, but at the same time is very inconstant and variable. This is the general character of women and children, the sanguineous temperament predominating with them, while the bilious more especially applies to adult male animals. But the theory of the temperaments cannot be reduced to certain rules ; the same individual at different periods of his life exhibiting the characteristics of each. The circumstances in which we are placed in society, so mingle our natural elements, that a perfect type of any one of the temperaments can hardly be found ; however, in almost every individual, the characteristics of some one will predominate, and it is by careful observation, and nice discrimination of the various constitutions of men, that the enlightened practitioner is directed in his treatment of disease.

Irritability or contractility, are terms used by different physiologists, to denote that inherent property peculiar to the living muscular fibre, by which it

contracts at the bidding of the will, or on the application of a stimulus, either directly or through the medium of the nerves. The heart may be made to contract some time after death on the application of a stimulus ; if a scalpel be thrust into the muscles of a recently amputated limb, it will contract violently. This irritability is more permanent in those animals, where, during life it is less vivid, as in the cold blooded classes ; the heart of the tortoise may be made to contract thirty or forty hours after death, while in the warm-blooded all contractility has fled at a much earlier period.

Irritability or contractility, is very distinct from elasticity, which the muscular possesses in common with other tissues, and also from that tendency which all organized parts have to continual contraction, when free from their natural connexions. Irritability is not continual ; it is exhausted by action, and requires repose for its regeneration.

The most characteristic feature of the locomotive organs of man, is his erect posture ; this position gives the most exhalted situation to his noblest organ, the brain. The erect position of the human body, is the cause of the great size and rounded form by which the muscles of the buttock, thigh and leg, are distinguished from the corresponding muscles in other animals.

The breadth of the feet and the distance to which they may be separated, is sufficient for the centre

of gravity of the whole body to fall within the space occupied by them ; these circumstances occur in no other animal among the mammalia, and therefore man alone of this class, can long maintain the erect position. Those which approach nearest to him in this respect, as the plantigrade animals, have the greatest facility in assuming the erect attitude ; every body has witnessed this in the bear.

In man the whole tarsus, metatarsus and toes, rest on the ground, while in quadrupeds, for example the horse, the os calcis is raised half way up the leg, and what in these animals is called the knee, is in fact the joints of the tarsus in the posterior, and the carpus in the anterior extremity.

The extensor muscles of the ankle-joint, forming the calf of the leg, in quadrupeds, and even in monkeys, bear no proportion to their superior magnitude in man, whose peculiar mode of progression required this developement. They not only raise the os calcis in the motions of the body, but when the foot is fixed in standing, they counteract that tendency which the weight of the body has, to bend the knee.

The gluteus maximus, which forms the great bulk of the buttock, is so small and insignificant in quadrupeds, that it can hardly be said to exist. This muscle extends the pelvis on the thigh in standing, and, assisted by the other glutei, maintains that part in a state of equilibrium on the extremity which

rests on the ground, while the other is carried forwards in progression. The true action of the gluteus being not solely to move the thigh on the pelvis, but also to fix the pelvis on the thigh, and to maintain it in the erect position.

The breadth of the human pelvis affords a firm basis, on which all the upper parts of the body securely rest; by this means the legs are more widely separated than in other animals, which have the pelvis extremely narrow. The great muscles of the back being fixed to the pelvis, and attached above to the ribs and spinous processes of the vertebræ, keep the trunk erect. Those from the dorsal and cervical vertebræ, to the back part of the head, keep this in equilibrium on the spine, and thus complete the erect position.

I shall conclude this general view of the muscular system, by a few remarks on some of the muscles of the spine.

The great muscles which move the back and loins, are the quadratus lumborum, the sacro lumbalis, and longissimus dorsi. The quadratus lumborum, so named from its square form, passes from the inferior border of the last rib to the back part of the ileum, and is connected by aponeurotic slips to the transverse processes of the lumbar vertebræ. The longissimus dorsi extends from the transverse processes of all the dorsal, and all the lumbar vertebræ, is attached to the seven or eight last ribs,

near their head, lies in the hollow of the back between the ribs and spine, and is lost in common with the sacro-lumbalis, in the strong tendon attached to the posterior part of the sacrum, and lumbar vertebræ. This last muscle, lies on the outside of the longissimus dorsi, and arises from the eleven inferior ribs, and transverse processes of the inferior cervical vertebræ. The quadratus lumborum helps to keep the trunk erect, when both muscles act together; when one only acts, the body is inclined towards one side. The longissimus dorsi and sacro-lumbalis also keep the body erect, and by their attachments to the ribs, must have some power in rotating the spine. These two muscles, with the cervicalis ascendens, have been considered as divisions of one muscle, and the whole has been properly called, erector spinæ.

The whole hollow, between the spinous and transverse processes and the ribs, is filled up by small muscles and tendons. Muscular and tendinous fibres connect all the prominent points, so that an infinity of small muscles might be described, and anatomists have not been wanting in confusing the subject, by a multitude of names.

The multifidus spinæ, is a comprehensive way of describing what many anatomists have divided into a number of distinct muscles: its fibres pass from the spinous processes to the oblique and transverse processes of succeeding vertebræ, commencing from

the atlas, and extending to the loins and sacrum. It moderates the lateral motion of the vertebral column, and contributes to maintain the erect position of the trunk.

The sacro lumbalis, longissimus dorsi, and multifidus spinæ, not only support the spine, but draw the body somewhat backwards. These muscles are called into action, and greatly increased in power, in those persons who carry weights before them, suspended by the neck, as pedlars, &c. It has been proposed, in some spinal curvatures, to take a hint from this circumstance, and various contrivances have been made use of with this view, of which we shall have occasion to speak.

Besides the muscles attached to the processes of the spine, and lying in the two channels between the vertebræ and the ribs, almost all the muscles connecting the trunk and the pelvis, the pelvis and the lower extremities, have considerable effect in assisting many of the motions of the vertebral column. The obliquus externus abdominis has great power in the rotation of the spine, which will readily be seen by considering its attachments to the ribs and pelvis, with the direction of its fibres. The latissimus dorsi, when the arms are fixed, balances the body, by redressing too much curvature of the lower part of the vertebral column. When a person is in danger of falling on one side, from unexpectedly stepping off the curb-stone, he instinctively throws

up the opposite arm, by which motion the latissimus dorsi draws the spine towards this same side, and prevents the fall. The action of this muscle preserves the equilibrium of the body in rope-dancers, by the aid of a pole.

Many of the speculations connected with muscular motion are exceedingly interesting, but it would occupy too much space to dwell longer on this subject; sufficient has been said, to shew the great influence the muscles must have, not only in the production and maintenance of deformities, but also the necessity of taking them into consideration in applying our remedial means. A careful study of the various actions of muscles will prevent the useless application of machinery in many cases, and in others will enable us to make use of it to the most advantage.

CHAPTER I.

General Observations on Deformities.

In the preceding introduction, I have spoken of the connexion of bones, by means of ligaments and muscles, considering these last of almost as much importance as the former, in retaining the bones in their respective situations. The ligaments are so arranged, that they permit the motion of a joint in every direction, that the muscles are calculated to effect; and a due reciprocity of action, between antagonist muscles, is necessary to maintain the bones in their natural positions. Therefore, when the flexors or extensors of a limb, or the principal of them, are deficient in length, in power, or in vigour, their opponents, being uncontrolled, will induce distortion. The due action of muscles, and their consequent vigour, strengthens the ligamentous connexions of the bones, and even tends to harden the bone itself; in strong athletic individuals, the ligaments are of greater tenacity, and the bones of greater hardness, than in persons of a lax muscular fibre. In the amputation of limbs, where disease has been long established, the bone is always softer, and more ea-

sily divided, than when the operation is performed in consequence of sudden accident.

Muscular power is throughout life very variable, and is subject to every influence, that affects the general health of the constitution. An acute disease, fever, temporary derangement of the organs of nutrition, and various other causes, often diminish, and sometimes destroy, muscular irritability. In youth more especially, while the body is growing, these causes of muscular debility are most pernicious in their operation. It is probable, that in growth, the bones take precedence of the muscles, and that the latter are, in the first instance, simply elongated by the wider separation of their points of insertion: we know that in individuals who grow rapidly, the muscular system is very weak, and that some time elapses before the latter acquires its proper degree of vigour; while in those who do not arrive at great height, and whose growth is comparatively slow, the development of the muscles, follows so quickly on that of the bones, that little or no difference, in this respect, is perceived. It is among persons whose growth has been rapid, before the muscles and ligaments could recover that density which had been diminished by extension, that we find the greater number of the subjects of distortion.

It is not uncommon to find growth considerable during, or immediately after, an acute attack of disease. Children, who did not previously grow with

much rapidity, will, during an attack of the exanthemata, or other disease, shoot up some inches; as if the morbid state had effected some alteration in the functions of nutrition, with respect to the osseous system. In such cases muscular debility is often extreme, and it is very common for parents to date a distortion of the spine, to the period of such disorder. The correctness and solidity of the relations of the bones among themselves, are in such close dependance on muscular action, that these relations will be disturbed, if the muscles are diminished in energy.

The same causes which operate in the production of muscular debility, extend their influence to the ligaments. It has been before observed, that the connexions of bones, in most of the articulations, is not wholly confided to the strength of the ligaments, but in part to the tension, contraction, and elasticity of the muscular apparatus. When these healthy conditions are destroyed, and the ligaments are alone left to maintain the integrity of the articulations, the superincumbent weight soon overcomes their power of resistance, and many deformities are thus produced.

The contraction of muscles, considered as a cause of deformities, cannot accomplish them but after having triumphed over the resistance of the ligaments. This is effected by the superincumbent weight, and by the constant action of the muscles.

These are among the cases which require the most persevering attention, because the ligaments being greatly extended, it is long before they can recover their natural firmness; these deformities are therefore ever threatening a recurrence.

Contractions from accident, or disease of skin and cellular tissue, are more formidable than muscular contractions. Nothing can surpass the force, with which the cicatrix of a burn, will contract the arm, or the foot; and equally great is the power of contracted cysts, after the cure of abscesses in the lungs, by which the vertebræ are drawn out of their line, and the ribs bent inwards.

In some examples of club-foot, we perceive the degree to which the ligaments may be extended, by congenital defect of the muscles. In these cases, there is a peculiar difficulty with respect to the ligaments: for as long as the growth of the body continues, the original disproportion between the short muscles and the bones will be felt, if artificial means are not constantly applied, to the defective organs, to maintain their elongation.

Any alteration in the natural form of the skeleton, will induce a physical change in the state of the muscles. Muscles are disposed in such manner, as to be submitted to a certain degree of tension: the forms, determined by the bones being changed, these relations are also changed, and the extremities of the muscles are no longer fixed at proper distances.

There are physiological conditions, depending on these mechanical circumstances, that are, perhaps, of more importance than the difficulty of motion induced by these alterations. The normal degree of tension of the muscles is essential to the prosperity of their nutrition: this function is defective, whenever their tension is augmented or diminished; whether the extremities of a muscle be brought nearer, or separated to a greater distance than natural, if their active power is destroyed, the consequences are the same; debility, extenuation, and degeneration. In cases of club-foot, the swelling of the calf is wanting, but no sooner is the deformity lessened, than the swelling of the muscles of this part begins to form.

In bad cases of distorted spine, the muscles are in the same state as in the legs of club-feet, small, pale, or yellow, in a languid state of nourishment, and degenerated into a kind of fatty substance.

Any deviation of the spine destroys the harmony between the dimensions of the bones and muscles: some of the latter are elongated, and some shortened; their nutrition, and their power of contractility, will be both deranged, whether the extremities of the muscles have undergone an unnatural degree of separation, or the reverse. It follows, that if on the one hand, primary muscular weakness can, by abandoning parts of the skeleton, to the sole density of the ligaments, lay the foundation for deformity; so,

on the other hand, distortions produced by other causes, engender debility of muscles, by destroying their equilibrium.

As muscular contractility becomes enfeebled, by disease or age, efforts will be made to place the body in those attitudes, and to move it in that manner, in which the least possible expenditure of muscular power shall be required. An old horse loses all the grace of his motions, and all the easiness of his paces: his legs become stiff, and he moves them as if they consisted of one piece: he stumbles easily, and his loins present a remarkable curvature: he avoids muscular exertion, and confides the weight of his body as far as he can, to the sole resistance of the ligaments.

In early age, the natural alternate curves of the spine are not formed. The infant, when placed upright, bends its body forwards, the weight of the trunk pressing entirely on the anterior part of the spine, until the muscles of the back have acquired strength enough to maintain the erect position. There are few children of 10 or 12 who do not hold the body bent forwards, especially if their growth be rapid: the object is to save the muscles; but as the chest expands, and the muscles acquire more vigour, the spine is brought back to its proper form. We meet with the same appearances in some incipient spine cases, and experience of the unaided powers of nature, to restore the former temporary deviations, have too

often caused the latter to be neglected in their early stages. Some persons, who during youth have been assailed by very long illness, attended with much muscular debility, and consequently curvature of the spine forwards, have preserved this form throughout life, being what is termed round-shouldered. These occasional curvatures of the spine from muscular debility, will generally be forwards. If the ligaments, or muscles, be weaker on one side than the other, there will also be lateral curvature; and as the equilibrium of the trunk will now be menaced, an effort will be made to draw the spine in an opposite direction to the primary curvature. These things are common, of daily occurrence, and prove the fact of muscular debility, from the speedy restoration of the natural form, by means which strengthen the system; exercise, good diet, cold bathing, &c. Not that by these means the ligaments are directly diminished in length, but the muscles recover their power, and by re-establishing the natural direction of the bones, they remove the causes of the stress on the ligaments, and these latter as a matter of course soon acquire a proper density.

The foregoing observations lead to the consideration of the effects produced on the skeleton by peculiar attitudes. In all persons who from accident or disease have one extremity shorter than the other, there is an inclination of the pelvis towards the side of the infirmity: the spine bends in the opposite

direction in order to maintain the equilibrium, and a great succussion occurs at each step. However, in such cases it is very long before the deformity becomes permanent, for when the body is placed in a horizontal position, the lateral curve of the spine is effaced, and the shortness of the limb is alone apparent.

In congenital malformation of the hip-joint, where the pelvis is inclined forwards, and the lumbar region backwards, progression is effected by a series of falls, from one lower extremity to the other; there may be a lameness on both sides, and although such a state of things shall have existed from the earliest infancy, no permanent deformity of the spine results. In the recumbent position the curve of the lumbar region is effaced, and when a certain degree of curvature is established by the entire development of growth, it remains in the same state for life.

No fact can be better established, than the effect of peculiar attitudes on the form of persons engaged in different occupations. Who cannot tell a tailor by his gait? shoemakers, clerks, &c. have their persons more or less affected by their peculiar attitudes, more especially when such sedentary occupations have been imposed, before the growth of the body is complete. Artists are also liable to lateral curvature of the spine from this cause. But when we consider the number of persons, whose occupation leads them to continued work in particular positions,

the proportion of deformities among them, is far from being so great as might be expected ; indeed the majority of deformed persons are of no occupation at all, which is perhaps one cause of their infirmity.

In the greater number of lateral curvatures, the right shoulder is more elevated than the left, and the inclination of the dorsal vertebræ is towards the right side ; some writers on this subject suppose the cause to be in the more frequent employment of the right arm ; this opinion has been disputed by others, who have not scrupled to place some cases of distortion to the account of attitude in clerks, artists, &c. which very peculiarity of attitude, consists in the more constant use of the right side of the body.

Attitude must be allowed to have some influence in the production of deformities, but perhaps too much has been attributed to it ; the fact appears to be, that it only operates in those individuals whose fibrous textures are lax, or in those who have a strumous taint.

Some cases of deformity arise from congenital inequality of the two sides of the body. The muscles, and in some instances the bones, are less developed on one side of the body than on the other.

There is perhaps no notion more pernicious, than the supposition that children will outgrow deformities. That a deformity will often stop at a certain point, and as the body grows will be less apparent

is a well-known fact; but the instances of a natural cure are so few, that all such hope ought to be abandoned, and proper means of cure resorted to, at as early a period as possible. Children with distorted limbs, are sent from their homes to the sea, in the hope, that by increasing the vigour of their constitution, the deformity may be removed; but disappointment too generally follows, and the malady, augmented during the time so devoted, must sooner or later be met by the only certain methods of cure—mechanical assistance, and means which give tone to the faulty muscles.

Generalisation is too often pushed to an extreme, in medicine, as well as in other sciences. A few years back, whatever might be the real nature of the disease, it was the fashion to treat all distortions of the spine by repose; and few schools or private families were unfurnished with an inclined plane. This practice arose from the mistaken generalisation, that all spinal distortions were dependent on softness, or disease of the bones. Without a correct diagnosis, we can never apply our remedies on any thing like a scientific principle: it will be one of my first objects, in treating of the particular kinds of deformity, to endeavour to trace effects to their primary origin, and to lay down rules for the treatment, not merely of symptoms, but of the causes of symptoms.

No age is exempt from one or other kind of

deformity. Many are congenital, as club-foot, malformation of the hip-joint, inequality of length of legs, &c. Some occur very early in life, in consequence of scrophula or rickets; others are most frequent from the ages of 8 or 10 to 16 or 18, as those which result from muscular debility, and chronic inflammation of the intervertebral cartilages; while those consequent on disease of the bones, and rheumatism, affect persons of all ages.

With regard to the period of life, to which a possibility of curing deformity extends, there will of course be great difference according to the cases. The earlier the stage, in which curative means are applied, the better; but it may be established as a general rule, that, during the period of growth, most distortions, that are at all curable, may be entirely removed. So long is it before any marked effect is produced on the form of the bones, in many varieties of club-feet, that these distortions may be entirely effaced, at almost any period before growth ceases. Even after the period of youth, they may be much benefited, and sometimes altogether removed. The same observations apply to many varieties of distorted spine. To be able to give a fair prognostic, we must be very careful in distinguishing the true nature of the cause, and the degree to which it has operated on the limbs or spine. In inflammation of the fibro-cartilages, for example, if the disease has

made such progress as to cause atrophy, or absorption of the cartilages, or if they are covered with ossifications, we can never hope to restore the form, which, in the earlier stages of this variety, may with certainty be predicted. It is of much importance, to ascertain whether the deformity is still making progress, because, if we find that for the space of a year or two there has been no advance, but a complete and gradual cessation of the attendant symptoms, it will be a strong presumption, that the time for a perfect cure has gone by. This opinion will be confirmed, if we find that extension produces no effect.

The application of extension and pressure to distortions are not modern inventions, but it is only lately that they have been revived in the cure of spinal deformities, and very recently indeed that any settled opinions have been formed on the subject. There is something so bold in applying extension to the spine, on account of the important parts contained within its canal, that the greatest circumspection in its employment is necessary. The accidents which may be produced, demand that such means should never be employed, but with the greatest prudence, and after a most careful investigation has clearly distinguished the species of the malady.

As one very general cause for many varieties of

deformity, I shall devote the next chapter to the consideration of that state of constitution known by the name of rickets. I shall then describe the principal deformities of the extremities, endeavour to point out all the varieties of spinal distortions, and conclude with an account of the principal mechanical means made use of in the cure of deformities.

CHAPTER II.

On Rickets.

In rickets, the bones lose their tenacity, and hardness, they bend under the weight of the body, and are also distorted by the action of muscles. The cause of this softened condition is a deficiency of the earthy materials, which give to the bones their solidity and power of resistance. This disposition is often manifested at a very early period of infancy, and has been known to occur before birth. Pinel describes a rickety fœtus. The disease most commonly makes its appearance from birth to the age of three.

Some writers have thought that the softening of bones was a consequence of excess of acid, decomposing the phosphate of lime: others, that a sufficient quantity of this material was not provided: others have supposed it to be the result of a morbid disposition of the absorbents, to remove too much of the earthy matter; but the most probable opinion appears to be, that the arteries, from some cause, are deficient of the power of secreting phosphate of

lime from the blood, or that they do not deposit it in a sufficient quantity.

Portal describes no less than six varieties of rickets, the venereal, the scrophulous, the scorbutic, that which succeeds eruptive fevers, that which results from abdominal obstructions, and the rheumatic or gouty rickets. He describes cases of children, labouring under this disease, which he supposes to have been propagated by a nurse infected with syphilis. Mercury was his specific in such cases, which he states was always successful in eradicating the mischief, if employed sufficiently early: it is quite clear, from his observations, that the sirop mercuriel, acted by improving the intestinal secretions. He calls those cases scrophulous, which were accompanied with enlarged lymphatic glands, he describes the vertebræ as swoln and softened, the long bones softened and enlarged at the ends, but hard and white in their centre.* The vertebræ

* There is some difference of opinion among the authorities, with regard to the swelling of the ends of bones in rickets; the older authors universally assert, that they are so, and many continental writers still maintain the same opinion. Anatomists in this country agree that there is no enlargement of the bone, but that it is rendered soft and spongy. All the morbid specimens I have myself examined, shew no enlargement of the ends of the bones, but rather the reverse, for the whole of the long bones are diminished in size. However, we seldom have an opportunity of examining such subjects in an early stage of the disease, when there is thickening, at least, on the surface of the bones; for the appa-

have been found reduced to a mere shell, the external appearance presenting but little difference from their natural state, while the interior was one vast cavern, divided by some irregular cells, the consistence of which were very soft. The scorbutic cases he describes, are but peculiar varieties of scrophula. The opinions of Portal are sometimes rather farfetched, for he mentions a variety of rickets, which he attributes to the operation of castration.

In children predisposed to rickets there is at an early age great deficiency of nutrition; the functions of the digestive apparatus are frequently deranged, while the appetite is often voracious: flatulence, irregularity of bowels, sometimes confined, often relaxed; tumid abdomen, retarded dentition, laxity of fibre, and general emaciation. With all these symptoms the countenance is often lively, the eyes bright, and the intellect precocious. This precocity of intellect, is not to be altogether attributed to the circumstances in which the child is placed, but is a characteristic feature of the disease. The volume of the brain is proportionally larger than in other children, and the organs of sense, particularly

rent swelling cannot alone be referred to the emaciation of the soft parts of the limb. In the skeleton of a child of 10 years of age, preserved in the Museum of the London University, the bones of the cranium are remarkably thickened, in some parts nearly to the extent of an inch, and have the characteristic softness of rickety bones.

sight and hearing, unusually developed ; the bones of the cranium being soft, readily yield to the premature development of the cerebral mass.

In the progress of the disease the skin becomes dry and scaly, the teeth are discoloured and decay early ; the extremities of the bones appear swoln ; the joints, especially those of the wrist and ankle, are larger than natural ; there is great disinclination to move, from the incapacity of the bones to support the weight of the body : the mesenteric and other glands are sometimes enlarged and indurated ; the internal functions greatly impaired ; and if the disease is not arrested, the lungs, to which the same strumous tendency extends, which has already affected other parts, become tuberculated, these suppurate, and a miserable state of existence is at length terminated.

Rickets is often considered to be a consequence of teething ; the fact appears to be, that the same causes, which engender rickets, retard dentition.

An increased degree of curvature in the clavicles, and unnatural projection of the sternum forwards, are often the earliest indications of the existence of this disease. The upper extremities are always less deformed than the lower, the bones are bent from muscular action alone, and acquire a direction forwards, from the preponderating influence of the flexors. The femur has its concavity backwards, the weight of the body augmenting its natural curve ;

the neck of the femur, from being oblique, forms a right angle with the body of the bone. The tibia and fibula vary much in their direction, being sometimes bent forwards, sometimes in the same direction as the thigh-bones, at others, laterally: these bones acquire increase of breadth, towards the curved side, losing a proportional degree of thickness in the opposite direction, and assume an unusually flattened form.

Rickets is one variety of scrophula, and is in many instances hereditary, appearing in the earliest infancy, in children, characterised by a large head, large joints, a skin of the most delicate transparency, and that general expression of face, which a careful observer will understand at a moment's glance. But scrophula is not always hereditary, it is often engendered in constitutions, not predisposed to it, by the over-care, indulgence, and general mismanagement of children. Infants are almost universally over-fed; their cries, from whatever cause, are appeased by feeding, and not content with giving them their natural aliment, they are too often crammed with a variety of improper food.

The first source of the disorders of children, is improper diet on the part of the mother or the nurse. The stomach is the fabricator of disease, as well as of nutriment, and the early disorders of infants have their origin almost invariably in this organ. The foundations of scrophula are too often laid in the

earliest infancy. Children born healthy, and who would have continued so under proper management, exhibit slight derangements, attributed to flatulence, acidity, &c. which are removed by medicine; an improper system of diet is continued, new and aggravated attacks occur, requiring more medical treatment, until a state of constitution is engendered, incapable of resisting the common complaints of childhood. Thus it is, that the bills of mortality are fed with so many victims at an early age, from one-fourth to one-fifth of the children born in this metropolis, dying before the age of two years. We accuse the changeability of our climate, but the fault does not lie there, but in that debility of constitution produced by mismanagement, which renders children incapable of resisting the influence of cold, and other external agents.

Some children outlive the worst nursing; and others who may have been nursed on more rational principles, have their constitutions ruined at a later stage by the false indulgence of parents, who allow them fermented liquors, under the mistaken notion of supporting their strength; others, again, are allowed to eat to excess the moment they can eat at all.

In this manner, frequent derangements of the stomach succeed each other, no means being taken to prevent their recurrence by a more judicious system of diet and regimen. The next stage in the progress

of the malady, is that febrile condition, commonly called the "infantile remittent fever," the source of which will be sufficiently pointed out by the distended abdomen. Parents now become somewhat alarmed, and if the child recovers, remember the admonitions of their medical attendant for a few days, and check the propensities they have hitherto indulged. But such restraint is unfeeling and inhuman, and the innocent, ignorant child is again permitted to revel in the luxuries of sweets and cakes, perhaps wine and porter, and other things which the parents partake of, and which the imitative faculty of children, naturally leads them to imagine equally good for themselves.

Derangement of health in children, is too exclusively attributed to teething. A child may be late in cutting its teeth, perhaps suffers much pain in so doing, but this is perhaps more frequently a consequence, than a cause of disordered health.

In the progress of disease, the child loses its rest, is always crying: its belly becomes tumid, from distension of stomach, enlargement of the mesenteric glands, and sometimes of the liver: the skin becomes loose and flabby: a constant attendant on these symptoms is the remittent fever above alluded to. The enormous abdomen, and the extenuated limbs, remarkably distinguish this period of the complaint. Even this state of disease may be removed by judicious treatment, sea air, &c. and all might yet

be well, if a long-continued perseverance, and strict attention to what the old physicians quaintly termed the non-naturals, diet, regimen, air and exercise, was adhered to. But no, the child is indulged further, until hydrocephalus, or some other disease, puts an end to the scene: or, the tragedy does not yet finish, the glands of the neck swell, the limbs bend, and the astonished parents discover that their child is a victim to scrophula, or rickets, when neither themselves, nor any relative on either side, ever had one symptom of such malady. This may readily be credited, the disease is not always hereditary, but the ultimate result of a long-continued course of general mismanagement.

The strength or infirmity of our constitutions, depends upon the management of our earliest infancy: our happiness, or misery, mental, as well as corporeal, have their foundations laid, although unconsciously, by our nurses. The subject is of such importance, that I shall risk the charge of wandering, and of repeating an oft-told tale, to discuss the question of health, from the first moment of our appearance in the world. If my observations produce but one convert to a more rational system in the management of children, my labour will be recompensed.

It is too much the fashion to suppose that women when pregnant or nursing, require a very great additional quantity of nourishment, and they are persuaded or persuade themselves, to take things which

are contrary to their usual habits. But Nature in this, and in every other instance, where we can take a hint from her, is our best guide, let a woman obey the natural dictates of her appetite with regard to quantity, and in quality that which her experience has found best to agree with her. The more simple and plain her diet is, at all times, the better for herself and her offspring.

No general and absolute rules for diet can be established, there are no two faces, nor are there any two stomachs exactly similar; neither can we, by any mode of reasoning, say what will agree and what disagree with any particular stomach. Precision as to quantity or quality is out of the question, individual experience is the only guide; a person of common sense ought to know better what is proper for his own stomach, than any other person. But as people in general prefer that others should think for them, rather than being at the trouble of doing it for themselves, it has become necessary to lay down laws for the regulation of diet. The best and most useful rule is to eat and drink in moderation, of those things which we know agree best with us, and this applies to mothers and nurses as well as the rest of human-kind; there is, generally speaking, no reason for any remarkable deviation from their ordinary mode of living. In general one meat meal is sufficient, but this like every thing pertaining to regimen and diet, is best decided by experience: where the

health is good, and there is no great tendency to corpulency, the mode of living may be esteemed proper.

For the first six or seven months after birth, or until the appearance of the first four teeth, the infant requires no other food than the milk of a healthy nurse. Nature dictates this to be the only requisite nutriment, and children who have no other, are the most healthy. The fashion of fattening them by additions to their proper diet is highly injurious: we often see children by such means rendered so fat, that at the period when they should be able to walk, it is necessary to keep them off their legs: the weight of the body being so great, that the limbs, incapable of supporting it, shew a tendency to bend. This is one cause of bandy legs, turned ankles, and bent knees.

In those instances where the supply of milk is really insufficient, it is an excellent plan to restrict the food to that, which can be sucked through leather over the mouth of a sucking-bottle: by this means the child has the exercise of sucking, which is as necessary a part of digestion as mastication is to an adult, and it cannot take that thick porridge, with which some nurses overpower an infant stomach.

To enter on the subject of clothing, air and exercise, would lead us too far away from our subject: but a few remarks may be pardoned. The skin should be more completely covered than it generally

is, the neck and arms ought not to be exposed; there is such an intimate connexion between transpiration from the skin, with that from the lungs, such sympathies between the functions of the skin, and the internal secretions, that too much attention cannot be paid to this subject. In this country we neglect the skin too much; I believe it may safely be affirmed, that a large portion of the community, never think of washing any part of the skin, beyond what is visible.

In mild weather, it is very serviceable to the youngest infants to breathe the open air, but there can be no good in exposing such tender plants to the piercing cold of winter. In such a climate as this, they should be treated as exotics, and defended from its rigours, until, by strength and habit, they are capable of contending with its influence. As soon as by exercise, they can increase the action of their circulating vessels, they cannot be too much in the air, in all seasons and in all weather, by which means they become inured to its vicissitudes. Even the open air of this metropolis is a source of robust health, evidence of which is exhibited by persons, whose occupations oblige them to be much out of doors. There are no healthier people than coachmen, persons keeping stalls in markets, &c. who, in spite of dram-drinking, and other pernicious habits, are among the most robust part of the community.

Good nursing is of as much assistance to the health of an infant as proper food; tossing and shaking, is to them what active exercise is to an adult. The choice of a nurse is of the greatest importance. A woman of a cheerful and kindly disposition, will naturally pour out its exuberance, when she has an infant in her arms, and health, cheerfulness, and activity, are imparted to the child. The great object of many nurses, is to keep their charges as much as possible in a state of sleep, which induces that torpor and listlessness, we occasionally see in children, and which is a commencement of bad health. Too much stress cannot be laid on these seemingly unimportant matters, for when we remember that man is an imitative animal, that all his early knowledge, his good and his bad habits, are acquired by imitation, it is of the utmost importance to be careful in our choice of those, from whom the earliest impressions are obtained. Much of our happiness depends on the first few months of our existence, if the management is good, the body will be healthy: and if kindliness of temper, and cheerfulness of mind, exist in the nurse, they will be engendered in the child.

Overfeeding is the most frequent cause of deranged health in children; they will often eat twice as much as is necessary for them, if their nurse has not sense enough to prevent it: nor can we much wonder at this propensity, when we see adults as

incapable of judging for themselves on this point, as children are. Few of us adopt the maxim, "that we ought rather eat to live, than live to eat." The great object of existence with half the world, is the pleasure of eating and drinking: and it is unquestionably a pleasure, which our beneficent Creator has ordained the gratification of, by a boundless supply of the productions of the earth. But experience teaches, that there is a limit to this indulgence, beyond which we lay the foundation of numberless diseases. The promises of medicine tend perhaps to maintain this system of indulgence, its early effects being readily removed; but let us not flatter ourselves that the very means used for their removal, leave behind no bad effects. Every disordered state of body, although removed by medicine, leaves the frame more susceptible of fresh disease, each succeeding attack becomes more serious, more powerful means are necessary for relief, until the disease becomes too formidable for any remedies. As children are incapable of judging for themselves on these points, those to whom they are entrusted must do so for them, and let them bear in mind that simplicity and moderation, are the best general rules for diet. A due attention to these points, will prevent the growth of that state of constitution, which engenders scrophula, and where there is an hereditary taint, will in all probability prevent its development.

Rachitis has been supposed to have first made its

appearance in this country about two hundred years back, but there is abundant evidence of the existence of deformities among the ancients, similar to those which we now attribute to this cause.

This disease occurs principally in cold and moist countries: it is very abundant in our manufacturing districts, where the parents are often ill fed, clothed, and lodged: with constitutions ruined by indulgence in gin-drinking, and other vices: and the children are rickety from their birth. There cannot be imagined human beings more sunk in vice and misery, than may be witnessed in some of the more crowded spots of our boasted manufactures. Such depravity and such wretchedness, cannot be surpassed among the wildest savages.

The early symptoms of the disease, have been pointed out in the course of the preceding observations. The curvature of the spine, in rickets, is commonly forwards, but in many instances, there is lateral deviation. As the curvature of the spine increases, the thorax loses its convexity, and becomes flattened at the sides, while the anterior part of the chest is narrowed and pushed outward, the long diameter instead of being from side to side, becomes antero-posterior. The bones are every where flexible, and become variously distorted. The disease will sometimes continue advancing for years, until it has affected almost every function of the animal economy, and is at length terminated by death. In other cases,

however, a stop is put to its progress, the health is entirely re-established, but the distortions produced during the disease, are seldom altogether removed.

Various morbid appearances have been found after death. Most of the abdominal viscera are enlarged. In the lungs we find various kinds and degrees of disorganisation. In the brain there is generally serous effusion on the pia mater and in the ventricles. The muscles are found pale or yellow, flaccid and emaciated. The bones are so soft, that they may be readily cut with a knife. Though the earthy matter of the bones is deficient, this is not the sole change: the close or compact structure is said to disappear, but the fact is, that it has not yet been formed. The interior of the bones presents no distinct medullary cavity, nor cancellated structure, but has the loose cellular, or areolar arrangement, observed during the fœtal period. The interstitial cells are filled with a brownish jelly-like substance, which appears to be a secretion from the medullary arteries. The colour of the bone is some shade of red, which it derives from numerous, large vessels, loaded with dark-coloured blood, deficient of fibrin. The periosteum is generally thickened and occasionally detached. In short, the rachitic bone is the fœtal bone in its internal structure, but destitute of its proportion of calcareous matters.*

* Craigie's Pathological Anatomy.

One of the most striking peculiarities of the rachitic condition of the osseous system, is, that although the bones present the characters enumerated above, during the continuance of the disease, if this be checked, they afterwards acquire equal, and even greater firmness and density than sound bones. While this change is taking place, the distinction between the cancellated and compact structure begins to be established, as well as the formation of the medullary canal. When this process once commences, it proceeds much as in healthy bone. In one respect, however, its completion is peculiar. Instead of the compact matter of bone, being equally distributed on each side of the medullary canal, as in sound bone, it is more abundant on the concave than on the convex side of the incurvated bone; as if Nature was aware of the part where firmness was most wanted, and intended to defend the skeleton against any increase of deformity, by depositing earthy matter in the best situation to resist the effects of pressure. This deposition may be so considerable in bones which are much bent, as to obliterate entirely the medullary canal. The restored rachitic bone is said to contain more earthy matter than healthy bone. In the disease called mollities ossium, the bones gradually lose their firmness, and become soft and flexible: it is a disease of adults. In this affection the absorbents would appear to be principally in fault, in rickets the secerning arteries

do not deposit that proportion of phosphate of lime, which is necessary to establish the compact structure of the bones.

In curvatures of the spine from rickets, the bodies of the vertebræ will, in some cases, be crushed and rendered cuneiform by pressure, in others, the articulating processes give way, and very considerable lateral curvatures are produced, with little or no alteration in the form of the bodies of the vertebræ.

In this disease the urine has been found to contain much phosphate of lime, and the bones, according to Dr. Bostock's statement in the Medico-Chirurgical Transactions, have not yielded more than one-sixth, or one-eighth of this salt, while in their ordinary state, it bears more than the proportion of one-half, to their whole weight.

The teeth generally remain hard, while the jaw in which they are fixed, has become quite soft. The late Mr. Wilson, however, mentions an instance when the bony parts of the teeth were softened.

Diagnosis. There is no disease which can be confounded with rickets, but it is important to distinguish curvatures of the spine, produced by this malady, from those originating in other causes. The application of mechanism, occasionally useful in some cases of spinal distortion, would obviously be improper where the bones are preternaturally soft; the pressure of instruments on the pelvis would tend

farther to increase any deformity, which might have already taken place in that part.

We should carefully examine the effects produced by the malady in other bones, besides those of the vertebral column. Not only do the bones of the extremities become soft and flexible, but those of the thorax and pelvis are more or less diseased. The pelvis in this malady, seldom fails to partake the fate of the spine; but in deformed spine, from other causes, the bones of the pelvis are but rarely affected. This is a most important distinction, and by properly attending to it, in obstetric practice, the alarms of many families may be entirely removed. As a general rule, it may be said, that deformities occurring after the first ten years of life, seldom implicate the form of the pelvis.

Treatment. Our primary object must be to restore the organs of nutrition to their healthy condition, the depraved action of these, being the primary source of the malady; this can only be effected by much perseverance, not only in the administration of medicine, but in a system of diet and regimen. Purgatives of calomel and scammony, or calomel and rhubarb, should be given every two or three days. A nightly dose of equal parts of hydr. c. creta with rhubarb, often does wonders in the disordered bowels of children. Tonics, where we can get children to take them, may be of use, and cha-

lybeates are of most essential service. The tinct. ferri mur. is a form which will be taken with least difficulty, but the carbonate I have thought more effective.

Madder has been recommended in this disease from some vague notion of its affinity with the bones.

Lime water, as a common drink, is useful in this, and in all forms of scrophula. The volatile alkali, and the liquor potassæ, have been extolled by some writers; they probably act in the same manner as lime water, by destroying the acidifying tendency of the digestive functions.

The diet should be simple: children do not require the variety of food, which adults are accustomed to take: before the age of two years, they should be confined to farinaceous food: soups and broths very often oppress their stomachs, and meat they are generally incapable of digesting. Quantity as well as quality should be attended to; there is no error more common, than, in cases of weakness, to accumulate food: it is not what can be swallowed, but what can be digested that is of service.

Cold bathing, especially in the sea, is of eminent service; frictions afterwards with flannel or a soft brush, will further tend to strengthen the habit. Friction is a variety of exercise, and should be frequently employed in all cases, where common exercise cannot be had recourse to. Nor should we be

satisfied with one rubbing daily, it should be several times repeated; and the benefit is increased, by combining that compression of the muscles, which constitutes what is termed shampooing.

Good nursing, and good air, are very important points in the amendment of the health. Portal and other writers recommend sprinkling an infant's face several times in the day with cold water, this, he says, induces the child to exert itself to no small advantage. We are also advised to apply cloths wetted with spirit and water to the arms, legs, and spine, every time the child is dressed or undressed, the parts to be afterwards rubbed dry with a flannel.

Unremitting perseverance in these or similar means, will put a stop to the disease, and where the bones are not very crooked, they will become straight even without the aid of instruments.

Some continental authors recommend in this and in other cases of debility, an exposure of the body to the rays of the sun: patients with deformed spine are placed on their belly, with the back exposed to the sun for some hours daily.

During the whole time that the bones remain flexible, the patient should lie in the recumbent position, and daily extension should be applied, to restore or to maintain the proper direction of their course. When sufficiently recovered to be able to support the weight of the body, the patient may sit up, and if the deformity be confined to the lower

extremities, properly adapted instruments, will assist their restoration, and enable the patient to take some degree of exercise. It is better in very young children to defer the use of mechanical means, until the bones of the trunk have acquired some firmness, and those of the limbs are hard enough not to be injured by the weight and pressure of the instruments.

We often meet with gross, heavy children, of lax fibre, flabby muscles, distended abdomen, with large joints, and spongy extremities of bones, especially of the wrists and ankles. This is an incipient state of rickets. The extension of the disease is generally prevented by occasional mercurial purgatives, and proper attention to food: but the bones of the leg bend under the weight of the body, and the ligaments of the knee-joint are apt to be elongated, producing what is called knock-knees. These effects are readily removed by a persevering use of mechanical means.

CHAPTER III.

Deformities of the Upper Extremity.

DEFORMITIES of the upper extremities, are infinitely more rare than those of the lower. We occasionally meet with contractions of the elbow, wrist, and finger joints, but very seldom with distortions of the bones, except in bad cases of rickets.

SECTION I.

OF CONTRACTIONS OF THE ELBOW.

Contraction of the elbow, occurs as a consequence of disease in the joint, and of a morbid condition of the biceps muscle. In the first case, we may often restore the use of the joint, but when complete anchylosis has been established, no means for removing the distortion can be prudently resorted to; the other case admits of cure. The primary cause of this latter contraction, is seated in the biceps muscle, the tendon which passes over the articulation of the elbow, to be inserted into the tuberosity of the radius, is extraodinarily hard and rigid. The fore-arm is bent on the arm, at different angles, ac-

cording to the degree of shortening in the muscle, or its tendon. When an attempt is made to extend the forearm, the tendon becomes more firm, and resists the motion. The brachilis internus will contribute to keep the arm in a state of flexion. The antagonist muscle, the triceps, will of course be in a state of inactivity.

The use of the upper extremity is much limited, and the consequent want of exercise, still farther increases the evil, by causing atrophy of the muscles, as in all other cases, where they are not called into action.

Having determined that no active mischief is going on in the joint, and that there is no true anchylosis, we must have recourse to gradual and remitting extension, shampooing, friction, the local application of vapour: by uninterrupted perseverance in these means we shall always succeed in overcoming muscular contractions, if the mischief has not been of very long standing, and the ligaments have not had time to acquire a very unnatural degree of density and rigidity. If there is any motion in the joint, we may confidently prognosticate the ultimate restoration of its utility.

No better instrument can be used in these cases, than that of Mr. Amesbury, for stiff elbow-joint: the power of the screw will overcome any resistance, and when employed with prudence, and sufficient perseverance, there are few cases in which it will not be beneficial.

SECTION II.

OF CONTRACTIONS OF THE WRIST AND FINGERS.

This, like club-foot, generally depends on congenital malformation, or unnatural disproportion in the power of the flexor and extensor muscles. The former set overpower the latter, are preternaturally contracted, and hold the hand in permanent flexion. The dorsal surface is always convex, the palmar concave. The hand is useless and wastes away. The carpal bones take part in the deformity, when it has been of long-standing.

In some cases, the flexion of the hand is accompanied with continued pronation, or supination. In other cases, the hand does not form a direct line with the fore-arm, but is drawn towards one side, forming an angle: this results from the consolidation of the radius and ulna into one bone, or a total absence of the lower half of the radius. In consequence of this, the carpus has a more narrow base of attachment, the articulating surface is too small, so that the hand will be readily drawn to one side by the action of the muscles. These cases are congenital, and are generally accompanied with irregularity, or malformation, among the carpal bones.

The hand and fingers are often contracted by burns, and present many varieties of form. The

fingers will be sometimes consolidated, and the hand of a fin-like shape, similar to the anterior extremity of the seal. Sometimes the bones are united, but most frequently the connexion is membranous. In these latter cases the fingers must be separated, and motion perseveringly employed, while the wounds are healing, to restore their use; without great attention to this circumstance, but little benefit will be derived from the operation.

Although operations for the removal of the contractions of cicatrices after burns, are often unsuccessful, cases are frequently met with, which justify the attempt, because without it, the limb must remain useless for life. Mr. Earle, in a paper in the 7th volume of the Medico-Chirurgical Transactions, has related some cases of successful removal of contractions among the fingers, and between the arm and fore-arm. His mode of treating such cases, consists in dissecting away every part of the contracted cicatrix, and gradually extending the limb by means of a splint, which must be continued not only during the healing of the wound, but for some time afterwards. Mr. Earle's operation has also been successful in the hands of other surgeons, not only in contractions about the arms, but in those about the neck; and when, from neglect in keeping the limbs in a proper position, during the healing of burns and scalds, such contractions have taken place, the sooner the operation is resorted to, the better.

Cases occasionally present themselves of gradual contraction of all the fingers: this most commonly takes place in blacksmiths, and other mechanics, whose occupation consists in the constant handling of hard tools, the use of which require powerful contractions of the flexor muscles. The palmar fascia in these cases is much condensed and contracted. Instances of this affection are also met with in persons, in whom it could not have been produced by hard labour: in an instance which I met with lately, the ring-finger of the left hand gradually but slowly contracted, and was followed, in the course of a few years, by the middle and little fingers of the same hand: after some farther time the ring-finger of the other hand contracted, and the others followed in the same course: the fore-fingers are beginning to share the same fate. Upwards of twenty years have elapsed from the commencement of the malady. I am not acquainted with any means of curing this affection; in the case above alluded to several of the most eminent surgeons of this metropolis were consulted, but they failed in suggesting any thing that was of the slightest service.

CHAPTER IV.

Deformities of the Lower Extremities.

SECTION I.

OF INEQUALITY IN THE LENGTH OF THE LOWER LIMBS.

CONGENITAL inequality in the form of the correspondent organs, on the two sides of the body, as a cause of deformity, has not been much attended to. Among children, in whose persons deformities of the spine, or limbs, make their appearance, at a very early age, some will exhibit well-marked differences in the development of the two sides of the body: that side which corresponds to the distortion, will present a diminutive size in all its parts, when compared with the other. The cranium will be less developed on this side: the frontal, parietal, and occipital bones will project less; the same inequality will be observed on the two sides of the face, and the bones and muscles throughout the frame, will be smaller on the one side, than on the other.

The consequence of the shortness of one leg, will be perceived, as soon as the child walks, in an in-

clination of the pelvis, and curvature of the lumbar region, while on foot, but which disappear in the recumbent position. A second curvature takes place in the dorsal region of the spine, to maintain the equilibrium of the body: every step the child takes, the vertebral column is thrown into a serpentine form, and the shoulder of the opposite side to the short limb, will be much elevated. These distortions, are at first only apparent in standing, or in progression, in the sitting posture the spinal deviations are obliterated, and it is very long before they become fixed and permanent.

A correct eye will, in a moment, perceive the unequal development of the two sides of the body. The different length of the lower limbs, may be correctly estimated, by measuring the difference of extent, between the great trochanter and external ankle, of the two sides; or by raising the head, so as to remove the curves of the spine, and bringing the pelvis perfectly horizontal, the difference may be precisely found, by placing something under the foot of the diminutive side.

Inequality in the length of the lower extremities, whether congenital, or resulting from some disease in early life, which has disturbed the reciprocal development of the limbs, is not only a deformity in itself, but is mischievous by the consequent distortions, that inevitably attend it. We should therefore attempt to remedy it at an early period, before any

serious deviations of other parts have been established. It is of course impossible to effect a change in the original vice of formation, but by the adoption of a high heel and sole of sufficient thickness, to supply the want of length of the defective limb, we shall prevent that succussion in walking, which induces early fatigue, prevents the child from taking sufficient exercise, and ultimately effects distortion of the spine.

Exercise is the best means of strengthening the muscles, but it will always be avoided as much as possible, when it is attended with difficulty and pain: it becomes comparatively easy, and may be employed with its usual good effects, by the simple means of artificially equalizing the length of the two members. We meet with prejudices against the adoption of this simple measure, which it is quite impossible to account for; it is difficult to imagine any ill effect that can result, while it is incontestible, that in numerous instances it has prevented, and even corrected, lateral deviations of the vertebral column.

Inequality in the length of the two lower extremities, sometimes occurs after birth, in consequence of paralysis, which is often dependent on a deranged state of the organs of nutrition. This wasting of one limb in infancy, has been ascribed to teething, it takes place sometimes at the period of weaning, and may be attributed to the difficulty with which

the digestive organs accommodate themselves to the change of food, more especially when the quantity and quality of such food, are not well adapted to the delicacy of a child's stomach. These cases of partial paralysis are removed by gentle aperient alteratives, cold bathing, friction, and exercise.

SECTION II.

DEFORMITIES FROM MALFORMATION OF THE HIP-JOINT.

THERE are various congenital malformations about the hip-joint, which have been described by Palleta, and more recently by M. Dupuytren; but the subject is still obscure from the very few opportunities of anatomical inspection, which have been taken advantage of. Deformities, until very recently, have been so entirely left to the care of mere mechanics, that this branch of surgery has been but partially investigated.

In the cases, which we are about to consider, there is a want of conformity between the head of the femur, and the acetabulum: the former is forced upwards, into the external iliac fossa, the latter is much altered in form, or nearly obliterated.

In these cases, the head of the femur, has the form of a depressed sphere, of a vertical, horizontal, or oblique plate, or the head is totally absent, the

neck forming a styloid process, more or less elongated: sometimes the cavity of the acetabulum, is merely a superficial depression, or groove: most frequently, the two parts are united by an intermediate ligament, of different form and length, but in some cases, they are entirely independent. The opposed articular surfaces bear no affinity, and permit an extraordinary degree of motion; the limb may be moved in directions quite opposed to the natural conditions of the joint: it may be greatly elongated by extension, on the cessation of which it will be retracted. In most instances, precisely the same appearances occur on both sides: in others, there are evident differences, although both may be deformed.

The superior extremity of the femur, is of much smaller dimensions, than it ought to be, and perhaps, as a law of formation, the necessary consequence, is defect in the cotyloid cavity. On the one hand, the head of the thigh-bone, is not regular, nor even formed, but is replaced by a smooth plate, or a style, which contains but a small proportion of the osseous matter it ought to have: on the other hand, the acetabulum, not having been moulded by the round head of the femur, has been at liberty to assume the form of an irregular oval, of large vertical diameter, or of an ill-shaped triangle, or of a simple furrow, surmounted, or not, by a horizontal plate. The consequence of such

dispositions, is a decided lameness, on one, or both sides, and sometimes total incapacity of progressive motion.

The following account of this malformation, is principally taken from a memoir in the second volume of the Repertoire Générale d'Anatomie, by M. Dupuytren, who has admirably described both the symptoms and the anatomy. An illustration of this kind of deformity, will also be found in Cruveilheir's "Anatomie Pathologïque."

The deformity is principally constituted, by a transposition of the head of the femur, from the acetabulum, into the external iliac fossa, similar to cases of dislocation of that bone, upwards and outwards. The limb is shortened, the great trochanter is unusually elevated and prominent, almost all the muscles of the superior part of the thigh, are drawn upwards, towards the crest of the ileum, the tuberosity of the ischium is more than commonly exposed, and the limb is rotated inwards, throwing the heel out and the toes in. The obliquity of the thigh from above, downwards, and inwards, is greater than ordinary, and increases as the child advances in age, and the pelvis becomes more developed: an acute angle is formed, at the upper and inner part of the thigh, where it joins the pelvis, the thighs have a tendency to cross each other, and there is emaciation of the whole extremity, especially at its upper part.

This structure very much impedes the motions of the limb, more especially those of abduction and rotation, and engenders many difficulties, in station, and locomotion. In individuals thus deformed, there is a striking disproportion, between the upper parts of the body, and the inferior extremities; the trunk is fully developed, while the lower limbs are short and thin, as if they had belonged to a person of smaller stature. The shortness, and leanness, of these members, are rendered more striking by the size of the pelvis, the development of which, does not suffer from what occurs at its exterior.

With respect to attitude, the upper part of the trunk is carried very backward: the lumbar region of the spine is unusually forward, producing a great hollow in this part of the back: the pelvis is situated almost horizontally on the thigh-bones: the point of the foot, alone touches the ground: all these circumstances evidently result, from the transposition of the ileo-femoral articulation, by which the centre of motion, is carried to a point of the pelvis more backward than natural.

When a person, having this conformation of the hip-joint, is disposed to walk, he rises on the points of his feet, inclines the upper part of the trunk towards the member, which is to support the weight of the body, elevates the opposite foot from the ground, and painfully transports his weight from one side to the other. Every time that this effort

occurs, the head of that femur, which receives the weight of the body, is distinctly seen to rise in the external iliac fossa, the pelvis to sink, and all the signs of displacement to become more apparent on this side, while they sensibly diminish on the other, until this in its turn receives the weight of the body.

In the recumbent position, the deformity in great measure disappears, the weight of the body no longer bearing down the pelvis. In this position, we may, by extension, lengthen the limbs from two to three inches, and this can be effected without inducing pain.

The diagnosis of this affection is very important, because it has been confounded with scrophulous disease of the hip-joint. Dupuytren states, that he has met with individuals having this malformation, who had been confined to the horizontal position, for years, and had undergone repeated applications of leeches, blisters, cauteries, and even moxas, all of course without the slightest benefit. The absence of all pain, or swelling, of abscess, or cicatrix: the simultaneous existence of deformity, on both sides: the appearance of this vicious formation from the earliest attempt at motion: the progressive development of the deformity, as the weight of the upper part of the body increases: these are characteristics, which should enable us to distinguish this affection, from one so different, in its origin, nature and treatment.

Attention is seldom directed to this deformity, until the period for walking arrives, when it is discovered, that the infant cannot stand without difficulty: sometimes this is disregarded, the child is considered backward, and the mischief is not fully appreciated before the third or fourth year, when the imperfections in the form of the parts are too apparent, to be any longer attributed to this circumstance. When the pelvis begins to enlarge, and the child is obliged to make greater and more fatiguing exertions, the defect becomes very remarkable. At this period, the balancing of the upper part of the body on the pelvis: the projection of the abdomen: the curvature of the trunk: the unsteadiness of the heads of the femurs, their alternate rising and falling in the external iliac fossa, begin to be manifest. But the cause and nature of the malady are still involved in obscurity; these symptoms have in several cases been attributed to a fall or other accident, or to a scrophulous affection, which, before or after birth, had removed the acetabulum or the head of the femur.

As the weight of the body increases, the effects of this congenital displacement of the head of the femur, become aggravated: the great trochanters are observed to rise, more and more upwards: the bend of the loins forwards, and the projection of the abdomen increase: the balancing of the upper part of the body, and the lateral motion of the pelvis,

become more remarkable. The constant action of the weight of the body causes such an elongation of the ligaments, that the trochanters, and heads of the femurs, have been observed, by Dupuytren, to rise in a few years, almost to a level with the crest of the ilia: so that as these persons, and more especially the females, advance in life, they become almost incapable of any exertion.

As this malady does not affect the continuance of life, but few opportunities of post-mortem examinations have occurred. In the dissections made by Dupuytren, he found that those muscles which were not impeded in their motions, had acquired an extraordinary development, while others were almost entirely degenerated, being reduced to a kind of tissue, which had lost every vestige of muscular fibre. There was some attempt at the formation of a cavity, in that part of the ilium, to which the head of the femur had been removed, similar to the arrangements round the same part, in unreduced dislocations: this new cavity was very superficial, with very little elevated margin, and was situated in the external iliac fossa, above, and behind the acetabulum. In some instances, the round ligament was preserved, but much elongated, and flattened in its form, (Dupuytren); in others, this ligament had acquired a conical shape, was very powerful, and filled by its base, a deformed cotyloid cavity: it embraced the whole of a simulated head of the

femur, where the neck was altogether wanting.—(Palleta.)

Unhappily this malformation admits but of palliation; the recumbent position should be indulged in, as much as possible. Those individuals who are obliged to seek their subsistence, should be recommended an occupation, which admits of the sitting posture, for they are never capable of long-continued standing or walking. Cold bathing is recommended, as giving tone and strength to the muscles, on which the power of the limbs will mainly depend. Dupuytren has invented a bandage, from which some of his patients derived benefit: it is fixed on the pelvis, between the crest of the ilia, and the trochanters: it should not be more than three or four inches wide, according to the age of the patient, it should be stuffed with cotton, or horse-hair, and covered with soft leather: cavities should be formed for the reception of the trochanters: straps, and buckles, fix it to the circumference of the pelvis, while others passing under, with holes to receive the tuberosities of the ischia, retain the bandage in a constant and proper position. By this means the trochanters are maintained at a regular height, their connexion with the pelvis is affirmed, and the vacillation of the false joint in some degree alleviated.

Dupuytren is of opinion, that these deformities owe their origin to luxation of the bones before

birth: he says, that the fœtus maintains a position in the uterus, which is likely so to strain a point of the capsular ligament, or a point of the edge of the acetabulum, by the constant pressure of the head of the femur, as to render dislocation probable. But it is difficult to conceive an accident, which shall displace both thighs at the same time, during the intra-uterine life. Others, attribute these congenital deviations, to some original defect of formation, (in the words of Geoffroy St. Hilaire,) to some accident which has disconcerted the order of the embryonic evolution. May not some of these cases, be caused by rickets before, or immediately after birth? Attention is seldom called to them, before the inability of the child to stand, is discovered, and during the preceding months, numerous causes, rickets among the number, may have operated in the production of these deformities.

Cruveilheir, in his "Anatomie Pathologique" gives the figure and description of a fœtus, in which this and various other malformations were found. The coexistence of several connate defects, favours the opinion that such cases depend on some primordial disturbance in the evolution of the embryo. I have alluded more fully to this extraordinary fœtus, in the chapter on Club-foot.

Other distortions, producing lameness of one or both sides, sometimes depend on the malposition of the acetabula, which may be situated forwarder

or backwarder, more within or more without, than in the natural position of the part. These deviations are generally caused by rickets, and we meet with innumerable varieties of form in the cotyloid cavities of rickety pelves, preserved in every anatomical museum. All these deformities, are accompanied with more or less deviation of the spinal column.

In these often obscure cases of lameness about the hip-joint, it is important to examine with great care, the form of the pelvis, and the dimensions of its parts, as well as those of the lower extremities, their mobility, &c. in order to obtain a correct notion of the origin of the mischief, which may depend on many different causes, among which some are to be remedied.

Lameness similar to that, dependant on want of conformity, between the articulating surfaces of the hip-joint, is sometimes produced by unnatural shortness of the psoas magnus, and iliacus internus, muscles: the effect of which, is to hold the pelvis inclined forwards, to increase the natural curve of the lumbar vertebræ, to prevent complete extension of the lower extremities, and to cause that alternate balancing of the body, which is characteristic of deformities, about the ilio-femoral articulation. These cases are to be distinguished, by the impossibility of bending the thighs, beyond a certain point: by the elastic nature of the resistance, opposing this motion: by the increased inclination forwards of the lower lum-

bar vertebræ, when the extension is augmented: and the renewed flexion of the thigh, when the bend of the lumbar region is diminished.

There are other cases of lameness about the hip-joint, dependant on defect in the relative length of the muscles of the posterior region of the thigh, inserted into the tuberosity of the ischium, proceeding from an unusual inclination of the pelvis forwards. In these cases, the extensors of the leg, have more freedom, and the flexion of this part is not impeded: but in those described above, the contrary occurs, and the patient prefers a sitting posture, on very low seats, because he can then keep his lower limbs in that degree of relaxation, which is agreeable. When the patient holds himself upright, the condyles of the femur draw upwards the muscles of the calf, and the heel is raised from the ground: the increased undulations of the spine, from the too forward inclination of the pelvis: the alternate angles formed by the thighs and legs, imperfectly extended, and by the foot, the flexion of which is not sufficient: the narrowness of the base of support, being reduced to the space comprehended by the metatarsus and toes: all these circumstances render the erect posture little secure, and progressive motion rapid, unsteady and limping. It is important to distinguish these complications, because they are susceptible of cure, while the malformation of the hip-joint, which commonly accompanies them, is not. (Delpech.)

Delpech states that he has met with cases, where the extensor muscles of the leg were too short, and which are generally accompanied with a patella of diminutive size. These muscular defects are commonly complicated with those which produce club-foot, but in some instances they exist alone. The muscles of the anterior part of the thigh, inserted into the patella, are not fully developed, and the motions of the leg are consequently impeded.

Whether these defects exist alone, or combined with club-foot, we must use means expressly adapted for their removal, and the principle on which these remedies should be applied is the same, as in all other cases of shortened, or contracted muscles; viz: continuous extension, which is alone capable of effecting a change in their dispositions. The measures to be adopted for this purpose must of course be varied, according to the muscle, or set of muscles, which are defective: but the defect being known, and also the principle on which it is to be treated, there will be no difficulty in the application of extending power to each individual case. It is remarkable that as we succeed in elongating the shortened muscles, we also obtain an increase in their volume, a circumstance which is very apparent in the cure of distorted feet.

SECTION III.

OF DISTORTIONS AND CONTRACTIONS OF THE KNEE-JOINT.

THE principal distortions of the knee, occur in two directions: in one, the knee is thrown outwards and the foot inwards, and when this deviation takes place on both sides, the knees are unnaturally separated, the soles of the feet approximated, and the weight of the body falls on the outer edge of the foot; in the other case, the reverse of this occurs, the leg is thrown out, and the knees are brought close together, forming the distortion, commonly known by the name of "in-knee."

This latter kind of deformity is of much more frequent occurrence than the former, and is generally complicated, with some degree of torsion of the bones of the leg, or of the ankle-joint. In these cases, the natural inclination of the leg outwards, from the axis of the thigh, is greatly exaggerated: a considerable angle is formed between the thigh and leg: the knees are sometimes so approximated, that when the patient is standing, he cannot place them side by side, but is obliged to carry one behind the other. Some degree of twist is usually added to this deformity, and we find the patella, instead of looking directly forwards,

having more or less of an outward aspect: this increases the outward direction of the toes.

This deviation of the leg, greatly diminishes the solidity of station and motion: the limb being shortened, in standing the body is inclined towards the defective side, and walking is effected by a series of falls: the leg is obliged to execute a circular motion, which impedes progression, and renders it insecure. The relations of the bones being altered, those of the muscles are also, and this of course affects the facility, and the power of their action.

These alterations of form necessarily produce others. The leg cannot have its axis changed, without influencing the position of the foot. The transmission of the weight of the superior parts, by the tibia to the tarsus, is not made, as it should be, in a perpendicular line on the astragalus, the keystone of the arch of the foot. The pressure is made obliquely, and falls, at least in part, on the os calcis, which is not so well disposed to bear it as the astragalus. The foot subjected to this defective action becomes flattened, in consequence of the elongation of the ligaments of its internal margin, where much of the weight falls, which ought to be participated by the opposite side.

The articulating surfaces of the femur, and tibia, are more used on their external, than on their internal half; the internal lateral ligaments, and the cross ligaments of the joint, are exposed to unnatural

strains. At each effort of walking, there is displacement of the bones, almost amounting to dislocation: the internal condyle of the femur, appears as if it would escape from the articulation: the semilunar cartilage of this side is distended, enlarged, and thrust out of its place. When the mischief has been of long standing, and, when the leg is bent much outwards, the articular ligaments become so much altered in their structure, that the deformity can never be entirely removed.

Rickets, or softness of the bones, from other causes, give rise to this distortion, either by producing an incurvation of the body of the femur, or of the tibia, near the articulation, or by inducing that condition of the bones, which permits them to be crushed by the superincumbent weight.

This deformity has been caused by the destruction of the external condyle of the femur. Cicatrices with loss of substance of skin, and subjacent tissue, from burns and other accidents, have produced this, as well as many other distortions. The unusual shortness of the extensor, or flexor muscles of the leg, may be noticed as an occasional cause; in the first case the leg is drawn forwards, as well as outwards: in the second, it is retained in a bent position: in both, the patella deviates considerably outwards.

Muscular debility, connected as it always is, with a relaxed condition of the ligaments, is a cause of

distortions of the knee, as of many other parts. An example of this occasionally happens, when the cross ligaments being disposed to yield, their elongation is augmented by the extreme weakness of all the muscles: from whence, a remarkable inflexion of the leg forwards, and the formation of an angle, at the anterior region of the knee, results. In other examples from this cause, in consequence of the relaxation being principally seated in the lateral ligaments, the more common form of distortion takes place, and the leg is directed outwards.

This tendency of the leg outwards is a remarkable circumstance. In anchylosis after white-swelling, and other diseases of the joint, where the malady has deteriorated the consistence of the ligaments, the leg is first inclined outwards, and is then contracted in the sense of flexion.

The apparent projection of the internal condyle of the femur inwards, resulting from the inclination of the leg outwards, has been the source of controversy with regard to the reality, or the mere semblance of swelling, in the heads of the bones interested in white-swelling: but the best authorities, uniformly agree that, in these cases, there is no bony enlargement.

This deformity, if neglected, will continue to increase, until the ligaments acquire density enough, to bear the entire weight of the body, and to resist farther extension. The degree of deformity, where

the mischief stops in this manner, is not the same in all individuals, and we occasionally see the legs reduced almost to a horizontal direction. Where it occurs to this extent, the deformity is hideous, and impedes all motion: to stop its progress, and to efface its effects is therefore of great importance.

The cases most difficult of cure, are those dependant on a rickety or other diseased condition of the bones. Nevertheless, if the original cause of the mischief has been arrested, if the health has been restored, the persevering use of mechanical means constantly acting on the distortion, and preventing its increase, by supporting the superincumbent weight, will often overcome very great deformity. We may almost invariably effect an alteration in the form of bent bones, and distorted joints, by taking advantage of the favourable changes, which the development of the skeleton affords, during the period of growth.

In slight cases of in-knee, or bow legs, nothing more is required than a shoe with a sole of unequal thickness: in the first case, the internal margin of the sole should be the thickest, and in the other, the reverse. If this simple means be attended to, the constant adduction and abduction of the foot, will in time influence the knee, and insensibly restore it to its natural position. Where the child is young, this treatment will generally be successful, and its benefits will be greatly increased by the use of friction, and other means to strengthen the mus-

cular system. However, in bad cases, we must have recourse to instrumental aid.

The machines used for the correction of these deformities are well known, they consist of steel splints with joints and springs. Great care should be taken that the joints correspond accurately with the articulations of the limb, and the bandage round the pelvis should be particularly attended to. The joint of the instrument corresponding to the knee should be rendered inflexible in the early part of the treatment, for it is advisable to prevent the motion of the articulation, until the ligaments have contracted to their natural length. The irksomeness of the machine is always considerable at first, but even children soon become accustomed to the inconvenience, and return to their usual amusements without feeling any material incumbrance. After some time the instrument may be altered so as to allow motion to the knee-joint, and an ultimate and effectual cure will in the majority of instances result, if the treatment is endured with a fair degree of patience.

The employment of springs, on a similar principle to those, described and figured in the last chapter, for club-foot, are equally applicable to deformities of the knee, and the elasticity of their action, renders them more beneficial than the unyielding instruments in common use.

CONTRACTIONS OF THE KNEE.

Of all contractions, that of the knee-joint is one of the most frequent. In this affection, the thigh and leg, no longer maintain the same line, but present posteriorly an angle, more or less open. The extension of the leg is impeded, and progression is rendered impossible. It is hardly necessary to state, that the bones do not originally participate in this contraction, although in long-continued cases, they become fixed by a true anchylosis. The muscles and ligaments are first implicated, in these affections. The biceps, semitendinosus, and semimembranosus, are principally concerned, their tendons being generally shortened, and so tense, as to render extension impossible. This contraction is induced by various causes, among which may be mentioned, long-continued flexion of the leg, in maladies of much duration: prolonged progression on the toes from wounds on the sole of the foot, and other causes, which retain the knees continually bent. This contraction also results from cicatrices of burns, or other wounds. Where there exists a contraction of the thigh on the pelvis, we have more or less contraction at the knee.

In old cases, from whatever cause, the articulating surfaces undergo an insensible alteration, so that when the impediment formed by the muscles is removed, the joint cannot be bent. This arises from

bony deposition on the femur, tibia, and inside of patella.

It is sometimes difficult to distinguish true anchylosis from that state of rigidity of the joint, which admits of relief. This must be made out by an attentive investigation of the previous history of the case, whether it had originated in inflammation, whether any erosion of the cartilages had taken place, &c. Where the cause of impediment has its seat in the muscles, there will still remain some mobility in the joint: when true anchylosis has taken place the tibia can no longer be moved on the femur, and much pain will be produced by any forcible attempt at motion.

In all stiff joints, from contraction of muscles or tendons, or from rigidity and condensation of the ligaments after disease, we may by perseverance almost invariably restore the action of the part.

Gradual extension, friction, the application of vapour, and mechanical aids, to allow of exercise, are the means to be employed. But before having recourse to them, we must be certain that all active mischief has ceased, and, be very cautious that we do not reproduce it.

Among Mr. Amesbury's ingenious contrivances, is an apparatus for acting on a stiff knee-joint. It is a very efficient instrument, perfectly well adapted to overcome the rigidity of muscles and ligaments,

and with modifications is equally applicable to all cases of contractions.

SECTION IV.

OF CURVATURE OF THE BONES OF THE LEG.

This is a very common case, is frequently seen in children soon after they begin to walk, and is in slight cases, only an increase of that tendency to curve inwards, which is natural to the feet and legs of infants. It is often attributed to putting children on their legs too soon, and it is, perhaps, sometimes the mere mechanical effect of the weight of an unnaturally fattened child, acting on the extremities of the bones, which are always softer and more spongy than the shaft.

This distortion has been also attributed to teething, but it may, in many instances, be more justly considered as an early symptom of that state of constitution, which, if neglected, would terminate in rickets, and it is almost invariably attended with the characteristic feature of this malady—an apparent swelling of the ends of the long bones. The bones of the leg are sometimes bent directly forwards, the front of the tibia projecting over the foot, but more generally they form an arch over the outer ankle.

The health in these cases must be attended to, and when the distortion is slight, nothing more

need be done ; as the child grows, the deformity entirely disappears. In bad cases, where the distortion is considerable, the common instruments made by all machinists for such cases, worn sufficiently long will always remove it. Where there is any debility in the knee-joint, it is proper that the instrument should reach up to the thigh : I have seen cases, where irons have been employed for the removal of curvature in the bones of the leg, which might have effected the purpose, but unfortunately the knee was forgot, and before the leg was made straight, the internal lateral ligaments of this joint gave way, and the limb turned outwards at a considerable angle.

SECTION V.

OF CLUB-FOOT.

THIS deformity is either congenital, or the result of accident. I shall confine myself to a description of the former cases, because they most commonly demand our attention, and a modification of the same treatment, is equally applicable in both instances.

There are three principal varieties of club-foot. Those persons, who were born with feet deformed, and turned inwards, were by the ancients termed Vari : those, on the contrary, whose feet were turned outwards, were termed, Valgi : * these terms have

* This term was also applied to the bow-legged.

been retained, and are used by modern writers to designate the same deformities. A third kind, where the toes are directed downwards, the foot being retained nearly in the same axis with the leg, has been termed pes equinus, in common language, pointed toe. Of these varieties, the varus is the most common; for one case of valgus, we meet with a hundred of varus. The pes equinus is generally complicated with some degree of the other varieties.

In long-standing cases of these deformities, the foot, instead of being a machine in which all the parts move under the influence of the muscles, becomes an irregular assemblage of pieces, which enjoy but a very limited motion.

There was no good description of club-foot, before that of Scarpa was published. Duverney and others, attributed torsion of the feet, to unequal contraction of the muscles, but Scarpa found that the position of the bones was imperfect from the earliest period. Some consider these deformities to be produced by the imagination of the mother: others think they are the effect of the false position of the legs of the fœtus in utero: while others again look for the cause in want of room in the uterus. Some French writers attribute this, and other congenital deformities, to convulsions of the fœtus before birth. Breschet who has studied the development of the embryo, and fœtus, and has paid much attention to monstrosities, regards this vice of conformation as an imperfect

development, or an arrest of the organic evolution, causing a primitive malposition of the feet. Probably there is some early disturbance of the embryo, which deranges the process of organization, and obliges it to take an unnatural position.

Cruveilheir, in his "Anatomie Pathologique," gives a plate of a deformed fœtus, in which the feet, and hands, are all distorted. He supposes these defects to have been produced by compression, which prevented the members from being developed in their natural direction. This pressure, he says, cannot depend on the action of the uterus, from deficiency of the liquor amnii, for many children are born perfect where this was not abundant, and others are born with club-feet where there has been a deluge of water. Neither can it result from external pressure or blows, for many women receive blows, and among those, who from peculiar circumstances, conceal their pregnancy by tight lacing, there is not a larger proportion of children, with these malformations. Cruveilheir gives it as his opinion, that the causes of the compression is in the fœtus itself. In the remarkable instance which he describes, the legs, instead of being bent upon the thighs, were extended and applied to the anterior part of the trunk, the feet being doubled under the chin, and bent inwards on the tibia to accommodate themselves to their position. The two feet differed in deformity, as the compression differed on the two sides. In this case, however, it must be observed,

that there were several other malformations and defects. Both hands were distorted, the phalanges of the thumb, the corresponding metacarpal bone, the os trapezium, and a portion of the radius, were wanting, on the right side: there was also deformity of the pelvis, congenital dislocation of the hip-joint, and the rectum opened into the bladder. M. Cruveilheir deduces all these defects from pressure: compression of the pelvis, he supposes, caused the dislocation, and likewise the malformation of the rectum. But it appears more reasonable, to refer all such defects, to some original vice in the primitive formation, the result of which, in some instances, may have been increased by peculiarity of attitude in the uterus. The great variety of form in club-feet, renders this supposition probable, we scarcely meet with any two cases exactly similar, which also accounts for the discrepancies of opinion, among those who have detailed dissections of such parts.

OF VARUS.

The characteristic feature of this variety is inversion of the foot. The point of the foot is turned inwards and upwards. The degree of deviation varies in every case; where it is slight, the external part of the sole of the foot, presses on the ground, while the internal margin of the plantar region, affords no support. The deformity may stop at this point, but when no remedial means are employed,

this is but the first step of a more considerable deviation, which may proceed to the total inversion of the foot, when the internal margin looks upwards, forming an angle with the tibia. The internal ankle is almost entirely concealed, while the external projects and appears lower, and more backwards than usual. The heel is drawn upwards, and inwards, towards the great toe, so that it forms the posterior extremity of a curve formed by the internal border of the foot, and when the patient stands, it does not touch the ground. The dorsum of the foot is very convex, the skin over this part being very tense: the sole is very concave, and furrowed lengthwise. The external edge of the foot is rounded, and half circular: as the weight of the body rests on this part, the cellular tissue, and skin which covers it, become callous. The great toe is separated from the others, and abducted. It follows, from the foregoing description, that the external margin of the foot is turned downwards, the internal upwards, the sole inwards, the dorsum outwards: the tendo achillis is directed obliquely from without inwards, and is constantly tense. The muscles of the leg, and even those of the thigh, in some cases, are imperfectly developed, the calf of the leg is never formed, until the deformity is alleviated: it invariably happens, that the muscles of the leg increase in size, in proportion as the foot is restored to its natural position.

When the deviation is slight, and confined to one

foot, progression will of course be less secure than usual, but it is not seriously impeded. But when the malady affects both feet; when, as often happens, the knees also bend inwards, and the toes of one side touch those of the opposite, there is the greatest difficulty in walking, which can only be effected by alternately raising each foot, and carrying it above, and before the other.

When the child raises one foot, he is in danger of falling forwards or backwards, because the line of gravitation does not fall directly on the top of the tarsus of the foot, which rests on the ground, but on the place where there is no posterior projection of the heel, or it falls on the outer part of the external ankle; the child totters still more, when there is also a deviation of the knee outwards or inwards, which is a very common complication.

The emaciation of the leg is clearly not to be altogether attributed to want of exercise, for we find in children, who are incapable of taking exercise, that in proportion as the feet are brought into their proper direction, the legs acquire nourishment, size, and strength: shewing that the nutrition of an organ is dependant on the reciprocity of connexion, and the natural harmony of all its parts.

The bones in this malformation are not, properly speaking, dislocated, but removed from their mutual contact, and twisted around their smaller axis. Writers on this subject have differed with regard to

the particular tarsal bones, which are principally implicated in the distortion ; the fact is, that there is much difference in this respect. In some instances, the astragalus, in others, the naviculare, are most displaced ; but the four first bones, the calcis, the astragalus, the scaphoides, and the cuboides, are those which alone suffer displacement, in the majority of cases ; but they are never entirely removed from their respective cavities. The essence of the deformity, consists in the twisting of these bones around their smaller axis, the consequence of which is, that the cuneiform, the metatarsal bones, and those of the phalanges, are drawn into the same direction, and the toes instead of being horizontal, are placed in a vertical position.

The effect of this alteration among the bones, is that some of the muscles are shortened and some elongated: among the former are the tibiales, the flexor longus, the soleus and gastrocnemius, among the latter are the peronei muscles. The ligaments, which unite the tarsal bones together, and to the tibia and fibula, are found in a state of unequal tension, some being extremely rigid, while others are attenuated.

The following description of the anatomy of a case of varus, is from Cruveilheir's Anatomie Pathologique. The subject was a woman of 41, the foot was deformed from infancy, and her situation in life obliged her to walk much daily.

The thigh of the deformed side, was of nearly equal size with that of the sound limb, but the leg was emaciated. The subcutaneous adipose tissue of the foot was of considerable thickness. The skin was callous, the cutis being thickened, and the cuticle composed of several laminæ, on the projecting point of the os calcis, which bore on the ground. Between this tuberosity and the skin, was an irregular subcutaneous synovial capsule, which facilitated the gliding of the skin over this part. The skin of the sole of the foot, was similar to any other not subjected to pressure.

The aponeurosis of the leg was much thinner than natural, and had lost part of that glistening appearance peculiar to it. The nerves supplying the muscles of leg and foot, were extremely small. The tibial arteries were not half their usual size, and no injection percolated the muscular branches. The veins were equally reduced in dimensions. Of the muscles of the leg, the gastrocnemius internus and the soleus, preserved some fibres of the colour and texture peculiar to muscles, all the rest were degenerated into a yellow, fatty substance. The tendons were very small: the tendo achillis was not half so large as that of the healthy limb. The plantar aponeurosis was reduced in thickness, and had lost its nacreous appearance: showing that exercise is as essential an agent in the development of tendons, and aponeuroses, as in that of the muscles. The

muscles of the sole of the foot had preserved their natural appearance and volume, none had passed into the fatty state, except the accessorius to the flexor digitorum communis.

The articulating surface of the astragalus with the scaphoides, was singularly diminished in size, as well as most of the articulations among the tarsal bones. Part of the cartilage of the articulating surfaces of the tibia, and the astragalus was destroyed.

The bones of the legs in these cases, are generally straight in young subjects, and even in some adults: in others however, they follow the inclination of the foot. The articulation of the knee is sometimes affected, and the leg deviates from its proper axis, outwards, or inwards; but this curvature of the leg is consecutive to the distortion of the foot, and we can easily understand, how this will happen in rickety subjects, who walk on the external edge of the foot.

The external ankle is thrown outwards, and is increased in volume. The internal ankle is short, as if sawed horizontally near its base: its lower extremity presents a surface, which sometimes articulates with the os calcis, and sometimes with the naviculare. The essential character of this distortion is the elbow or angle, which the first range of tarsal bones, forms with the second: the first being on the same line with the leg, the second with the rest of the foot.

If we examine the phalanges of the toes, the metatarsal, and even the three cuneiform bones, we find that they are only changed in direction, and not altered in form. The scaphoides, says Scarpa, of all the bones of the tarsus, is subjected to the greatest deviation : in the dissections of Cruveilheir, this is not so apparent, and he considers the defects of this bone as consecutive. It is diminished in volume, in consequence of the compression to which it is subjected, and by the displacement of the astragalus : the articulating surface of this bone, with the naviculare, being reduced to a half or a quarter of its usual extent. Similar remarks apply to the cuboides, the articulating surfaces of which are equally deranged.

The astragalus, according to Cruveilheir, suffers more than any of the other tarsal bones : in this bone there is not only a change of direction, but also of figure : its deformity is exactly proportioned to the degree of club-foot. This bone is sometimes diminished in volume, and always deformed : its external articulating surface looks downwards, the internal is directed upwards. The articulating cartilage of its superior surface, is partially destroyed in some, and wholly in other cases. The head of the astragalus is reduced to two-thirds or less, and a large part of it having abandoned the cavity of the scaphoides, is placed under the skin, forming a tumor more voluminous, as the displacement is more

complete. In very bad cases, the weight of the body falls on this head of the astragalus, which takes the place of the tuberosity of the os calcis, or the heel.

The os calcis follows the astragalus in its displacement, and only rests on the ground, by its external margin: its posterior extremity is deformed and diminished in volume, and brought nearer to the internal ankle than natural. The anterior surface of this bone is not in apposition with the corresponding surface of the cuboides, hence the projection formed by the anterior tuberosity of the calcis under the skin, on which the foot sometimes rests in walking instead of the posterior extremity. When this part suffers pressure, the skin over it becomes callous, and a bursa becomes organised between the latter and the bone: the same circumstance occurs when the astragalus bears on the ground, and sometimes a cartilage is formed in the part subjected to pressure. Thus Nature accommodates herself to the morbid condition of a part, by the application of the same laws, which govern her operations in a state of health.

Among the descriptions which we have of the osteology of this deformity, there are no two which agree. Such is the great variety of club-feet, that in no two cases are the same bones equally displaced. At birth, the bones of the tarsus are so unformed, that they may be moulded to any shape, and many

of the peculiarities in the form and position of the tarsal bones in these cases, depend on circumstances which have operated after birth.

Plate 2 represents the bones of the foot in a case of varus: we see that in this case, the chief cause of the alteration in the form of the foot consists in the removal of the scaphoides from its articulation with the astragalus. The cuboides is also turned on its smaller axis, and leaves exposed part of the anterior articulating surface of the calcaneum: there is a kind of fossa formed between these two bones. The astragalus very nearly retains its proper position with regard to the tibia and fibula, its head being denuded by the turning of the naviculare, causes a protuberance.

Fig. 2 is a back view of the same foot.

OF VALGUS.

In this variety the foot is turned outwards: a very flat foot is a specimen of this malformation in a slight degree: bad cases are occasionally seen, where the dorsum of the foot is applied to the outer and anterior part of the leg. In these distortions the heel touches the ground first, and in some instances no other part of the foot; the astragalus being thrown behind the tibia, gives a lengthened appearance to the foot. I can find no anatomical description of the changes produced among the tarsal bones by this

distortion. It is comparatively very rare, and as the only difference in the treatment between this and varus, consists in reversing the action of the springs, used in the restoration of the foot, it is unnecessary to dwell longer on this subject.

Treatment of Varus. In early infancy, the foot may be easily restored to its proper direction: the ligaments then preserve all their suppleness; but as the child advances in age, the retracted ligaments become more rigid, the shortened muscles yield less to elongation, and the restoration of the foot cannot be completely effected; at a more advanced stage, anchylosis takes place among the tarsal bones, it is no longer possible to alter the direction of the foot, and all machinery is unavailing.

We cannot commence the treatment of this distortion too early; at birth very simple means only are required to restore the foot, and this may in all cases be effected, before the period arrives when the child should walk. Anchylosis is the only real obstacle to the cure of these distortions, and this does not take place generally, before the period of growth has ceased; but the bones become accommodated to their new positions, and it is difficult to effect a change in their position after the age of ten or twelve. The atrophy of the muscles may render the treatment longer, but it is never an insuperable difficulty, for the muscles invariably begin to ac-

quire strength, and to increase in form, as soon as the foot is restored to its natural direction. Neither is age always insurmountable, since many cures have been effected, after the body had ceased to grow. Every thing depends on the integrity of the bones, and the flexibility of the joints.

Whatever machines may be employed in these cases, we should be guided by the principle, of applying a power which shall gradually restore the foot to its natural direction, without causing pain, or other inconvenience, and without impeding progression during the period of the treatment. All the instruments used for this purpose, consist of one or more levers, to draw the foot in an opposite direction to that of the deviation. Some variations will be required in each individual case, to render the machine as little inconvenient as possible.

The objects proposed in the application of machinery, in these distortions, are, 1st, to effect a gradual turning of the bones of the tarsus, metatarsus, and phalanges, in a contrary direction, to that which the deformity has produced, and to restore the fore part of the foot to its proper and natural direction with the tibia; 2d, to substitute for the deficiency of the external ligaments, but more especially for the peronei muscles, an artificial force, capable not only of counterbalancing that of the tense internal ligaments, and shortened tibiales muscles, but of overpowering it, and of causing the ex-

ternal margin of the foot to remain, as it were suspended, on the ground; 3d, as soon as the equilibrium of the muscles of the leg is restored, to promote by means of the combined action of the two classes of muscles, the flexion of the foot on the tibia, so that as soon as the great tension of the tendo achillis, and gastrocnemii, is overcome, the posterior tuberosity of the os calcis may be depressed, and brought into its proper direction with the sole, that the foot may acquire the aptitude of performing the motions of flexion and extension.

The artificial force should at first be very moderate, and be gradually increased, but must never prevent walking. A gradual force will effect an elongation of muscles and ligaments without danger, when sudden straining and violent compression, far from producing relaxation and elongation, will have quite an opposite effect, and occasion retraction, rigidity, and spasm.

There are two stages in the cure of the disease, and there are two parts of the apparatus of Scarpa, respectively adapted to the two stages: the first, for turning the foot, from within outwards, to bring it into a proper direction with the tibia: the second, for correcting the direction of the heel, and retaining the tibia and fibula perpendicular to the astragalus. These objects are to be effected by a horizontal and a vertical spring, the actions of which will be understood by referring to the figure, and

description of the apparatus in the last chapter. The horizontal spring, should at first be only moderately tense, and gradually increased until the foot is quite straight.

Although I have particularly described the apparatus of Scarpa, I do not wish to be understood as recommending it in all cases, various modifications will be required to meet peculiar circumstances. In some forms of this distortion, simpler means, as that of Dr. Colles, will be efficient, but in more complicated cases, we shall find a necessity for other powers. A very excellent instrument is made by an ingenious mechanist, Mr. Taylor, in the Strand, it consists of an iron shoe, having a lever affixed by straps to the inside of the leg, with a bent spring passing from above the ankle-joint, to act on the foot when fixed in the shoe, and to force it towards its natural position. It may be sometimes necessary to combine the action of such an instrument as this, with that of Scarpa.

Daily frictions and manipulations of the muscles, should be employed, as they materially assist the action of machinery, in bringing the parts into a healthy condition.

During the treatment, we observe that the callosity of the skin, which was previously situated under the margin of the foot, is gradually removed to the dorsum: the external ankle, which almost touched the ground, by degrees assumes a more ele-

vated position: the internal ankle, which before was scarcely seen, gradually protrudes as the cure advances: the upper part of the foot loses its projecting part, and becomes of its regular shape.

In the second stage of the treatment, a lever is required to bring the body, and tuberosity of the os calcis more outwards, than can be effected by the horizontal spring, and at the same time to retain the tibia, and fibula, perpendicular to the astragalus. This is effected by a vertical spring, which being fixed to the stirrup, that passes under the sole, and bending outwards from the leg, will, when bound to the upper part of the tibia, bring the whole foot outwards, and place it in a proper direction, with respect to the bones of the leg. This second stage of the treatment, will require double the time of the first: the spring should be gradually increased in intensity, and the apparatus should never be displaced, day or night, except during the process of friction.* The child should never complain of pain, if he does, we may be certain the instrument is in fault, the springs are either too powerful, or there is some improper pressure, which will require to be attended to. For about a year after the cessation of the treatment, boots should be worn, having the outer edge of the sole thicker, and more raised than the inner margin.

* See figure and description in the last chapter.

It will be obvious that in valgus, where the foot is turned outwards, the instrument must be reversed.

In very young infants it was formerly the fashion to apply a bandage soaked in white of egg, and flour, but this is a very inconvenient and coarse mode of treament. In very slight cases, the judicious application of soap-plaister and a common splint will effect a cure. In other cases an instrument invented by Dr. Colles of Dublin, and figured in the first volume of Dublin Hospital Reports, should be applied. This kind of instrument will indeed remove the deformity, in most instances, if properly persevered with, before the age of two years: after which time, Scarpa's apparatus, or other more powerful means, must be had recourse to.

A similar mode of treatment will be found applicable to cases of contraction, resulting from abscesses and accidents. A deformity similar to varus has been produced by long-continued habit of walking on the outer margin of the foot, in consequence of the existence of sores on the inner border.

OF THE PES EQUINUS.

In this deformity the ankle-joint is stiff, the foot is fixed in a right line with the leg, and the patient walks on his toes. The heel is drawn upwards, the anterior part of the foot is carried backwards, so as

to become almost perpendicular to the tibia. There is a great concavity in the sole, and much convexity on the dorsum of the foot. When the deformity has been of some duration, the anterior part of the foot, on which the patient walks, and especially the great toe, become proportionally stronger, and more voluminous than the posterior part. The leg after some time, partakes of the malady, for since the patient cannot so well make use of this, as the sound foot, the muscles and bones are imperfectly nourished, and their development is consequently impeded.

This deformity is not preceded by any alteration in the osseous system. The essential feature of the disease is a shortening of the muscles of the calf of the leg, and consequent tension of their common tendon, which is extremely rigid and hardened. Other muscles are implicated, as the plantaris, the tibialis posticus, peroneus longus, which being shortened, concur in augmenting the malady. Any accident or other cause, that can effect a permanent contraction of these muscles, will produce this deformity, but it is generally congenital.

It seldom happens that more than one foot is affected. Progression is impeded to a great degree: for the articulation of the foot with the leg being destroyed, the patient is always obliged to place the deformed foot before the sound one. Walking on the toes is of course fatiguing and insecure, and it

generally happens that the foot is inclined to one side, so that in the course of time this deformity is often complicated with one of the other varieties of club-foot.

By the continual retraction of the heel, the upper surface of the astragalus becomes so displaced forwards, that it no longer remains in contact with the tibia, which bone in old cases rests almost entirely on the posterior part of the calcis. In the majority of cases there is no separation between the bones of the tarsus, or of the metatarsus, nor are these bones displaced as in the other varieties of club-foot, but in very old cases, they are longer in proportion on their superior surface, to what they are on the inferior.

In the fourth volume of the "Repertoire d'Anatomie," a case is described by M. Holtz, where the toes were so completely turned under, that the patient walked on the dorsum of the foot. The deformity existed on both sides, the legs were of equal size at all parts, the calves not formed. Walking was not painful, the patient moved easily without support. The knees were always somewhat bent, to maintain the centre of gravity. The tarsus bore on the ground, nearer to its external than its internal margin. He wore ordinary boots, but with the heels in front, and the points behind.

This man died in the hospital at Strasburg, and the following description is given of the dissection.

The tarsal bones were all luxated, but not altered in form, there were great intervals between them on the upper surface of the foot. The os calcis was drawn upwards and directed outwards. The tibia reposed on the inferior surface of the astragalus, and the inner ankle was situated above the scaphoid bone. The insertions of the muscles were, of course, altered by the derangements of the bones, but they were not so completely degenerated as in the dissection of Cruveilheir.

All these deformities depend on some incipient interruption in the process of organization, or on a change in the direction of the feet, during their evolution, at an early period of the fœtal life. There is always a tendency in the foot, to turn inwards, which may be observed in children after birth ; a great degree of this, constitutes varus, hence, this variety of club-foot, is the most common. Any peculiar impediment may place the foot in an unnatural position, the bones as they grow become accommodated to their new situation, and the articulating surfaces are shaped accordingly.

Mr. Amesbury's apparatus for pointed toe, is applicable to most of these cases. I have also figured at the end of the volume, an instrument used by a celebrated orthopediste of Paris, M. d'Ivernois.

CHAPTER V.

Of Pigeon, or Chicken Breast.

This deformity consists of lateral compression of the parieties of the chest, with anterior projection of the costal cartilages, and the sternum: it is sometimes complicated with posterior projection of the dorsal vertebræ. The sternum, with the cartilages of the ribs, which are fixed to it, form a narrow and elevated crest: sometimes the projection exists only at the upper, at others, only at the lower part, of this bone: sometimes the centre only is elevated. In the fourth volume of the Medical Gazette, Mr. Coulson has described a variety of this deformity, in which the sternum is depressed in the centre, and the corresponding ribs preternaturally bent.

While the ribs at the anterior part of the trunk, together with the sternum, form an irregular projection, in the rest of their extent they are too little curved, and even sometimes approach rather the straight line, than the curve: sometimes they rise at one point into a hump, and are depressed at another: this also occurs to the sternum.

This deformity is most commonly congenital, but

it is sometimes produced by pressure, blows or other accidents, which operate on the sides of the chest, or on the sternum: this, however, never happens except in unsound rickety children, whose bones and cartilages are soft, and ready to take any impression. In many instances, it may be considered, as the first indication of rickets.

This malady is far from being uncommon, especially among the children of the poor. It is seen every day at hospitals, and dispensaries, in the children of persons of scrophulous, or rickety constitutions, or among those, who live in the midst of damp, cold and dirt, who are ill-fed and worse clothed. The sternum forms a keel-like prominence, often attended with projection of the spine, like the back of a dog, indeed, the whole chest assumes the narrow form which characterises that of quadrupeds. Persons thus deformed, often have enlarged lymphatic glands and tonsils, with tumid abdomen: they are always subject to pulmonic complaints, which generally terminate, sooner or later, in phthisis. We may conceive the misery of that state in which, with a bad cough, there is a contracted chest, and enlarged tonsils; and when the hooping-cough attacks such children, we have presented a spectacle of as much suffering, as human nature can well sustain.

The chest is so compressed in some cases, that the two sides may be grasped with one hand. Al-

though the thorax gains in depth, what it loses in breadth, the new form does not suit the contained organs, for it is always accompanied with oppression and shortness of breathing, hurried circulation, and a condition of anxiety, and anguish, on every attack of cold, or other derangement of health. In the infant so formed, there is great difficulty in sucking, and threatened suffocation, which renders it necessary, that the child should quit the nipple every few instants, to breathe by the mouth. Going up stairs, speaking with vehemence, &c. affects these individuals, like those who labour under organic disease of the heart: indeed the disordered emotions of this organ, and the irregularity of the pulse, might induce a supposition that it was the seat of disease, if an attentive examination did not point out, that these symptoms were in relation with the motions of respiration, and the immediate effects of its obstruction. The child generally respires with its mouth open, and its sleep is frequently agitated, and interrupted by cries and starts.

Few infants born with this deformity get through the period of lactation, still fewer survive the third year, and of those who do escape the dangers of childhood, the majority are emaciated, weak, and incapable of much bodily exertion, all their life is in fact, one prolonged disease.

Many malformations of the chest are consequent on disease of the lungs in early life, or of congenital

defect in these organs. The chest envelops its viscera as the cranium does the brain: there is the same correspondence between the cavity of the chest and its contents, as between the brain and skull; where the brain is wanting we have no skull, and analogy would lead us to expect, what proves to be the fact, that where the lungs are not properly formed, the shape of the chest will be relatively distorted. Where any part of the lungs has been obliterated by disease, the corresponding part of the chest will contract: many instances of this are related by Laennec, Delpech and others. The mutual dependance of the lungs and chest is further proved, from the great benefit derived by persons on the verge of consumption, who have gone through those exercises by which the muscles of respiration are brought into action.

With regard to medical treatment: we must regulate the organs of nutrition by the persevering use of simple, and sufficiently nutrient diet: hyd. c. creta and pulv. rhei. are equally useful in this malady, as in rickets: tonics are beneficial, and of these carbonate of iron is one of the best. But the most efficient remedy is exercise, and many very bad cases have been greatly benefited, by the judicious application of such exercises as tend to spread the chest and depress the sternum. Dumb-bells are perhaps as good for this purpose as any of the more modern inventions: but as, in these cases, we have to

do with children who soon tire of any one thing, we must amuse them, and keep up their attention by as much variety, and novelty of exercise as we can furnish. A mode of exercise applicable to these and many other cases, is to raise a weight attached to a cord passing over two pullies: the other extremity of the cord should be attached to the middle of a lever, which is to be held by both hands: the patient standing, and even raising himself on his toes, to reach the handle of the cord, seizes it with both hands, alternately drawing up the weight and letting it fall: in this manner, the muscles of the arms, chest, neck and back, are brought into action, and invigorated by exercise. A pole held by the hands, with the arms extended, and moved in various directions, is also a good kind of exercise.

To these means, must be added friction and pressure on the chest, before and behind, performed not once, but several times during the day, and for a quarter or half of an hour each time. Pressure on the prominent part of the thorax, applied so as to correspond with the motions of respiration, I am informed by my friend Mr. Coulson, has been extremely beneficial in many instances where he has recommended it. The great perseverance required in such cases, makes it difficult to find any person, except the mother, who will do a child justice: but a sufficient number of cases are recorded

of the great benefit derived from the use of these means, when applied in early life, to afford ample encouragement to give them a fair and efficient trial.

In the intervals of friction and during sleep, an instrument should be worn, which will apply constant pressure on the projection: this is effected by the addition of springs and pads, similar to those of a common truss, passing from the back-plate of a shoulder-strap, or collar, and exerting counter-pressure on the seat of the malady.

CHAPTER VI.

Of Wry-Neck.

UNDER this denomination is understood that deformity, in which the neck is bent to either side, and a little forwards. In some instances, the head is carried sideways to such a degree, that the chin is brought into contact with one of the clavicles. The two sides of the neck, are very unequal: on that, towards which the head is drawn, the muscles are contracted, and shortened, of great volume and very tense: on the other side, where the neck makes a kind of projection, the muscles are extenuated. Sometimes the two sides of the head are originally deficient in their development, or they become so, when the malady has been of any duration: the muscles of the face, on the side where the contraction occurs, are diminished in size, the zygomaticus major, buccinator, masseter and others, become less prominent, and expressive, than those of the other side: the countenance acquires a disagreeable aspect, and indicates the constrained position in which the head is fixed. Very considerable efforts are required to rotate the head, even

in a limited degree, and sometimes this motion cannot be at all effected: patients so circumstanced, are obliged to turn their whole body, instead of turning their head only, and the constraint thus constantly endured, tends to the increase of the contraction.

In some instances, the face looks towards the opposite side to that, where the malady is seated: this will be easily understood, if we contract the left sterno-cleido-mastoideus, and although the neck is drawn to that side, the aspect of the face will be rather directed to the right.

The primary cause of this disease is most frequently seated in the muscles, especially the sterno-cleido-mastoideus, others may be in some degree implicated, but this is the principal seat of the contraction. The origin of this muscular contraction, has been attributed to many different circumstances: the habit of holding the head always on one side: being carried by nurses always on one arm, the child supporting its head on the nurse's shoulder: lying constantly on the same side in bed: these have been considered by different writers, as sufficient to shorten the muscles of one side, and to impair the power of their antagonists. But this inequality in the muscles is most commonly congenital, being slight at birth, and increased afterwards by any of the above-mentioned circumstances. This malady is also produced by wounds, or abscesses,

occurring in the vicinity of the sterno-cleido-mastoideus: the misplaced insertion of this muscle is said to be an occasional cause. Burns or other accidents, causing contraction of the skin, and subjacent tissue, also produce this deformity. Malformation or disease of the bones, may produce this distortion, but I have not been able to discover any account of such a case; the bones become implicated when the deformity has been of long duration, and anchylosis sometimes takes place among the cervical vertebræ.

Before applying our remedial means we should clearly ascertain, whether the original cause of the disease was in the skin or muscles, whether the malady was congenital, or subsequent to birth, and whether any degree of anchylosis has yet taken place. In all cases the rotatory motion of the head is very limited, and effected with difficulty and pain, but when anchylosis has been established it is altogether impossible.

Where the deformity depends on short or contracted muscles, it may be cured on the principle of continued extension, which we have so often had occasion to mention. A machine which will gradually extend the defective muscles, and at the same time allow motion to the head, will be the only efficient method of treatment.

In contractions of the skin from cicatrices, although operations are generally unsuccessful, and

have been abandoned by many surgeons, yet where the patient is willing to try the experiment, the mode of operating recommended by Mr. Earle, and described in Chapter III. may be resorted to. If the contraction is in a transverse direction, after the bands have been removed, we are advised to endeavour to make the wound contract longitudinally, by bringing the two sides as near together as possible, by means of adhesive plaister.

CHAPTER VII.

General Observations on Spinal Distortions.

Few complaints have given rise to more discordant opinions, than distortions of the spine. By some the original cause has been ascribed, exclusively, to the muscles: by others to the ligaments, and cartilages: and from the time of Pott, until very lately, caries of the bones was universally considered, as causing all the varieties of spinal deformity.

Before the time of Mr. Pott, these diseases were only considered with respect to their external characters; the distortions were mechanically treated without any regard to their causes. In the books of some old authors, we meet with plates and descriptions of instruments for the cure of deformities, and we can readily imagine the injurious effects of their application, in some instances, and their total inutility in others, from ignorance of the origin and true nature of the various kinds of deviation. In the present day we still meet with instances of the application of mechanism without due discrimination; and direct injury done, or valuable time lost, by trusting to the promises of those, who do not look

beyond the external symptoms, and profess to cure all deformities by external force.

Mr. Pott was the first who called in the aid of anatomy and physiology to the elucidation of spinal diseases, and we are indebted to him for leading the way in a rational investigation of this class of maladies. Many of his opinions have been modified by subsequent enquiry, but in that variety of disease to which his observations are especially directed, his descriptions are as valuable as ever. For many years after the death of Pott, surgeons appear to have remained satisfied with his Essay, the disease was called by his name both here and on the Continent: "Maladie de Pott" is still its designation in France. When a surgeon was applied to in any case of spinal distortion, issues were made on each side of the most prominent vertebræ, of course in many instances to no purpose, and mechanics often got into credit for curing deformities, which had derived no benefit from the advice of the most celebrated surgeons.

The beginning of the present century will probably be, in future ages, considered as an æra in the natural sciences. A new impulse has been given, more correct methods of investigation have been adopted, and these have been followed by general conclusions more useful and satisfactory, than in any preceding age of the world. It would hardly be exaggeration to say, that the natural sciences have

made more progress during the last thirty years, than was effected by the labours and investigations of philosophers, during all the preceding ages of the world. This applies perhaps more truly to medicine than any other branch, and the greater number of the maladies, of which I am about to speak, were absolutely unknown, at least their real nature was not understood, before the commencement of the present century. Indeed, it is only within the last ten years that the subject has been thoroughly understood, and the works of Mr. C. Bell, and the late Mr. Shaw, have been the cause of more correct enquiries into the nature of spinal diseases, not only in this country, but on the Continent. To Mr. Shaw we are indebted for the best work on lateral curvature, and for calling our attention to muscular inactivity and consequent debility, from which this variety of distortion most commonly originates.

Delpech, in France, has carried pathological investigations farther than any other writer, his account of curvatures from chronic inflammation, or what he terms, a peculiar affection of the fibro-cartilages, and from a tuberculated condition of the vertebræ, being derived from extensive opportunities of post-mortem enquiries, are particularly valuable.

By fair analogy we may expect to find in the joints of the spine, the same diseases which attack analogous structures in the other articulations of the body, and any man of unbiassed judgment, will

readily see that the primary cause of distortions is sometimes seated in the muscles, sometimes in the ligaments or cartilages, and sometimes in the bones. As the mode of treatment is essentially different in these varieties, it is imperative on us to discover the original cause of the mischief: for as it is wiser, and more effectual, to attack the causes rather than the effects of disease, so the trouble of the investigation will amply repay us. At one time it was the fashion to place all persons with deformed spines in the recumbent position, so to remain for one or more years. Now, it is obvious that if the cause of the deformity, lies in a deficiency of muscular power, total inactivity will not be very likely to remedy the disease, and it was therefore no uncommon occurrence to see persons after going through this ordeal, becoming at the end of the course of treatment worse than at the beginning; for such a state of disease, the simple remedy is muscular exercise, variously modified. Now the exercises of gymnastics in cases of inflammation of the fibro-cartilages, or caries of the bones, would clearly increase the cause of the distortion; in these instances, repose in the recumbent position, is the essential feature of the management.

The earliest source of deformities of the spine is rickets, cases from this cause mostly occur in the first ten years of life. The next general cause is muscular debility, and produces its effect on girls

of rapid growth from the age of 10 or 12 to 15 or 16. The affection of the fibro-cartilages attacks children of a lymphatic or scrophulous tendency during the period of growth: while curvatures from disease of bone occur at all ages, but seldom later than forty.

Among the occasional causes of deformity may be mentioned, contractions within the chest. The cavity of the chest, like the cavity of the cranium, is entirely filled with its viscera, the parieties are moulded upon their contents, and the proper development of the thorax, depends on the proper development of the lungs and heart. If any portion of the lungs is deficient, there will be a corresponding defect in the containing cavity. Cases of deformity occur from contractions within the chest, after abscess and destruction of portions of lung. Seurat, the man exposed to the gaze of the curious in this town, under the name of "the living skeleton," was an example of this kind. In the work of Delpech, will be found a detailed account of this man's case, and many others of a similar kind; Laennec has also described numerous instances of the same nature.

The contraction of the cavities of abcesses in the lungs, draws inward the corresponding ribs, and bends the spine laterally or anteriorly. The tissue generated by suppurative inflammation, which forms the cyst of the abscess, contracts and produces these

results. If an abcess forms in the upper part of the lung, the cyst will be attached by adhesive inflammation, to the three or four upper ribs, and also to the spine: after evacuation of the pus, the fibrous matter forming the cyst, will contract and bring together the ribs and the vertebræ. This fibrous matter sometimes ossifies, and the deformity becomes fixed and apparent. Recoveries from phthisis and empyema, in this climate at least, are so rare, that we are not likely to have our attention frequently directed to these results.

Some cases of deformity arise from congenital inequality of the two sides of the body. The muscles, and in some instances the bones, are less developed on one side of the mesial line, than on the other. The most important of these cases is where one lower extremity is shorter than the other: an account of this will be found in its proper place. The undue development of the bones or muscles of one side of the vertebral column, must be so rare a cause of distortion, that we may safely pass it by without further comment.

Rheumatism is a very common cause of curvature of the spine. In these cases the vertebral column is implicated, and a great arc is formed, the concavity of which is always forwards. The fibrous apparatus on the anterior part of the bodies of the vertebræ, is extremely liable to rheumatism, we may also expect, from analogy, that the fibro-cartilages are some-

times the seat of this disease, and the contraction of these parts will necessarily incurvate the spine forwards.

In subjects predisposed to rheumatism, the slightest twist of the spine will often produce a return of the disease: the writer of this, experienced an attack of lumbago and sciatica, which lasted for months, by suddenly jumping out of bed, and giving the back a jar. In such constitutions a slight deformity of the spine, which has been considered as permanent, will sometimes make a sudden and enormous progress.

In distortions from rheumatism, the curvature of the spine forwards, is, in some measure, the effect of indulgence in the most easy position. Few cases of curvature can be referred exclusively to any one cause, there is generally one or more secondary causes, which operate in conjunction with the primary. So, in rheumatic curvatures, there is generally defective action in the extensor muscles of the back: this operates by allowing an anterior flexion of the vertebral column, on the same principal that it does in the bent back of infancy and of old age.

The difficulty of correctly judging of any malady is greater, as the organization of the part affected, is more complicated and its functions more varied. The head alone excepted, there is no part, the functions of which deserve more attentive study, than those of the spine and its contents. The vertebral

column is destined to carry the head, to support the ribs and thorax, as well as the upper extremities; it forms the only solid portion of the abdominal cavity, and through the medium of the pelvic bones, it serves as a point d'appui for the lower limbs. In its canal is contained, that important organ with which all the nerves of sensation and motion, below the head, communicate. Whether it supplies them with their materiel of power, or merely receives their intelligence, and conveys it to the brain, we shall not here enquire; certain it is, that when any portion of it is injured, or compressed, all the parts below are paralysed. A smaller degree of derangement, whether from irritation, inflammation, or any other cause, will produce a proportionate effect on all the parts, which are supplied with nerves from that portion of the spinal brain, which is affected. Many of the obscure, anomalous, and what are termed nervous cases, which so perplex us in practice, have unquestionably their origin within the spinal canal, and in such cases it will be wise to refer to that portion of the back, where the nerves of the disordered part terminate. A more intimate acquaintance with neuralgic diseases, will probably establish the seat of many of them to be in the spinal marrow.

There are three varieties of spinal distortion: 1, lateral curvature: 2, curvature forwards or angular projection, which are degrees of the same inflexion: and 3, curvature backwards. Some con-

fusion has arisen from the use of the same terms, in different senses: the term excurvation, or curvature outwards, has been applied to the common variety of hump back, where the upper part of the spine is unquestionably bent forwards. I shall make use of no other terms than curvature forwards, and curvature backwards: by the first will be understood all cases where the upper part of the spine is bent anteriorly, by which the sternum is brought nearer to the pelvis than natural: by the latter term will be meant the reverse of this, which, indeed, is so rare a case, that it will require but little consideration.

In lateral curvatures, the whole spine is more or less distorted: in whatever part the vertebræ may first incline to either side, there will be, above or below, one or more curves in opposite directions, to maintain the equilibrium: and in some instances, the head will be so correctly placed over the centre of gravity, that the body will appear at first sight to be only shortened, and not distorted. Sometimes the whole of the dorsal vertebræ are included in one great sweep. This variety is generally dependant on muscular debility, and like all distortions from this cause, is temporary in its incipient stage, disappearing in the recumbent position, and by gentle extension; nor do such cases become truly permanent, until from very long continuance, the bones or fibro-cartilages are rendered cuneiform by pressure. Curvature forwards is most commonly dependant on

disease of the cartilages, or the bones: that degree of it, which has been denominated angular projection, is almost invariably permanent, and depends on progressive, or ulcerative absorption, of the fibro-cartilages, or of the bones.

The spine cannot be deformed in the dorsal region, without implicating the situation, and relations of the sternum, and the ribs: the rotation or contortion which is generally more or less combined with curvature, will also secondarily alter the form of the ribs and sternum. The mode of the posterior articulation of the ribs, hardly permits them to escape in any degree of dorsal curvature, unless the ligaments become greatly relaxed: to a certain extent this may occur, but at a later period of inflexion of the dorsal vertebræ, the ribs corresponding to the concavity of the curve, will be necessarily brought nearer together, while those of the convex side will be separated, and on the degree of resistance offered by the ligaments and cartilages, will depend the amount of distortion of the chest. The varieties of this are innumerable, as may be seen in any anatomical museum.

In old subjects we often meet with bony concretions between the vertebræ; this is also very common in old quadrupeds, many of those dying in menageries have the entire vertebral column formed of one solid piece, and it is the principal cause of that rigidity of the back, and want of ease in the

paces of an old horse. There is a remarkable peculiarity in this kind of ossification, it does not ordinarily occur in the substance of the fibro-cartilages, but covers them in several points, or in the whole of their circumference, leaving the subjacent structure untouched: so that, when vertebræ in this state are subjected to maceration, the bones remain united by osseous plates, or bands, while a space is left between each vertebra equal to the thickness of the cartilage. Persons having the vertebral column so affected suffer more danger in falls, than others; for not only are the bones more readily fractured, but, there being no elastic interventions, the jar is carried to the head, and may be immediately fatal.

Perhaps more distortions occur about the two inferior dorsal, and upper lumbar vertebræ than in any other portion of the spine: the connexion of the vertebræ of the back, is firmer than in any other part of the chain: just at the base of the firmer column there will be unusual freedom of motion, and this is the cause of the frequency of distortion in this part.

We may here notice some of the effects of spinal deformities on particular organs and functions. Curvatures forward produce only one kind of alteration in the form of the thorax: reduction of its cavity in the vertical axis of the chest. The two extremities of the spine cannot be brought nearer together, until the resistance of the sternum is overcome: it follows

that if this bone has lost none of its consistence, if it has not been drawn backwards, the cavity is little diminished, and the contained organs but little impeded.

Curvature of the spine backwards is of much greater importance, but happily it is more rare than any other form. In these cases, other curvatures either simply forwards, or on one or both sides, are soon produced. A strong pressure consequently takes place on the extremities of the sternum, and this force, combined with the different tractions of the ribs, produces a proportional inflection of that bone: generally a curve of which the concavity is directed forwards. There will then be projection both of the spine and the sternum, in the interior of the chest, and the constraint of the contained organs may be easily imagined.*

Dyspnœa occurs in distortions, from the irregular disposition of the bones of the chest. In inspiration, the cavity cannot be dilated to its usual capacity, in its lateral or perpendicular diameter, because the shortened intercostals cannot elevate the ribs to a proper extent, and the impeded action of the diaphragm, prevents it from depressing the abdominal viscera, so low as usual. From the inclination of the body forwards, the abdominal muscles, in expiration, cannot so completely effect a diminu-

* Delpech.

tion of the capacity of the chest, by pressing the viscera against the diaphragm, as when they enjoyed their normal degree of length.

From the diminution in length of the spine, the diaphragm presses unusually on the liver, and the contents of the abdomen. The viscera often accommodate themselves to such position, and carry on their functions much better than might be expected. But when the abdominal muscles are paralysed, or have their nervous energy impaired, from pressure or irritation of the nerves at their exit from the canal, or that part of the spinal marrow with which they are connected, the functions of the abdominal viscera will be greatly deranged. Pressure of the muscles of the abdomen, seems to be essential to the well-being of the functions performed in its cavity.

In the various forms of spinal distortions, the interior surface of the spinal canal is almost always, preserved smooth and continuous. When the deformity has taken place at a very early age, the calibre of the affected part is somewhat contracted, but in the dissection of adults it is rare to find any diminution. The foramina deviate with the vertebræ, are occasionally diminished in size, but never entirely obliterated.

In some cases of spinal deviation the growth of the body ceases: puberty is retarded: in males, the voice does not change, nor the beard grow.

The great vessels will be found, in post-mortem examination, to follow the course of the curvatures, and the circulation will of course, in such cases, be more or less impeded according to their extent. The ganglionic system of nerves and the thoracic duct will also be perverted in their course. The œsophagus generally passes through the chest in a direct line.

When we contemplate the deviations of the viscera of the chest and the abdomen, of the great blood-vessels, of the great centre of the absorbent system, of the various nervous ganglia concerned in the supply of nervous power to the organs of nutrition; when we consider the deranged condition of the spinal cord, the principal seat of sensation and motion, and the centre of communication of all parts with the brain, the perverted course of the nerves connected with it, as well as the great sympathetic; when we call to mind the impaired condition of the respiratory organs, of the intercostal and abdominal muscles; when we remember the important offices of all these parts in the animal economy, we cease to be surprised at the long list of maladies, which are attendant on, or consequent to, spinal deformity.

Our admiration is excited in witnessing the powers of nature, in many cases accommodating the viscera to new positions of the skeleton, by which they are enabled to carry on their offices suffici-

ently well, to permit many deformed persons to enjoy a great share of health and spirits, and often to distinguish themselves by great mental efforts.

We may form an opinion of those cases of distorted spine, which are susceptible of cure, by gently raising the body by the chin and nape of the neck, or by extension in the horizontal position, which is the best mode; if the curves are in part effaced, it is enough to shew, that the vertebræ have not been rendered immoveable, and we may consequently give a favourable opinion of the result. It does not follow that very bad cases are the most difficult of cure, for where there is great, but increasing deformity, we have more reason to expect success in our treatment, than when a smaller degree has been long in a fixed state.

In distortion from caries, the most happy result will be anchylosis of the remaining portions of the bodies of the diseased vertebræ. The necessity of a correct diagnosis in these cases is obvious. The same remark applies to spinal deviations in consequence of rickets; when the disease has terminated, and the bones have recovered their density, any change in form is almost, if not altogether, hopeless.

These general observations sufficiently establish the necessity of a careful diagnosis, in cases of spinal distortion, seeing that they are the effects of very different causes. For the sake of perspicuity, I shall

devote the next chapter to the description of the external character and the anatomy of the various forms of spinal curvature, and shall then proceed to investigate the sources of these deviations in the following order :

1st. Those which are dependant on defective muscular action.

2d. Those which result from disease of the fibro-cartilages.

3d. Those which result from disease of the bones.

CHAPTER VIII.

Description and Anatomy of Spinal Distortions.

SECTION I.

OF LATERAL CURVATURE.

THIS is the most common form of spinal distortion: indeed, there are few delicate females, in the higher or middle ranks of life, whose figure is not more or less affected by it, but often in so slight a degree, as not to attract the notice even of the individual herself. From the early application of tight stays: from the practice of keeping girls at work, or study, in the sitting posture, for many hours daily: from too little exercise, and consequent delicacy of health: these, added to a habit of leaning, or indulgence in any other attitudes, weaken the muscles of the back, and cause a deviation of the spine in the lumbar region.

In very many instances, no farther effect is produced, and a very slight curvature in the loins continues for life. It is only when a secondary distortion occurs in the dorsal region, and the figure palpably suffers, that the attention of the patient, or her friends, is directed to the subject. Perhaps many

of the anomalous complaints, to which hysterical and nervous women are so liable, may originate in these slight distortions of the lumbar vertebræ. The affections of the spinal marrow are every day attracting more attention, and I have no doubt, that future investigations of this part of the animal economy, will lead to the elucidation of these, hitherto, intractable disorders.

The first symptom which attracts attention, when a lateral curvature is forming, is the greater elevation of one shoulder; this is less perceptible in the morning than in the evening, when the patient is fatigued. By degrees the shoulder rises more, is more full, and a slight lateral bend becomes perceptible in the spine. On examination, the spinous processes of the dorsal vertebræ will be found sweeping too much to the right, those of the lumbar to the left; if a plumb-line be held from the occiput, and the points of the spinous processes be dotted with ink, the degree of deviation will be easily measured. In the dorsal region, the right side of the body will be more full, and rounder than the left, which is contracted and depressed: in the lumbar region the reverse condition will be found, fulness on the left, and sinking in on the right. (See plate 3.)

The characteristic features of this variety of spinal distortion, are an elevation and fulness of the one shoulder, generally the right, and the opposite hip.

There is a provision in the lower extremity by which the leg can be extended, and the weight of the body rest on the ligamentous connexions, without much muscular effort.* It is that position into which a soldier throws himself when commanded to stand at ease. One leg is gently bent, the other is extended and supports the whole weight of the body: the lumbar vertebræ bend towards the opposite side to that of the extended leg, while the dorsal vertebræ are drawn in a contrary direction, to maintain the equilibrium; this is precisely the case, in the common form of lateral distortion of the spine. As the leg on which the body rests is changed, the curves of the spine change: when the body rests on the left leg, the right shoulder is the most elevated.

A weakly girl will often indulge in this position, almost always on the left leg, and the left haunch will project, or as it is usually described to us "grows out." To balance the body, the trunk is

* This circumstance was first pointed out by Mr. C. Bell. It is similar to the contrivance in the legs of birds, by which, in roosting, they are enabled to grasp the perch without any muscular effort, but by the mere weight of their body. When a soldier is ordered to stand at ease, he instantly places himself in such a position, that the centre of gravity of the trunk falls in the back part of the pelvis, the weight of the body renders tense the muscles and fascia passing from the superior spinous process of the ileum to the patella: the bones of the leg become perpendicular to the arch of the foot, and the erect position is maintained with very little muscular effort.

carried towards the right side, and thus we have the right shoulder raised. As this position becomes fixed, and that it often does very rapidly, from the rapidity of growth at this period of life, the ribs of the left side are crowded together, while those of the right side are more than commonly separated: the consequence is fulness on the right and depression on the left side of the chest. A third curvature, often very slight, takes place in the cervical region, in order to bring the head perpendicular to the centre of gravity.

Independent of these lateral curves, the vertebral column is generally more or less twisted, or rotated, on its axis; by which the transverse processes of the lumbar vertebræ, are thrust forwards on the left side, while those on the right are entirely concealed. The sacro-lumbalis, and longissimus dorsi muscles, form a protuberance on the left, and are drawn inwards on the right, leaving a degree of concavity. In the dorsal region the transverse processes of the right side will be thrust outwards. The lumbar deviations form the first stage of the malady, but this seldom meets our eye, for, as I before observed, attention is not called to these early symptoms, being only awakened by the appearance of deformity in the back and shoulder. However, it often happens, that more than one cause operates at the same time, in the production of spinal distortion; when the fibro-cartilages are greatly relaxed, a deviation will

readily be effected in the dorsal region, without any previous curvature in the loins, and the first inflection will take place, where there is a constant solicitation to the right.

When a curvature has been once established, it generally goes on increasing, and a lateral curvature, as it advances, becomes complicated with distortion of the whole trunk. The ribs on the convex side are curved outwards, forming a hump, while the anterior part of the thorax becomes unusually flat, or sinks inwards. On the concave side of the distortion, the ribs are thrown forwards, while they present a hollow behind. These distortions of the ribs will be greater, or less, according to the degree of spinal deformity, and the rigidity, or relaxation of their articulations. In extreme cases the ribs are drawn into the axis of the chest, their upper edge becomes external, and their internal surface is turned upwards; they press upon, and mutually deform, each other, contract species of articulations at the points of contact, unite together in these points by a new fibrous tissue, and are sometimes completely anchylosed by bony secretion. In cases where the deformity of the ribs is not carried to this extent, the advantage is balanced by the want of security, arising from the great relaxation of their articular ligaments.

To attempt to describe all the variations in the form of the chest, in lateral curvatures, would per-

plex the mind without instructing it: a very slight inspection of the preparations of these parts in a museum, will explain more than the most laboured description. The distortion of the chest is greater in this, than in the other varieties of curvature, not only from the double or treble inflexions of the spine, but from the rotation which accompanies them. To so great a degree will this rotation occur, in some instances, that the body will be twisted almost to a lateral aspect, and the lower part of the sternum, and ribs, will be suspended above the crest of the ileum of the opposite side. The torsion of the abdomen in these cases, produces such a depression at the epigastrium, that the ordinary effects of the deviation of the lower part of the chest, are very much increased.

Although lateral curvatures of the spine, most commonly commence in the lumbar region, this is by no means invariably the case. Occasionally they originate with the dorsal vertebræ, but in whatever part of the column a lateral bend takes place, it is invariably followed, sooner or later, by one or more, in opposite directions. The body is not so much deformed by several of these inflexions, as it would be by one which was considerable, and it may be established as a rule, that the fewer the curvatures, the greater is the deformity. When there are four gentle curves in the spine, giving it a serpentine appearance, the deformity will hardly be perceived,

and may be concealed from any eye by dress: but when there is a very large inflexion of the dorsal vertebræ, the false ribs will approach to the crest of the ileum, and the distorted appearance of the body, will be very great.

When the malady has not been of long duration, the scapula is merely raised upwards, but when the subjacent ribs have become very convex externally, the scapula is also projected. The prominence formed by this bone, will depend on the seat of the distortion of the ribs, and accordingly we sometimes find the inferior angle the most projecting point, at other times the posterior or internal margin.

In very bad cases of lateral curvature, the form of the pelvis is affected, but this is so rare an occurrence, that it must be considered only as an exception to a general rule. The crest of the ileum on the side opposite to the lumbar curvature, will sometimes be elevated, the pelvis will consequently be oblique, and some internal irregularity will occur. The younger the subject the more danger will there be of distortion of the pelvis, which rarely occurs after the age of 12. When the lower limbs are tortuous, and the spinal curvature is connected with rickets, we may expect to find distortion of the pelvis. The weight and pressure of instruments have been charged with compressing, and distorting the pelvis; if applied to the soft bones of very young children, and considerable pressure used, such effects

may occur, but in this instance, instruments have been accused of more than can be fairly laid to their charge.

Lateral curvature occurs at all ages, but from very different causes. In the children of weakly and scrophulous parents we see it at the earliest infancy, and when it appears before the age of 10, it is almost invariably the consequence of rickets. From the age of 10 to 16 or 17, this variety of spinal distortion is met with in girls of rapid growth, whose constitutions have been weakened by inactivity: these are cases of every day occurrence, the effect of muscular debility. Lateral curvature takes place very frequently in girls of the same age, in consequence of a softened, and thickened state, of the fibro-cartilages, dependant on chronic, or scrophulous inflammation. I must refer to those divisions of my work which treat of these specific affections; we must always bear in mind, that distortions are only the external forms of internal diseases, they are consequences of some prior derangement, if we can destroy the causes, the effects will cease, at least we can never hope to remove the effects while the causes are still in operation.

This kind of deformity has been attributed, by many writers, to inequality in the action of the muscles of the two sides of the spine; but it is difficult to conceive that this can be the case, inasmuch as we generally find two or more curvatures in opposite

directions. If the malady originated in the want of due antagonism in two sets of muscles, the vertebral column would be bent on one side only, but this is comparatively a rare case. However, in admitting the fact of the greater number of lateral deviations in the dorsal region, towards the right side, we must also grant, that this direction of attitude, is determined by the greater use, and power of the right-hand muscles, and therefore some influence must be allowed to this cause. This theory has given rise to an absurd practice of anointing the muscles of the contracted side with goose-grease, and such other unguents as are thought to be softening, and relaxing, while the weak muscles of the opposite side are rubbed with spirits and strengthening liniments.

Some curvatures, to a certain degree at least, must be allowed to depend on attitude. This is proved by the form of many persons who sit much at a desk, nurses who always carry a child on one arm, turners, artists, and others. In these instances the deviation is generally confined to elevation of the right shoulder, and slight uniform curve of the upper lumbar, and all the dorsal vertebræ, towards the right side. Insane persons who remain constantly in one position, often exhibit deviations in the form of the spine. Lying on one side in bed, with the head raised, has been considered by some a cause of distortion, but this, and all other attitudes, to effect

any serious curvature, must be seconded by other causes. Growing boys indulge in peculiar positions as well as girls, yet how comparatively free are they from deformity. The plain state of the case is, that we are instinctively directed to relieve the back, by placing it in a waving direction, first on one side and then on the other, as horses rest alternately their hind legs; so long as the frame is in health, no evil can arise from such natural indulgence, but where the muscles of the back are weak, or where there is a scrophulous disposition, the ligaments will be lax, and the intervertebral cartilages less dense than they should be, and it is from such combinations of causes, that these distortions commonly arise.

Anatomical investigations have ascertained that the bones are seldom diseased in lateral curvature. In those cases which originate in very early life, they are usually soft and spongy, and lose their shape by pressure, but in the most frequent instances of this variety of curvature, we may consider it as established, that the bones are never altered in structure, nor is their figure changed but in old, and permanent deformities. The muscles, and ligaments, are found considerably altered both in form and texture: they are stretched and elongated on the convexity of the curves, while on the opposite sides they are contracted, as is also the skin. When the deformity has been of long continuance, the

muscles are found wasted, pale or yellow, and flaccid. When the ribs have for many years been placed in close apposition, or ride one over the other, the intercostal muscles will be nearly obliterated, this will also be the case with other muscles, which have been totally inactive for many years. In some old cases, the tuberosity, the neck and head of some of the ribs have been found completely anchylosed with the transverse processes, the whole being enveloped in bony matter and confounded together.

The fibro-cartilages are always reduced in thickness in the concavity of the curves. Mr. Shaw states that he never found them diseased, but that they always retained their peculiar firmness and elasticity: this is true with regard to lateral curvatures dependant principally on muscular debility. In cases resulting from the action of scrophula, or chronic inflammation of the intervertebral substance, it will be found softened and distended, its texture infiltrated with a gelatinous fluid, as the analogous structures are found in similar affections of the knee, or other articulations.

The influence of this distortion on the animal economy can be readily imagined by considering the anatomy of the parts implicated. The functions of the lungs and heart will suffer according to the degree of the deviation of the parieties of the thorax. The large vessels, the thoracic duct, and great

sympathetic nerves, follow the course of the spine, and make the same curves. The viscera of the abdomen are also displaced and often compressed, but they suffer less in general, than in curvature forwards.

SECTION II.

OF CURVATURE FORWARDS.

In this variety of spinal distortion, the upper vertebræ are brought nearer to the lower, and the spine is so curved, that the convexity of the arch is directed backwards and its concavity forwards. It is almost as frequent in occurrence as lateral curvature. It takes place at all ages, but from very different causes. In infants the spine is naturally bent forwards, the alternate curves do not then exist, and it is some months after birth before the dorsal muscles are capable of keeping it erect. In weakly children it is very long before the spine assumes the erect position, and in those of a rickety tendency, at the period when they should walk, their body is doubled forwards, from general muscular debility, or a compressed state of the bodies of the vertebræ; this is one of the earliest forms of anterior curvature. During the whole period of growth we meet with cases of this variety of distortion, sometimes the result of rickets, sometimes of chronic inflammation of the

fibro-cartilages, and at others of muscular debility. It occurs at all ages from disease of the bodies of the vertebræ, but more rarely after 40. The bent back of rheumatic and old persons are forms of anterior curvature familiar to all.

In this kind of deformity, a few vertebræ only may be affected forming a slight projection backwards, or a larger number being implicated, will produce a more extensive curve, or the whole spine may lose its normal form, and become one great arch. The rotation of the vertebral column on its axis, is less frequent than in lateral curvature.

When the malady depends on muscular debility, the curvature will be most extensive: when it results from intumescence of the fibro-cartilages, there will be first a projection of only one or two spinous processes, but the disease will soon extend above and below the original seat, and if not arrested very considerable curvature will ensue. In cases arising from the disease of bone, fewer vertebræ are concerned, and we consequently have, from this cause, rather an angular projection, than a curvature.

In many instances, where muscular debility is the principal cause, there have been no symptoms leading to any suspicion of approaching mischief, but as in lateral curvature from the same cause, the incipient deformity will first draw attention to the spine. Even where there is disease in the fibro-cartilages, or the bones, the pain is often so obscure, that the

nature of the complaint is not suspected, until one or more of the spinous processes project backwards.

In the chapters devoted to the consideration of the diseases which lead to the formation of spinal distortions, I shall dwell at large on the early symptoms of those morbid conditions of the muscles, ligaments, cartilages, and bones, which are the real causes of these deformities. In this section I shall briefly follow the progress of the malady, and confine myself to a description of the alterations of form externally, and internally, their effects on various functions, and the appearances on dissection.

In those cases attended with pain in the vertebræ, an accurate examination will detect an irregularity in one or more of the spinous processes, and if the body be bent forwards, this will be more apparent. At this period, the deviation disappears when the patient is in the recumbent position. After some time the spinous processes more evidently project, and are soon followed by others above and below the original seat of the disease: their projection beyond the proper line will be found to vary from half an inch to two inches.

Sometimes the whole of the dorsal vertebræ, are included in the curvature. When the disease occurs in this region, the curve is larger and less abrupt than when it takes place in the loins, because the closer attachments of the dorsal vertebræ together

and their connexion with the ribs, prevents the extrusion of one or two, without drawing others into the curve. In the lumbar and cervical regions, these distortions will approach more to the form of an angle, than in the dorsal region. The upper part of the spine will sometimes form a right angle with the lower; in some dreadful cases even an acute angle has been formed. (See plate 4.)

As the disease advances the patient becomes incapable of maintaining the erect position, and in sitting he is obliged to support the upper part of his body, by resting his elbows on a table. The lower extremities sometimes become paralysed, especially in that degree of curvature forwards, which has been termed angular projection.

The form and the extent of the curvature, depends on the number of the vertebræ, or fibro-cartilages compressed, or removed, as well as on the situation of the disease. When the bodies of many vertebræ are destroyed, the curve will approach to an ellipsis or an angle, but the degree of curvature will also depend on the depth to which the bones are corroded. Sometimes many vertebræ are affected, but the osseous matter absorbed, or destroyed is not great, because the effects of the disease are confined to the anterior surface of the bodies: hence there may be very extensive absorption, or caries, with little or no deformity. On the other hand the bodies of one or two vertebræ may be entirely removed, the column

will sink at this point, and the spinous processes will be very prominent. We may readily imagine the mischief done in such cases by shampooers and others, who see nothing but dislocation of the vertebræ, in such projections.

The bodies of the vertebræ are seldom entirely destroyed, that portion which forms the anterior part of the spinal canal, is the last to be affected, and in most instances escapes altogether, so as to leave the canal continuous and undiminished in calibre. This portion of the bone is of a more compact texture, than the spongy body, and like the spinous and transverse processes not so liable to disease. In very bad cases these processes are found anchylosed, but never carious. In the whole circle of medicine, there are few more interesting reflections than those which arise in viewing the evident provisions of Nature, for the protection of the spinal brain. Not only is the canal defended by the more indestructible nature of the bone which immediately surrounds it, than that of the rest of the bodies of the vertebræ, but when this is so diseased that the weight of the body must soon crush the spinal cord, an attempt is made to uphold the column, by the deposition of bony matter between the spinous processes, producing such a degree of anchylosis as will sufficiently support the spine, and preserve the functions of its important contents.

The spinal canal of course follows the disposition

of the vertebræ. If the curvature has been formed during the period of growth, the compressed and distorted vertebræ, do not increase in size in a relative proportion with the rest of the column, and the calibre of the canal will be contracted at the part where the disease is seated, but its internal surface almost invariably remains smooth and continuous.

When the arch formed by the curvature is small, the spinous processes are much separated, and the medullary cord is more exposed than usual, but these processes becoming ossified, an additional protection is formed for this part. The foramina for the passage of the nerves, are often considerably thrown out of their natural directions, and diminished in size, but never obliterated. We should naturally expect some disturbance in those parts, the nerves of which communicate with the tortuous portion of the spinal marrow, but the nervous symptoms do not in all instances bear a relation to the extent of curvature. Some patients with a small degree of distortion will be affected with paralysis of the lower limbs, general weakness, and torpor of the digestive and urinary organs, while others with very considerable curvature, from destruction of the bodies of several vertebræ, shall be able to walk to a very late period of their existence. (See plate 4.)

Although an interruption of the continuity of the medullary cord in curvatures of the spine, is not a frequent occurrence, some few instances of destruc-

tion of a portion of the medulla, are recorded by Ollivier, and others.

Numerous dissections have shewn that the aorta, vena cava, and thoracic duct, follow the circuitous route of the spine, but I shall avoid repetition by referring to the observations on this subject in the account of lateral curvature, many of which equally apply to the variety of distortion now under consideration.

When the malady is seated in the dorsal vertebræ the ribs are elongated, being drawn backwards by the receding vertebræ, so that the long diameter of the chest is reversed, and instead of being from side to side, becomes antero-posterior. The ribs are extenuated and rounded in form. The anterior part of the chest is narrow, and the sternum appears to project too much forwards. In some cases the sternum is bent, and forms an arch, the ensiform cartilage being entirely concealed.

The scapulæ are more or less changed in situation; when the distortion is considerable, and has commenced at an early age, they suffer in development. When the upper dorsal vertebræ project backwards, the superior portion of the scapulæ is also carried in the same direction: their inferior surface is thrown backwards and outwards, when the hump is formed by the middle dorsal vertebræ. As the disease advances, the ribs become straightened, and, losing their convexity, no longer afford the scapulæ

sufficient basis posteriorly, these latter bones are then situated at the sides of the chest, and are thus more than usually removed from the spine. Lateral curvature is sometimes complicated with anterior, and then the scapulæ are still more deranged.

The pelvis is more likely to suffer in those cases, where the disease is in the lower vertebræ: when it is affected, the deviation is in its antero-posterior diameter, not obliquely, as in lateral curvature. In curvature forwards, the inclination of the pelvis with the horizon, is more or less changed, according to the degree and proximity of the distortion. The sacrum suffers more from the influence of the malady, than the other pelvic bones: its superior portion is sometimes thrown more backward than usual, thus producing a preternaturally large antero-posterior diameter: it is also generally less inclined towards the horizon. In a great degree of angular projection, the promontory of the sacrum is entirely lost, which accounts for the observation, that some women with these deformities have, contrary to expectation, very easy labours.

When the distortion has altered the form of the thorax, and reversed the direction of its long diameter, the heart is situated at a greater distance from the spine than natural: palpitations, and irregularity of its action are common, and often give rise to unfounded suspicions of the existence of organic disease of this viscus. The form of the lungs will

be altered, being compressed at their side, and dilated in their antero-posterior direction. Respiration is always more or less impeded and pulmonic complaints are frequent. Oxygenation of the blood is not effectually performed, the lips, cheeks, nails, &c. often exhibiting that bluish tinge, so indicative of derangement of the respiratory functions. The ribs and sternum often approach so nearly to the pelvis, that we are surprised to find the functions of these parts carried on so well. On the principle which we have had frequent occasion to mention, that muscles lose their power when their insertions are preternaturally approximated, we may account for the want of proper action in the abdominal muscles, without attributing it, in all cases, to paralysis. This, however, does occasionally occur, according to Mr. Copeland's observations.

The length of the trunk being shortened by the curvature forwards, the thoracic viscera unusually press on the diaphragm, which forces down the liver and abdominal contents; and thus is produced, in part at least, that tumidity of belly, which is one of the characteristics of these complaints. By the sinking of the thorax, and its approximation to the pelvis, the abdominal muscles and the diaphragm are shortened, and until their structure accommodates itself to this change, they do not contract as it is necessary they should do, for the healthy action of the digestive, as well as the respiratory functions.

Many of the ribs being brought into close apposition, the intercostal muscles are rendered useless, and this is another cause of difficulty of breathing.

The muscles attached to the prominences of the vertebræ, implicated in the curvature, are stretched and diminished in size, and are found after death attenuated, pale and flaccid. The muscular system in the whole frame, suffers as well as in the immediate region of the gibbosity, for immobility of the vertebral column produces general inactivity, and impeded respiration is always attended with diminished muscular irritability.

The ligaments on the anterior part of the spine, are found in various states of tumefaction and ulceration, while the ligaments within the canal, and those connecting the posterior parts of the vertebræ, are generally free from disease. Analogy would lead us to expect that the disease sometimes originates in these parts, but this opinion has not been confirmed by anatomy, opportunities for examination not occurring until a late period of the malady, when the bones are also diseased. The destruction of the ligaments, is considered to be a consequence of the propagation of the malady to them from the bones, but it is not improbable, that the ligaments are sometimes the seat of chronic inflammation, of a similar kind to that which often invades the same tissues in the joints of the limbs.

When the bodies of the vertebræ have been wholly

destroyed, the anterior ligaments are sometimes found thickened, and partly ossified. In the progressive absorption of the bodies of the vertebræ, the ligaments are preserved entire, but in the carious or ulcerative absorption, they are destroyed. When anchylosis has commenced, the anterior and posterior ligaments, have been found in different stages of conversion into bone, or, to speak more correctly, the arteries had deposited bony matter in their interstices.

Where the cause of the curvature has been muscular debility, or rheumatism, the fibro-cartilages are much compressed, their anterior margin is rendered very thin, and in some cases the cartilage is entirely removed. The weight of the body, causing the absorption of the cartilages before it operates on the bones, which, as the curvature increases, are rendered cuneiform.

The intervertebral substances have been found thickened and softened, their texture being infiltrated with a gelatinous fluid. The distended fibro-cartilage forming a transverse ridge between the bodies of the vertebræ, and pressing on the spinal marrow, by protruding the posterior ligament into the canal.

When the disease originates in the bones, the bodies of the vertebræ, are found in every degree of caries, or of progressive absorption. The other parts of the vertebræ appear to be exempt, by their structure, from this peculiar affection. The bodies of the

vertebræ are destroyed in the most irregular manner, instances of which must be so familiar from the multiplication of engravings, and the numerous specimens contained in every anatomical museum, that it is quite unnecessary to enter into detail on this subject. Progressive absorption begins on the anterior surface of the vertebræ, and proceeds gradually backward ; in this manner, many of the bodies of the vertebræ may be entirely removed without suppuration. When suppuration takes place to a considerable extent, it constitutes lumbar, or psoas abscess.

Anchylosis takes place not only between the bodies of the vertebræ, but also between the spinous and transverse processes. No trace of the existence of the bodies of many vertebræ can be found in some preparations, two, three, or four occupying the place of one. The ribs are also found anchylosed with each other, and with the vertebræ. In caries of the spine they sometimes partake of the disease, and have been found soft and carious.

SECTION III.

OF ANGULAR PROJECTION.

What has been named angular projection, is but a peculiar form of the curvature of the spine forwards; the history in the preceding section equally applies

to this form of distortion, and but little more requires to be added.

Angular projection occurs most frequently in the lower dorsal, or upper lumbar vertebræ, for reasons which have been before stated. The fixed state of the lower lumbar vertebræ, near the sacrum, enable them to retain their position, without giving way at all, towards the production of a curve, and consequently if disease is seated in the bodies of one or more of the neighbouring vertebræ, the change of direction will be abrupt, and an angle will be formed. In these cases the bodies of the vertebræ are entirely removed, for if they are only partially absorbed, a curve is formed, amounting to a larger or smaller segment of a circle, according to the extent of the disease.

It is in angular projection, that the most frequent instances of pressure on the spinal marrow occur, producing paralysis of the lower limbs, of the bladder, rectum, &c. This effect would appear to be sometimes dependant on the extension of inflammation to, or effusion of some fluid on the medullary sheath.

When this deformity occurs in a child, it is almost invariably accounted for by some blow or fall, which would probably never have been thought of, but for the great anxiety which universally prevails, to avoid the imputation of constitutional infirmity. However, it is not improbable, that a fall may be the

exciting cause, which brings into activity, latent mischief.

Patients suffering under this form of distortion, are debilitated, and incapable of much exertion, they cannot hold themselves erect long, without support: the act of walking is imperfectly performed, the gait is waddling, or the legs cross, and the patient is thrown down. Persons thus deformed often seek support by placing both hands above their knees, and they avail themselves of any accidental assistance that falls in their way. When the vertebræ, fibro-cartilages, and ligaments, are much diseased, patients instinctively seek to remove all pressure from the bodies of the vertebræ, by lying down in the horizontal position, or by placing themselves on their knees and elbows.

The spinal canal in angular projection always maintains its continuity. When the fibro-cartilages between the carious vertebræ, and the bodies of one or more of these bones have been removed by ulcerative absorption, when their posterior surfaces are destroyed, the canal is laid open, and the medullary membranes, are exposed not only to mechanical pressure, but to the irritation of purulent matter: those dreadful consequences ensue, which are fully detailed in Chap. XI.

SECTION IV.

OF CURVATURE BACKWARDS.

In this deformity, the spine is bent backwards, so that the occiput is brought nearer to the sacrum; it is the most uncommon of all the varieties of spinal curvature. It occurs occasionally in the loins, but the deviation of the vertebræ hardly amounts to distortion, since it is but an increased degree of the natural curve of these bones forwards. Indeed, so far from being considered a deformity, this great bend of the back is at the present moment in fashion, for it appears to be the object of the present race of staymakers, and other manufacturers of ladies' figures, to force forwards the loins and pelvis, while the shoulders are thrown as far back as possible.

Mr. Bampfield mentions a case of great curvature backwards of the cervical vertebræ, where the occiput approached so nearly to the first dorsal vertebra, that the intervening space was only a finger's breadth. This was in a rickety and diseased child.

Preternatural inclination of the lumbar vertebræ forwards, has been met with, in consequence of a shortened or contracted state of the psoas, and iliacus muscles. When an attempt was made to produce perfect extension of the thigh, the lumbar vertebræ were drawn still farther inwards. These curvatures

of the loins are sometimes produced, by carrying heavy weights on the head. They are occasionally connected with lumbar abcess.

The differences in the anatomical structure of the anterior and posterior portions of the vertebræ, sufficiently account for the infrequency of curvature backwards, compared with curvature forwards. In their healthy condition, the intervertebral substances readily yield to compression, and allow motion of the spine forwards to a very much greater extent, than the oblique and spinous processes permit in the opposite direction.

CHAPTER IX.

Of Defective Muscular Action, as a Cause of Spinal Distortions.

In a state of health, the antagonist muscles of the limbs and trunk, are reciprocally poised, and equally proportioned in power. When one, or several muscles of similar action, lose their power of contractility, the limb is drawn by the antagonist muscles, out of its natural direction, and some degree of deformity ensues. In high amputation of the thigh, the flexors place the stump nearly at a right angle with the pelvis, because they have lost their controlling antagonists. The ligaments are not alone capable of maintaining the articulations of the bones in their perfect integrity; a correct action of the muscles is necessary to keep all the parts of a joint in their appropriate positions. The due maintenance of the osseous connexions, being in part dependant on the muscles, a defective or irregular action of these organs, must have considerable influence in the production of deformities.

Muscular activity is essential to the healthy state of the ligaments, fibro-cartilages, and bones. Want

of exercise is followed by debility and degeneration of the muscles; relaxation of ligaments, and softness of bones, are consequences of muscular debility. In persons of a strong, muscular frame, the ligaments are dense, and capable of much resistance: in weakly habits, where the muscles are but little exercised, the ligaments are relaxed, and the fibro-cartilages more pulpy than they should be. The same observation applies to the bones, which are extremely hard, and dense, in very athletic persons, while they are more or less soft and spongy, in those of an opposite character. Such are the mutual relations of the whole fibrous system. The integrity of the entire apparatus of the organs of motion: bone, ligament, and muscle, is dependant upon muscular contractility, the degree of this is consequent on exercise, and if the natural relations of these parts are destroyed, deformity ensues. The ligaments permit all the motions, which the muscles are capable of effecting; when the latter are irregular in their actions, or when they are defective in power, the ligaments soon yield, in the first instance to muscular contraction, and in the second, to the weight of the superincumbent parts of the body.

There are few cases of spinal distortion, which can be exclusively referred to mere weakness of muscle, or deficiency of irritability: probably in every case of this kind, there is more or less relaxation of the ligaments, and some loss of consistency

in the fibro-cartilages: but as these latter states are, in some instances, consecutive to muscular debility, they may be placed in a secondary rank, as causes of distortion.

Muscular debility is a common consequence of fever, or any general disturbance of the health, but in the form of malady we are now considering, it is generally the result of too little exercise, and is therefore a cause, as well as a consequence of ill health. Those muscles which should maintain the spine in its upright position, become so weakened that they are incapable of properly performing that office. We have endeavoured to shew, that the ligaments permit motion, but are not of themselves alone, adequate to maintain the articulations, without the aid of the muscles: consequently, when these fail in the performance of their functions, the weight of the body bears on the ligaments and fibro-cartilages which yield to the pressure, and spinal distortion ensues.

Distortions of the spine from this cause, most commonly occur in girls from the age of ten to sixteen. Weakness of the frame from some temporary derangement of health often lays the foundation, and the deformity sometimes makes great progress before it excites attention. In this variety of curvature, the lumbar vertebræ almost invariably give way first, as we should naturally expect, not only from the greater mobility of this region, but from

having to bear the whole weight of trunk, arms and head. The inclination in the loins is generally to the left, this is soon followed by another in the dorsal region to the opposite side, and the unusual protrusion, or elevation of one shoulder, is the first symptom which directs the attention of friends to the malady.

Girls of a relaxed fibre, of a lymphatic temperament, who have suffered much from the usual disorders of childhood, and whose growth is rapid are the most frequent subjects of this affection. Rapidity of growth is probably one of the most powerful exciting causes. The bones take the lead in the growth of the body, the muscles are at first elongated by the increased distance of their insertions, and some time must elapse before their breadth becomes proportionate to their length. It is at this critical period that young people are especially liable to this variety of curvature, and too often a pernicious system of education completes the mischief. At whatever sacrifice, this period of life must be devoted to the acquirement of that endless list of accomplishments, which modern refinement has rendered essential to female excellence. This is not the place to enter into a discussion on the merits of the present system of female education: happily the attention which has of late years been directed to this subject, has, in the better class of schools, led to the introduction of exercises, which

will be the means of preventing many deformities, and physical education may now be said, properly to share with mental. Happiness should be the end of every system of education; but, however beautiful may be the precepts, however excellent the principles inculcated, however highly the mind may be adorned, without health, these excellencies cannot be enjoyed. We too often witness minds endowed with almost every human perfection, struggling through life tied to a crazy constitution, the consequence of the greater attention paid to the mental capacity, than to the physical frame.

It is well known that muscles which are not called into action, lose their character, and after some time, suffer almost entire annihilation. It has been asserted that inactive muscles degenerate into cellular tissue, and that the latter is not merely the original tissue in which bone, muscle, &c. are deposited, but even that from which all other parts may be formed. The fact appears to be, that in the process of absorption, the fibrous parts of inactive muscles are removed, and the arteries do not deposit new ones, because they are not required, so that after some time, little remains in the place of such muscles but fat and cellular tissue. Such is the wonderful regularity with which the laws of Nature are carried on, that the secretions of a part are always accommodated to the wants of a part. In unreduced dislocations of the hip and other articulations, Nature attempts the

formation of a new joint; structures exactly similar to capsular ligament and synovial membrane are produced, but we cannot fairly infer that these new structures were effected by a mere change of cellular membrane into fibrous and serous tissue. Such changes never occur in the animal œconomy, all new structure is the work of the arteries, which by some inherent power, alter their depositions according to the new wants of a part. Such is the case in the formation of new joints, not a change of old structure, but a secretion of new by the minute arteries. In tuberculated lungs, in cancerous breasts, in fungus hæmatodes, the original structure is not changed, but in the ordinary course of nutrition, the disused particles are removed by the absorbents, and the arteries, instead of depositing new particles of a similar nature, deposit those which form a morbid structure. These and all other organic diseases, are the result of some morbific action of the local arteries, or of the general circulation, and this leads us pretty near the old humoral pathology, which like many other old notions, may one of these days come again into fashion, and I think with some modifications it will explain many of the morbid conditions of the animal œconomy. Cancer, fungus hæmatodes, and the deposition of tubercles, are not always confined to one texture in the same subject. It is possible that in these cases, there may be some erroneous mixture of the circulating fluid, (the consequence of

faulty digestion, or some of the other processes concerned in the formation of the nutritive particles,) and that the minute arteries deposit the matter, so contained in the blood, sometimes in a part already predisposed to a peculiar form of disease, as the breast with respect to cancer, or the lungs to tubercles, and at other times in tissues of a totally different nature.

As inactivity leads to distortions by destroying the power and energy of the muscles, so inordinate exercise will produce a degree of muscular development which almost amounts to deformity. This is seen in the disproportionate size of the legs of opera-dancers and the arms of blacksmiths. The influence of the muscles in maintaining the proper position of the articulating surfaces, is exemplified in the elongation of the ligaments of posture-masters, rope-dancers &c. whose occupations lead them, from an early age, to distort their limbs and trunks in a most extraordinary manner: for example, to hang their legs on their shoulders and walk upon their hands, the difficulty of which will be seen by trying to do it on the skeleton. The ligaments are, in these people, greatly stretched, and the connexion of the bones must mainly depend on the power and correct action of the muscles. However, such is the tendency of parts to return to their natural conditions, that the ligaments will soon contract to their proper dimensions, whenever the extraordinary action of the mus-

cles ceases. When such occupations are continued late in life, the ligaments will remain in a lengthened state, the joints will be loose, and we find that opera-dancers, &c. when, by age or infirmity, their muscular power has diminished, have their feet deformed, and their gait impaired.

Inequality of power in antagonist muscles is a frequent cause of deformity in the limbs and joints. As the limbs on the right side of the body are generally more powerful than those of the left, so this must be in some degree the case with the muscles, on the two sides of the spine, and in persons of weak relaxed habits may be partly the means of producing a lateral curvature. In these cases, there should be one general curve of the vertebræ towards one side, but this is a very rare occurrence in comparison with the number of cases where there are two, three or four curvatures in alternately opposite directions.

Inactivity is not alone sufficient to account for that degree of muscular debility, which induces spinal deformity. In warm climates, women take less exercise than they do in this country, and yet curvature of the spine is infinitely more rare in such countries, than in our own. In hot climates, all people indulge more in a recumbent position, reposing themselves when fatigued, as Nature dictates. With us, a girl from the age of 10, is obliged throughout the day, to maintain a constrained position of the body, she is not permitted to rest the muscles

of the back however weary, and the admonitions of parents and tutors are unceasing to keep herself erect. In this way the muscles of the back are overstrained, and the child will take every opportunity of relieving them, by falling into those positions which afford some relief.

The comparative immunity of the higher classes of females, in hot climates, from spinal distortion, may in part depend on their freedom from the pressure of stays and bandages. Mr. Shaw has some good observations on this subject, he says "it is perhaps correct to say, that the less exercise a child takes, the more does it require general muscular relaxation in the recumbent position, and that the lighter and more sedentary the pursuits are, the more necessity will there be, either for active exercise or general relaxation. Thus in warm climates, where active exercises cannot be taken, the due relation of parts, or balance of the system, is preserved by great indulgence in the recumbent position."

The effects of a constrained position of the body, and of defective muscular action, are farther increased by pressure on the muscles of the trunk by stays, which, like tight bandages to a limb, tend to produce extenuation of the muscles. They act injuriously in two ways: when very tight they cause wasting of the muscles by pressure, and when very stiff they induce debility of the muscles, by relieving them from a portion of their duty, and superseding the necessity

of their action in keeping the spine erect. Perhaps too many ill effects have been exclusively attributed to stays, for our great grandmothers wore articles of this sort, at least as stiff as any modern lady, but during the period of their growth they were not doomed to sit for so many hours daily to the harp and pianoforte, like their more unfortunate descendants.

The extensor muscles of the back, are inserted into the transverse processes of the vertebræ, and when those of both sides act in unison, the motion produced will be perfect extension; but when those of only one side act, a degree of rotation, or lateral curvature will be produced. When from any cause one set of these muscles are more frequently called into action than the other set, a tendency to curvature will be established, which, as a matter of course, will increase, unless means be used to arrest it. The weaker muscles will, from inactivity, continue to diminish in force, their power of opposition will more and more decay, until their antagonists, for want of control, will at length have produced permanent contortion.

Cases are occasionally met with, of excessive growth, during the continuance of febrile action. I knew a girl of fourteen, who, during the continuance of, and recovery from scarlet fever, grew to the extent of between two and three inches. The fact is difficult of explanation, but it is of too frequent occurrence to be doubted, and it would appear that

there was some relation of cause and effect, and reason to suppose that the morbific state had induced a change in the nutritive functions, with regard to the osseous system. For it is in the bone alone that the growth occurs, all the other parts being at the same time emaciated. This state of things frequently engenders curvature of the spine, as it did in the instance here referred to.

There are few children of either sex, about the age of ten or twelve, who do not hold the body bent forwards, especially when they grow rapidly, because the muscles are weak, and the weight of the superior parts is thrown on the ligaments, and fibro-cartilages. As the skeleton becomes developed, and the chest enlarges, the muscles acquire vigour, they restore the spine, re-establish a proper equilibrium, relieve the ligaments, and dissipate all fear of deformity. There are few mothers who have not felt alarm under these circumstances, for the form of a child, which has afterwards been developed without the least accident. Persons who, during the period of youth, have suffered from protracted illness, will sometimes have a degree of this kind of deformity permanently established, and become what is called "round shouldered." These inclinations of the spine, produced by temporary debility of the muscular system, are generally forwards: but if the ligaments of one side, give way to a greater extent than those of the other, in any one point, then we shall

have also a lateral curvature. Such cases of trifling distortion are common, and readily yield to exercise, regulated diet, cold-bathing, and tonics. The muscles, by these means, acquire vigour, and re-establish the natural direction of the bones; the ligaments, being no longer stretched by the pressure of the superincumbent weight, contract to their proper dimensions; as the elongated ligaments of rope-dancers, &c. return to their wonted length, when the exercises, which caused their unnatural dimensions, have been discontinued.

Deformities occasionally result from paralysis of certain muscles, or sets of muscles. Debility and wasting of some part, often of a whole limb, will be observed, and this may be followed by distortion of the spine. Cases of this sort are often consecutive, or co-existent with a deranged state of the nutritive organs, and readily give way as these organs are restored to health. In some instances such connexion cannot be traced, and we are led to believe that the mischief is seated in the brain or spinal marrow, but in the majority of such cases, the remote cause will be found in the digestive apparatus, the nerves being the medium through which such derangement affects, primarily, the muscles, and consecutively the spine.

In spinal distortion from defective, or irregular action of the muscles, the attention is first excited by the unusual projection of one of the shoulders or

hips, and a disposition to stand or sit on one side. This observation will lead to an examination of the spine, and we shall generally find it taking a serpentine course. The whole of one side, most frequently the right, will be fuller and rounder than natural, while the reverse will be seen on the opposite side. In distortions from this cause, there are no premonitory symptoms which would lead to an examination of the spine, before the deviation becomes obvious. There is in most cases little or no pain in the back, a weary, heavy pain is occasionally complained of, but this sort of feeling is so common during the period of growth, that it is generally unheeded.

In the greater number of these cases the lumbar region first yields to the pressure of the parts above, but this will be so slight as to escape observation, until the upper part of the spine is curved in an opposite direction, by the natural efforts to restore the balance of the body. After some time three distinct curves may be traced. One from the pelvis to the lower dorsal vertebræ, a second in an opposite direction, to the upper dorsal, and a third in the cervical region, to bring the head into its proper axis.

The thorax will be more or less distorted, one side of the chest being obviously increased, and the other diminished in size, but the ribs in recent cases are not materially altered in form. Indeed it may be laid down as an established principle, that in all distortions, whether of the limbs, or of the spine,

from defective muscular power, the bones are not altered in their form until the deviation has been of very long continuance. This fact is of great importance in respect to the possibility of effacing the distortion; instances have occurred, in which deformities from this cause have been entirely removed, even after the growth of the body has ceased.

The pelvis is never deformed in cases originating in defective muscular action. This is a most important circumstance, and by a little attention to the diagnostic symptoms of the various kinds of deformity, much unnecessary alarm may be prevented. Mr. Shaw's observations on this subject are so just, and lead to such valuable inferences, that they cannot be too widely diffused.

In all distortions of the pelvis, there will be found evidence of rickets, or other disease of the osseous system. It is well known, that ladies with considerable lateral curvatures of the spine, have very easy labours; and on the other hand, the pelvis will be very much distorted, where the spine is not at all so. The pelvis will seldom be found affected, unless the distortion of the spine began in early childhood. However twisted or curved the back may be, if the long bones of the extremities evince none of the effects of rickets, we may expect to find the pelvis free from deformity. When the curvature has been established after the age of twelve, the

pelvis will seldom suffer, but if the distortion appeared before the age of five, when the effects of rickets usually take place, there will be more probability of finding a narrow pelvis. Mr. Shaw thus expresses himself on this subject; "I shall even venture to say, that on prosecuting the enquiry farther, we shall be induced to conclude, that, in whatever state of distortion the spine and ribs may be, the bones of the pelvis will not be found distorted, unless there be at the same time, marks of rickets in some of the long or solid bones."

Instruments for the support of the spine have been charged with producing distortion of the pelvis, by their pressure on it as a point d'appui. Whatever other mischief may result from the machinery used to conceal distortions of the spine, it has no ill effect on the form of the pelvis, if there be no disease of the osseous system, and if there is, it would be madness to use machinery of any description. In all cases of distorted pelves, there will be found unequivocal signs of rickets, or other disease of the bones.

Treatment. Having endeavoured to describe those cases of distorted spine, which depend on some defect in the muscular system, we are now to speak of the treatment. It will be obvious, from the causes enumerated, whether debility, paralysis, or irregular action of muscles, that the indications of relief are,

in all the cases, nearly similar, viz: to give tone and power to the muscular system generally, and to the particularly defective muscles locally. This is to be effected principally by exercise.

It is of the utmost importance, that a correct diagnosis be formed, because, the mode of treatment is essentially different in this, and the two classes of spinal distortions, described in the following chapters. Nothing, for example, could be more unwise, than to prescribe perfect repose, in a class of diseases which are dependant on imperfect muscular action: from carelessness in tracing effects to their causes, and from the system of prescribing for symptoms, this has been done, and I know individuals who have been condemned to a recumbent position, for months and years, whose cases required to be met with various modifications of exercise. In slight cases of spinal deviation, from mere muscular inactivity, perseverance in a course of exercise, adapted to bring the muscles of the spine into regular action, should be rigidly enforced, not only to restore the vertebræ to their true position, but after this has been accomplished, to maintain them so.

Much has been said, and much has been written on the subject of exercises, adapted to bring into play the muscles of the spine, to expand the chest, &c.; many of those which have been recommended are good, but perhaps not superior to some of the old English games, which in former times, young

ladies were permitted to indulge in. Few will dispute the point, that most of the old games were far more consistent with female delicacy, than many of the modern gymnastic, and callisthenic exercises, which are better calculated for rope-dancers, and similar exhibitors, than for delicate females. Many of those exercises are partial, and tend to the development of particular muscles, which is a kind of beauty by no means desirable for a young lady. Some of them are too violent, absolutely amounting to very hard work, and if long continued must induce diseases, similar to those, which afflict the hard-working classes of the community. But others of them, are unquestionably beneficial to health and strength, and are well calculated to be of service in particular kinds of deformity.

Like most novelties, gymnastics attracted much attention on their first introduction into this country: some accidents occurred from the injudicious and indiscriminate employment of them, and they have lately been gradually sinking in estimation, many schools in which they had been adopted having relinquished them. This neglect will be as unwise, as was their too general use at first, for a good selection of them under proper regulations, would tend much to improve the form and vigour of the body, as well as the general health.

In France gymnastics have been employed to a much greater extent, than in this country, not only

are they prescribed in cases of deformity, but children of weakly habits, convalescents, hypochondriacs, and other invalids, are sent to the gymnasia, instead of the chemists, and exercise is considered as a better tonic than quinine. In the numerous establishments on the Continent, for the cure of deformities, every variety of exercise, which could be contrived, has been employed, and apparently with great success. Among the plates of Delpech, will be found representations of the positions, in which his convalescent patients are required to place themselves, many of which would accord very well with lads who were intended for the sea, but are preposterous in the persons of growing girls.—However, some of these exercises may be employed with great advantage in spinal distortions, but they should be regulated to the strength of the individual, and varied according to each particular case.

When curvature of the spine is attributable to carrying weights on one arm, to peculiar attitudes, or other habits, these must of course be discontinued, and in slight cases, the causes being removed, the effects will cease.

We can never expect that stays will be relinquished, such is the force of habit, that few women could dispense with them without great inconvenience. It is commonly considered, that if stays are not stiff they can do no mischief, but perhaps more ill effects are produced, if they are too tightly laced.

Although they may be considered but as secondary causes of muscular debility, and if worn sufficiently loose to permit exercise, and allow a proper play of the dorsal muscles, they may not be so injurious as thought by many, yet we know that tight bandages long worn, will produce extenuation of muscles. The bad effects of tight stays, and the necessity of continuing them when the habit has been long established, I have lately seen illustrated, in a manner by no means uncommon. At a certain time of life, ladies often relinquish that extreme anxiety about their figure, which formerly had perhaps absorbed too much attention. The stiffness and tightness of their stays, being no longer considered of importance, are diminished; in consequence of the removal of the accustomed mechanical support of the spine, curvature soon becomes apparent, and a figure which, at 30, was admired for its beauty, shall, at 40, be extremely crooked.

The slight anterior curvature, which constitutes what is called a stoop, is readily removed by proper exercises, but the means frequently made use of increase it. A weight hanging behind to keep back the head, calls into unusual action, the anterior muscles of the neck, and still farther increases their relative disproportion with their posterior antagonists, so that when the weight is removed, the stoop is worse than ever. The collars in common use,

for the same purpose, are equally injurious, they relieve the muscles of the back from all exertion, by preventing the possibility of their action, and thus increase the mischief they were intended to remedy. The plan of carrying on the crown of the head a bag of shot, of different weight, according to circumstances, is excellent in these cases, and when sufficiently persevered in, will effect a cure by strengthening the muscles. A cord attached to the head by means of a band, and passing through two pullies, having a weight at its other end, is also employed for this purpose. The head being moved up and down, exercises the muscles of the back, and the weight to be raised should be gradually increased as the muscles improve in vigour.

In recent cases of lateral distortion, it is still too much the fashion, to increase the stiffness of stays, and to employ steel supports and bandages, which undoubtedly improve the appearance of the figure, and conceal the distortion, but do worse than nothing with respect to the cause of the evil. These means are useful adjuncts to the treatment, they support the spine in the intervals of exercise, and thus relieve the irksomeness of long-continued recumbency, but their inefficacy in the cure of deformities, has been sufficiently exposed by their frequent failures. Exercises judiciously applied according to the variety of distortion, the occasional use of collars, and supports for the spine, attention to correct improper

attitudes in sitting, standing or sleeping, are the essential means for relieving recent cases of lateral, or anterior curvature from defective muscular action.

In cases of some standing, where the contractions of the muscles, and ligaments, have fixed the deviations of the vertebræ, more or less rigidly, we shall be obliged to use mechanical extension, before we can hope for much benefit from exercises.

Much prejudice prevails among English surgeons, with regard to the employment of machinery, to extend the spine: Mr. Shaw has raised some objections to it. In careless and ignorant hands, it is unquestionable, that unfortunate accidents have occurred, but we ought not to reject a most valuable means of removing some of the greatest of human misfortunes, because it has been abused. In France, mechanism is applied to distorted spines, with immense benefit, and some of those practitioners in this country, who have acquired eminence, for the treatment of this class of disorders, are indebted for their success to extension of the vertebral column. It is a most powerful auxiliary, and numerous cases of spinal deformity present themselves, which cannot be benefited, without the use of machinery, to overcome the contractions of the muscles, ligaments, and fibro-cartilages. All fibrous structure contains within itself a principle, by which it constantly contracts, when there is no resisting influence. If the fixed extremities of muscles, or ligaments, are by

any means brought nearer together than natural, the opposite force, which should hold them at a proper distance, being lost, the muscles, or ligaments, so circumstanced will contract and continue to do so: but separate their points of insertion, keep up a proper degree of extension, and the shortened fibres will gradually recover their normal length. This principle has long been acted upon, in the treatment of club-feet, and contracted joints. So long as anchylosis is incomplete, and the rigidity depends on contraction of muscles or ligaments, we know that, by extension and exercise we can overcome it; in true anchylosis, dependant on union of bone, remedial attempts would be worse than useless. These observations equally apply to curvatures of the spine; while there is no bony anchylosis, we may confidently anticipate a perfect restoration.

In the application of machinery to the spine, the danger to be feared, is injury to the spinal marrow, but such accidents can never happen with common care. In the process of hanging, death is produced by suffocation, and cases have occurred where, by some means, the trachea has escaped compression, and a person has survived an hour's hanging, although the weight of the lower parts of the body must have considerably stretched the vertebral column.

The employment of machinery to extend the spine, is the great secret of cure, in bad cases of

curvature. The means used for this purpose, are of less importance than prudence and care, in their management. I prefer making extension with the patient in the horizontal position. The head and shoulders being fixed by proper pads and bandages to the head of the bed or sofa, extension is made by a screw or a pully at the foot, communicating with straps attached to the sides of a bandage which surrounds the pelvis. Having by a careful examination determined that the curvature is unconnected with disease of the cartilages, or the bones, we must ascertain how far the vertebral column can be restored by extension.

If we find that the curvatures may be even partially removed by extension, our prognosis will of course be favourable. If there is no complete anchylosis, if the ribs are not greatly altered in shape, we may confidently expect to palliate the deformity, to improve, at least, if not to restore, the shape to its natural proportions. What may be effected by perseverance, even in inveterate cases, is truly astonishing, but it is only by rigid adherence to rules, and faithful attention to them, on the part of the patient, that we can hope for success in such cases. The earlier an attempt is made to cure deformity the better, but there are few curvatures, originating in muscular derangements, which cannot be entirely effaced before the growth has ceased, and many

old established cases have been cured, even some years after this period.

The great difficulty of treating this class of spinal distortions, consists in the necessity of removing the weight of the body from the vertebral column, and at the same time of using such exercises as will remove the evil by strengthening the muscles.

The plan in treatment I adopt in these cases of curvature, is in the first instance to place my patient in the recumbent position, to use gentle extension, and in the intervals, friction or shampooing. If the health is disordered it must of course be properly attended to, alteratives and tonics will often be required, and bathing will always prove highly beneficial; indeed, swimming is the very best exercise that could be employed in these cases, and is much used on the Continent. When by these means some improvement has been effected, the patient will be enabled to make use of Mr. Shaw's inclined plane with moving boards, or the moveable car of Delpech. (See figure and description in the last chapter.) Both of these plans, enable a person to exercise the body generally, and the dorsal muscles in particular, without assuming the erect position, and consequently without bearing the whole weight of the body on the debilitated spine.

It will be necessary to vary the exercises according to circumstances, and any person of common

ingenuity, will be able to invent something to meet the peculiarities of each individual case. Patients who are not yet old enough to estimate the value of a good figure, and who are not prompted by such considerations, to adhere to the rules laid down, must be induced to persevere by novelty in the exercises, and by making them, as much as possible, to resemble amusements.

In slight and early distortions, some attention should be paid to position during sleep, but in advanced or old cases this is essentially requisite. Means for retaining during the night, the advances made in the day, must be adopted. Stiff stays or steel supports, will, in some cases, be sufficient, in others, extension of the spine must be continued throughout the night. In Dr. Darwin's Zoonomia is a good expedient; he recommends a bed inclined twelve or sixteen inches from head to foot, the patient's head is held by an apparatus attached to the upper part of the bed, the inclination of the body to slide down, stretches the spine, and this may be farther increased by a weight appended to the feet.

In all the exercises employed, the muscles of both sides of the vertebræ, should be equally exerted, as well as those of both arms. A long pole held to the hands, with the arms fully extended, and moved in various directions, is a good modification of ex-

ercise, as is also, turning a wheel by each hand at the same time.

We are recommended to make use of sheet lead, to press on the prominent part of the ribs, but where such an expedient is at all requisite, the pressure of a spring as advised in the cure of pigeon-breast is preferable. Advantage will be derived, during the process of extension, from the employment of pressure on the curved portions of the spine, and also on the projecting parts of the ribs. The position may be varied from the back to the face, according to the feelings of the patient. Mr. Bampfield recommends a constant facial position, but as far as I have observed, this is more irksome, and endured more impatiently, than the usual method of lying on the back.

In all cases of spinal curvature, we should bear in mind, the natural inflections of the column. The object of the recumbent position is to afford repose to the muscles by supporting them: all muscles are in a state of relaxation when they are supported, no matter what the position of the limb, whether flexed or extended, if the muscles are horizontally supported, they cease to act. When, therefore, a person is ordered to lie on a hard mattress, we should take notice, that between the occiput and the dorsal region, there will be a hollow, and consequently no support; the same remark applies to the lumbar

region, which will especially require, a pad or pillow, to support the muscles in the natural bend of this part. Much has been said against the use of feather beds, but if not too soft, I think that in most cases, they are preferable to mattresses, for the pliability of their surface naturally accommodates itself to the inflections of the body, and every part is equally supported and at rest.

The above system of treatment is equally applicable to convalescents, from other spinal diseases, but the activity of the malady, whether seated in the ligaments, cartilages, or bones, must have completely subsided before we have recourse to active exercise.

The time required for the cure of spinal deformities of course varies. During the period of growth, perseverance will almost invariably ensure success, and if the distortion is recent, the shape will be restored in a few months, but the exercises must be continued afterwards to prevent a relapse. Even when the growth has ceased, if no absorption has taken place in the bones, if they have not yet been rendered cuneiform by pressure, we may sometimes succeed in removing the deformity entirely; but it is obvious that, when the osseous system is much implicated, a complete cure cannot be effected, and some degree of deformity must remain for life.

CHAPTER X.

Of Disease of the Fibro-Cartilages, as a Cause of Spinal Distortion.

In the disease which I am about to describe, the intervertebral fibro-cartilages undergo a peculiar change, they become tumid and soft by an alteration of their tissue, or an infiltration into its texture, of a jelly-like matter. This affection of the cartilages, is frequently confounded with that of the bones, described by Pott: the two diseases are often allied to scrophula: caries of the bones is sometimes a consequence of diseased cartilage, while ulceration of the cartilages in other instances, is the effect of carious vertebræ. The best account of this diseased state of the cartilages is given by Delpech: Dr. Jarrold of Manchester has also described a similar affection. The subject, however, is still enveloped in much obscurity, and it is extremely difficult, especially in the early stages, to distinguish disease of the fibro-cartilages from that of the vertebræ.

This malady is very insidious in its approaches, in its early stages it is often unnoticed, or the symptoms are referred to disturbance of other organs. It

occurs most frequently in strumous habits, or in constitutions partaking of the lymphatic temperament. The most frequent subjects of it, are weakly, pale, sickly girls, about the age of puberty, who have been tender from their infancy, and whose constitutions are so delicate that they are liable to disturbance of health from trivial causes. In such subjects, complaints are too often disregarded, or considered mere effects of rapid growth: any alteration observed in their gait, is often attributed to inequality of growth in the lower extremities: the manner of progression in the early stage of this disorder, having precisely the appearance of one leg being longer than the other, and requiring to be dragged after. However, long before the occurrence of these, or other symptoms, which would lead to apprehension for the spine, the individual is liable to slight attacks of fever, general malaise, and disturbed health, hardly amounting to positive illness, and which is often disregarded from an unwillingness to complain, and a difficulty to describe what is really felt.

So little do the early symptoms of this malady, lead to a suspicion of its real nature, that a decided curvature of the spine is often established, before it has been thought necessary to consult any medical authority. It is then ascertained that the health has long been in a precarious state, that the patient has been subject to repeated febrile attacks, dis-

ordered digestion, cough, and other symptoms; but so trifling has been the pain or uneasiness in the spine, that no suspicion existed of this part being the primary source of the disturbed health. Among the remedies usually applied to such derangements, a recumbent position is instinctively adopted by the patient; the symptoms are thus alleviated, and sometimes removed, to be reproduced by the weight of the upper part of the body or other exciting cause operating on the diseased cartilages.

If we are consulted at an earlier stage of the malady, we shall often find that pain may be produced, by pressure on the spinous processes of one or more vertebræ, and a hot sponge passed along the spine, will produce heat and pain in the immediate seat of the disease. The pain is usually described as heavy, dull, aching, very similar to slight rheumatism. By bending the body forwards, some of the spinous processes will appear to project more than others, stretching the skin and making it appear white and shining over their points; the spine will be found to deviate from the straight line, but is readily reduced to its proper form, by gentle extension in the recumbent position. Great fatigue is now induced by little exercise, the patient takes every opportunity of reclining, and if this posture be much indulged in, the progress of the malady will be retarded; but if the patient continues to walk about, and the superincumbent weight is con-

stantly bearing on the diseased cartilages, the curvature will increase with more rapidity.

The first stage of this disease is a slow, or scrophulous inflammation of the fibro-cartilages, the result of which is tumefaction and softness of their tissue. In many instances, the progress of the disease is extremely slow, but any derangement of the constitution, any accidental fever or other complaint, will call the mischief into full activity. It is under such circumstances that a fall, or other injury may appear to be the exciting cause, and generally bears the imputation of having solely produced the distortion. In the greater number of cases, the disease continues its progress unobserved, until the attention is called to an unnatural elevation, and protrusion of one shoulder, when a key to the disordered health is discovered. If the progress of the malady be not now arrested, the symptoms become aggravated, pains are felt between the shoulders, which are carried forwards in search of an easy position. The effect of this slowly progressive inflammation of the intervertebral substance, is to soften its texture, and destroy its elasticity, so that when the spine is acted upon by the muscles, it no longer retains the power of returning to its natural position, and a curvature is formed.

In this class of spinal distortions, the muscles may be the active means of drawing the spine out of its position, but the cause of the malady is not with

them, they act in the same way they always have done, but the healthy condition of the cartilages being destroyed, that re-action which opposed the muscles is lost. While the fibro-cartilages were sound they counteracted the efforts of the muscles, and by their elasticity restored the vertebral column to its proper position, but this elasticity being lost the vertical condition of the spine can be no longer maintained; it gives way to one side, most commonly the right, possibly because the muscles of this side are the most powerful, and the common attitudes for drawing, writing, &c. tend to elevate the right shoulder. A slight distortion being established, it continues to increase, not only by the contraction of the muscles, but also by the weight of the body, and a second and third curvature will be established to restore the head and trunk to the centre of gravity. Thus we have a lateral curvature established. In some cases of this malady the spine is curved forwards, and in others there will be a complication of both descriptions of distortion. On the subsidence of the inflammation and tumefaction of the cartilages, and when these substances contract, which they always do after the active stage of the disease has passed away, if the patient has much indulged in the sitting posture, with the body bent forwards, the fibro-cartilages will be reduced to the shape of a wedge, and an anterior curvature of the spine will be established.

In many of the preparations of distorted spine, preserved in museums, we find the bodies of the vertebræ very little, or not at all, changed in form; the altered dimensions of their intermediate spaces being sufficient to account for the tortuosities of the whole column. In recent morbid specimens of this kind of distortion, the difference in the thickness of the fibro-cartilages from one side to the other is very perceptible; but, in those where the soft parts have been destroyed by maceration, it is sometimes difficult to judge of the real nature of things; however, we sometimes meet with preparations where the vertebræ are held together by exostoses, and the vacant intervertebral spaces, give the idea of an interposed body, the thickness of which was greater in some points of its circumference than in others. In many cases this oblique form of the cartilages is in harmony with the general curvature of a whole region of the spine. In the dorsal region, where curvatures from this cause most frequently occur, the thickest part of the fibro-cartilages will be on the right and the thinnest on the left. Where there are two curvatures in opposite directions, the difference of thickness in the circumference of the cartilages, follows the course of the inversion; thus in the loins, where the curvature is in the opposite direction to that of the back, the cartilages will be thickest on the left side.

In the majority of anatomical investigations, the

intumescence has been found to affect several of the intervertebral cartilages, but in some instances it is limited to a small number of them. From the manner in which these cases proceed, it would appear that the affection has its origin in one point of the spine, from whence it spreads to others; however, the disease will sometimes attack a large portion of the column simultaneously.

Unfortunately, the early symptoms of this malady are very equivocal, and many of them are equally characteristic of other derangements. Sometimes there will be fixed pain in one or more points of the spine, but it is often so general that the precise seat of the disease is but vaguely indicated. Sometimes the only pain felt is in the epigastrium or flanks.—The first deviation is very indistinct; the direction is determined by the greater or less thickness of any point of the circumference of the fibro-cartilages; from which circumstance we have in this disease distortions in every direction before or behind, but most commonly to the right or left. If, at the same time, any cause of complication exists, as inequality in the length of the lower extremities: a cicatrix on the external surface, or within the chest: a constant and peculiar attitude: any of these may determine the direction in which the distortion shall take place. The deviation is, at its origin, not only slight, but disappears when the patient is in bed; is not at all apparent in the morning, and makes but slow ad-

vances, if the principal functions, especially the digestive, are correctly performed : it increases rapidly under the opposite circumstances, and may be traced in its progress to other vertebræ, above and below the primary point of attack.

According to the observations of Delpech, the vertebræ in this form of disease may be moved in a horizontal direction, that is to say, by pressing on the spinous processes the bodies of the vertebræ may be forced inwards, in consequence of the thickening and extreme softness of the fibro-cartilages, and the relaxed state of the ligaments. I have never had an opportunity of verifying this observation, which is very important, for if it be correct, a partial luxation of the cervical and lumbar, if not of the dorsal vertebræ, may be readily supposed to occur, and the views of Dr. Harrison deserve more attention than they have received. Delpech relates cases where one or two vertebræ deviated in an opposite direction to that of the general curvature, which are in fact examples of partial luxation.

In children of scrophulous constitutions, this disease will attack the whole course of the intervertebral cartilages: the little patients are fatigued by the smallest exertion, they like repose, and take no part in the exercises, or amusements of their age. They suffer from frequent and inexplicable derangements of the digestive functions, palpitation of the heart, oppression, and pain at the epigastrium. They

avoid bending the body in any direction, and the expedients made use of when they cannot avoid it, are often remarkable. In walking they will stumble frequently, and feel pain in the back, which pain ceases as suddenly as it occurred, and of which the patient cannot always indicate the seat with precision. If pressure be made on the spinous processes of each vertebra in succession, pain will be felt in one or more points, and sometimes an almost epileptic seizure will be experienced, accompanied with convulsive actions of the upper and lower limbs. If this examination be made while the patient is standing, he will sometimes fall down at the moment when the pressure is made.

Spinal curvatures from this cause, are most readily multiplied, on account of the unusual mobility, which the tumefaction, and softness of the fibro-cartilages, produces in the vertebral column. It is important to ascertain all the inflections of the spine, in order to meet them by proper modes of treatment, but it is often difficult to make out the whole extent of the malady. Curvatures backward are long before they are remarked, are difficult to distinguish, because the spinous processes and the posterior plates of the vertebræ, prevent such deformities from becoming extreme. Very particular attention is required, to detect the existence of a concave point, in the posterior region of the spine: we should bend the body forwards, and we may then discover if there is any

break in the great arch, which the spine should form in that position.

Some lateral distortions from thickening and softening of the fibro-cartilages are very complicated; not only does the alternate play of the muscles, to establish the equilibrium, singularly vary and multiply the inflections of the vertebræ, but an unequal thickness in any one or more of the intervertebral spaces, may at that point produce a deviation in an opposite direction to the rest of the curvature.—Delpech states, that he has met with five or six opposite curvatures in cases of this nature, which he attributes to the circumstance of some of the fibro-cartilages being more diseased than others; and the corresponding vertebræ are consequently forced by pressure in an opposite direction to the rest. Incurvations of this kind in the upper part of the dorsal region, are often difficult to detect, because, if they are not very considerable, they are easily concealed under the displaced shoulder-blades.

Although produced in the first instance by tumefaction of the fibro-cartilages, long-continued deformity from this cause, induces atrophy of these same parts, and the pressure will then be directly on the bone. Amongst the distorted spines, preserved in museums, will be found many specimens exhibiting this absorption of the intervertebral substance, the vertebræ being in juxta-position with little or no alteration in their form.

Diagnosis.—Careful investigation will readily enable us to distinguish deformities from disease of the fibro-cartilages, from those originating in defective muscular action. The weary pain sometimes complained of in distortions from muscular debility, is relieved by exercises, which would increase pain that was dependant on chronic inflammation of the intervertebral substance: the pain in the former cases is never so great as in the latter, nor is it ever induced in the first by pressure on the spinous processes, or by the application of a hot sponge. In deformity from muscular debility, the primary distortion is in the lumbar region, which forms a gentle curve to the left, followed by a deviation of the whole dorsal region, in the opposite direction, producing elevation of the right shoulder; the curves are more regular, and implicate a greater number of vertebræ than in deformities from alteration of the fibro-cartilages, in which the primary deviation is rather a projection backwards, of one or more spinous processes in the dorsal region, complicated with some degree of lateral curvature, but the curves are smaller, less regular, and more numerous than in the former.

The health is more impaired in these cases, than in those described in the preceding chapter, the constitution often exhibits marks of scrophula: the patients are generally dyspeptic and febrile, bad sleepers, complain of a sense of constriction at the

pit of the stomach, of twitchings in the muscles of the abdomen and those of the lower extremities, with various anomalous nervous symptoms, dependant on pressure of the thickened fibro-cartilage on the spinal marrow, or, more probably, on an extension of inflammation to the medullary sheath.

It is somewhat difficult to distinguish, in every instance, the deformities which are respectively caused, by deficiency of muscular power, and disease of the elastic cartilages, but the importance of such distinction is paramount to the difficulty, and therefore we should make a patient investigation in the first instance, before we decide on the mode of treatment. We shall thus avoid the mistake of condemning a person to inactivity, in the horizontal posture, for a debilitated state of the muscles, and we shall not apply local remedies to remove inflammation, when exercise and activity, are alone required to give tone and energy to the defective muscles.

Our first examination should be, to press, one by one, the spinous processes of the whole column, to discover whether pain, or convulsive twitchings, are produced. A second important observation consists, in comparing the difference of the stature, night and morning. If the removal of the weight of the body, produced by a recumbent posture, is followed by any very marked increase of height, we may conclude that the tumefaction of the elastic

cartilages is considerable, that the reciprocal separation of the vertebræ is great, although it may not amount to the extent of admitting a sensible motion amongst them.

If it be judged advisable to use either manual, or mechanical extension of the spine, it must be carefully practised, because great effects are produced in these cases, with little power, in a comparatively short time. It is obvious, that if the relaxation of the cartilages, is so great as to allow any degree of horizontal motion, between the vertebræ, we must not think of extending the spine, or of using any mechanical means capable of producing alteration in its form: it is desirable, before having recourse to such measures, that the diseased action of the fibro-cartilages be subdued, and that the articulations should have acquired more solidity.

Treatment. This disease does not amount to acute inflammation, but is characterised by an increase in size, of the vessels, and an infiltration into the tissue of the cartilages, a condition which probably constitutes what we term sub-acute, or chronic inflammation. This state is succeeded by slow ulceration or absorption, not only of the structure of the fibro-cartilages, but ultimately of the bones; such a state of things is always to be feared, and is to be prevented by repose, local abstraction of blood, alterative aperients, and counter-irritation.

It will be proper to extract blood, by cupping, or leeches, in the neighbourhood of the disease, and more advantage will be derived from their repeated application, than from one large bleeding, for it must always be borne in mind, that individuals most liable to this complaint, are not subjects to bear the loss of much blood. All chronic inflammations are to be removed by degrees, their inroads are slow, and their removal is almost equally so; by the repetition of small bleedings, before the vessels have had time to become again distended, we may keep up the tonic power of their coats, by frequent diminution of their contents. We shall thus induce a more healthy action, and restrain that debility, which permits exhalent or other vessels, to carry red blood, contrary to their healthy condition. Perhaps the term inflammation, is an improper designation for such a state, and it is in consequence of ignorance of the real nature of such derangements, that we employ the word. How essentially distinct, for example, are acute and chronic inflammations of the serous and mucous tissues: they are, in fact, totally different diseases. We want a term to designate that state, which is called chronic inflammation, and which is, in many instances, no inflammation at all.

In acute inflammation, we succeed in arresting its progress, by one or more large bleedings, it is as suddenly checked as it arose, but in chronic diseases,

reason dictates, and experience proves, that small and repeated bleedings are more beneficial. A disease that has taken some time to be established, is not to be removed quickly, we can only expect to undermine it by gradual means. In all chronic inflammations, though there may be local fulness, or irregularity of circulation, there is weakness in the general system, that ill bears the loss of blood: and it is on this principle perfectly rational to bleed locally, and administer tonics at the same time. The disease of which we are treating, and many other chronic affections may be cured, by no other means than repose, and small repeated bleedings, of four or six ounces, every second or third day. I cannot help deviating from my subject, in urging the efficacy of this mode of treatment in many glandular enlargements, and other results of chronic or specific inflammation. By small repeated local bleedings, with attention to diet, and repose of mind and body, we may keep in check, relieve all, and cure many, chronic diseases. The great difficulty in such cases is to obtain a sufficient degree of the confidence of patients and their friends, to induce them to pursue a process, which produces its good effects, only by long-continued perseverance and patience. The mass of mankind believe, and will continue to believe, that there is a specific remedy for the cure of every malady. Persons of all ranks afflicted with chronic diseases, run from one medical practitioner

to another, from these to quacks and nostrum-venders, until life is cut short, perhaps as much by the multifarious remedies employed, as by the disease; under a more simple mode of treatment, with quietude and regularity of living, the malady, if not cured, might be kept at bay, and a sufficient degree of health established for the enjoyment of many years' existence. Health is too often not valued for itself, but as a state which permits indulgence, and sensual enjoyment, and as the greater part of mankind seldom think for themselves, they are always ready to listen to any one who pretends to possess a secret, by which disease may be speedily removed.

But to return to the treatment of this peculiar affection of the fibro-cartilages: after the repetition of several small bleedings, by cupping or leeches, a small blister should be applied on each side of the principal focus of the malady, and be kept open, or repeated, according to circumstances. Conjoined with the local treatment, we must pay due attention to the general health: the digestive organs, will be benefited by mild aperients, and alteratives: small doses of hydrargyri cum cretâ, with rhubarb, to children—pilula hydr. and rhubarb: decoct. aloes comp. to adults, will be useful medicines for such purposes. These and other medical means, to improve the action of the various functions, will be required, but our chief dependance for the restoration of health must be on a well-regulated system of diet and regimen.

In this disease of the fibro-cartilages, although the vessels of the part may be enlarged, and a morbid action established that will sometimes require small local bleedings, yet the general system will be benefited by any means which invigorate, and such improvement of the health will of itself put a stop to the malady. Such diseases, although designated "inflammatory," are often removed by means which ought to increase inflammation. It is well known that chronic or scrophulous action may be subdued by tonics, and many practitioners confide in the various preparations of iron for the removal of this class of disorders. This peculiar affection and many others dependant on scrophula, will be eradicated as the action of the digestive and nutritive functions are improved by alterative aperients and a regulated diet, and the general health re-established by tonics, and exercise, where it can be employed. The diet must be modified to the peculiarity of the individual stomach prescribed for: generally speaking, the principal meal should consist of meat and stale bread, with no other vegetable matter: a moderate quantity of diluted wine will promote digestion, and thus invigorate the system.

When all pain in the seat of the disease has subsided, friction along the whole course of the spine, will be useful, and camphor or other liniments may be employed: vapour impregnated with different substances, or simple steam, which is perhaps equally

efficacious, may be directed to the spinal region. In cases which have resisted other treatment, moxas have been burnt over the seat of the disease, and are in my opinion superior in efficacy to either caustic issues, or blisters: there appears to be something peculiar in the action of fire on the skin, different from simple irritation produced by other means, and its effects are often more beneficial than other counter-irritants, though it may not be easy to explain why.

Tonics form an essential part of the treatment of these maladies, and the various preparations of iron are extremely beneficial. Carbonate of iron combined with carbonate of soda, is a useful combination: alkalies being very excellent remedies in this class of diseases, as they are in all constitutional affections, more or less allied to scrophula.

When all symptoms of inflammation or tumefaction of the fibro-cartilages have disappeared, we must have recourse to exercises, upon which our great dependance must rest, not only for removing the existing, but for preventing future deformity. The modes of exercise described in the preceding chapter, are equally applicable to convalescents from disease of the fibro-cartilages. It is in the deformities resulting from this affection, that mechanical extension of the spine, and pressure on its curvatures, have been so successfully employed by Delpech, and other continental surgeons.

CHAPTER XI.

Of Disease of the Vertebræ, as a Cause of Spinal Distortion.

In this disease there is an approximation of the upper, to the lower part of the spine, in consequence of softness, gradual absorption, or caries of the vertebræ. The bodies of these bones, are either too soft, to bear the weight of the upper part of the body, which crushes them, and causes their absorption; or they are destroyed by ulceration, and the upper extremity of the diseased portion of the spine, is brought into juxta-position with the lower. In this manner a hump is produced posteriorly, varying in size and shape according to the degree of destruction of the bodies of the vertebræ, and the number of these bones implicated in the malady. In some cases, the disease will be arrested, when only a superficial layer of the anterior part of the bodies of several vertebræ shall be removed, under which circumstance there will be little or no distortion of the spine, or only a very slight curvature forwards: in other cases, the whole of the bodies of one or more vertebræ, are totally destroyed when the spine

will project backwards, forming the segment of a circle, or an angle. In these latter cases, the happiest result is anchylosis, and the spine remains for life, permanently deformed. The projection is produced more gradually, when the disease occurs in the dorsal region, than in the lumbar: one or more spinous processes are observed to protrude, and are followed by three or four above or below. The transverse processes, project on each side of the spinous, elevate and stretch the muscles, and integuments, producing an arch from side to side, of which the spinous processes form the centre. Although the leading character of the deformities produced by this disease, is inflection of the spine forwards, in many instances there is also some degree of lateral curvature.

The early symptoms are so equivocal, that the disease is often overlooked, until the deformity makes its appearance. In some cases, there is considerable pain experienced in the vertebræ, in others little or none, unless they are much pressed on, and even this often fails to produce any uneasiness.

Persons of all ages, are liable to this disease. When it occurs in infants, it is unobserved, until about the period when they should walk; and then, too often, the child is merely considered backward, and the malady is left to continue its uninterrupted course. When it attacks children, who have walked, the loss of power in the legs is gradual, they are

easily fatigued, languid, unwilling to join in their usual games: the little patients often trip without any apparent cause, their legs get entangled, and frequently throw them down: when they try to stand erect without support, the knees give way and bend forwards: the ankles are often rigid, and the toes pointed downwards. At a later period the sufferer is unable to direct his feet to any precise point, the legs and thighs waste, become cold, insensible, and totally useless for locomotion. In adults the progress of the disease is more rapid, but in other respects similar: they will describe the earliest symptom to have been, a sense of weakness in the back, accompanied with dull, heavy pain, often ascribed to rheumatism. They will complain of lassitude, rendering a small degree of exercise fatiguing: of coldness in the thighs not owing to the weather: of diminished sensibility, twitchings in the muscles: constriction at the pit of the stomach, and disordered respiration. These symptoms are followed by paralysis of the lower, rarely of the upper extremities, and of the bladder and rectum. However, I have very lately seen a case in a child of about five, in which the third and fourth dorsal vertebræ protruded considerably, before any appearance of ill health occurred, and I found the child on my first visit, running about in high spirits.

In our examinations of the spine we should always bear in mind the natural inflections of the column;

that the spinous processes of the cervical and lumbar vertebræ are horizontal, while those of the dorsal vertebræ are inclined downwards, each being covered by the one above it; that the spinous process of the last cervical vertebra naturally projects farther than the others, and has been mistaken for a morbid appearance.

The symptoms accompanying this disease of the spine will vary according to the region in which it is seated; the functions which are disordered being connected with the affected part through the medium of the nerves. If the disease is in the cervical region, there is pain and difficulty in rotation, and other motions of the head, and oppression in breathing will be one of the most marked symptoms. If the dorsal region is the seat of the disease, the principal symptoms will be constriction at the epigastrium, and disordered digestion. The functions of the bladder and rectum will be more or less deranged according to the extent of the mischief, when it occurs in the lumbar vertebræ. The symptoms will sometimes indicate disease within the spinal canal, without being sufficiently definite to enable us to judge precisely at what point of the medulla it is seated. In such cases our only guides are greater sensibility to the touch, or greater susceptibility to heat.

When any of the above symptoms occur, with debility or torpor of the lower limbs, the whole

spine should be carefully examined. So low is the degree of sensibility, in bone and cartilage, in health, and even in early inflammation of these parts, that the smallest degree of tenderness to the touch is evidence of morbid action. But even this sometimes fails to point out the seat of the malady, when we may have recourse to the expedient of carrying a hot sponge down the spine, which will often produce a very acute degree of pain, while passing over the part where disease is going on. Mr. Copeland very justly observes, that although the absence of pain on the application of heat, is not a certain evidence of the absence of disease, the feeling of acute sensation in any one part, is sufficient to mark the seat of mischief. Whatever circumstance, however trifling, leads to an accurate diagnosis of this formidable complaint, cannot be too much insisted on, at the only period when it is in our power to prevent the deformity, and other serious effects which are usually consequent on a continuance of this disease.

The condition of the lower extremities in paralysis from this affection of the spine differs from that of common palsy: the muscles have not the flabby feel of a truly paralytic limb: there is not that looseness of the joints, nor that total incapacity of resistance, which allows the latter to be twisted in all directions; on the contrary, there is commonly rigidity of the joints, especially the ankles. A sense of stricture and stiffness, accompanies every stage of

compression of the spinal marrow, and is an indication that the disease does not originate in the brain: these have been shewn by many writers, to be constant symptoms of paralysis dependent on pressure of the medulla spinalis, as distinguished from that general relaxed state of the muscular system, in paralysis from compression of the brain. Numerous facts prove the occurrence of paralysis in this disease without any distortion of the spine. The increased thickness of the fibro-cartilages may in some cases partially press on the spinal marrow. Preparations of vertebræ exist where the whole intervertebral substance has been removed, and the bones anchylosed, without any elevation of the spinous processes and consequently without deformity.—Many instances of this kind are recorded, where paralysis occurred without distortion.

Some of the persons suffering from this disease, are totally incapable of walking at a very early period of it: others can do so by the help of crutches, or by grasping their thighs: some can sit in a chair, which others are incapable of doing: some have a certain degree of command over their legs, and can move them in bed, while others are totally dependant on assistants, for every change of position.

Mr. Copeland considers paralysis of the abdominal muscles, an early symptom of the disease, especially when it occurs in the dorsal region; this is

commonly described as oppression of breathing, a sensation of tightness in the region of the stomach, of a band round the belly, torpor of the abdomen, &c.; it produces costiveness, retention of urine in a more advanced stage, and other derangements of the abdominal viscera. This paralysis of the abdominal muscles, from incipient spinal disease, is said to have been for months treated as asthma, dyspepsia, and even diseased liver, from the uneasiness and sense of constriction over the regions of the liver and stomach. The functions of the colon, rectum, kidnies and bladder, being all in some degree dependant on the proper action of the muscles of the abdominal parieties, consequently suffer; these organs, at a more advanced stage of the disease, are themselves paralysed, independent of the loss of assistance from the abdominal muscles, but at this period, there can be no difficulty in detecting the malady.

In the time of Pott, this disease was commonly met with, in a more advanced stage than at present, the diffusion of knowledge since he wrote on the subject, enabling the first consulted surgeon to trace the symptoms to their origin, and to apply those remedies which check its farther progress. Formerly, when the extremities began to give way, nervous debility was considered the cause, and the usual remedies for this supposed state, were administered with the effect of keeping up the inflam-

mation, and exasperating the disease. We may congratulate ourselves on the more advanced state of surgery in our own time, which affords us the gratification of being enabled to check the progress of a malady, that renders an individual, beyond all others, a misery to himself, and a pitiable spectacle of human infirmity to his friends. It is the melancholy fate of this affection, that though it rarely kills, it produces results perhaps more to be lamented, than loss of life, for it often leads its victims to struggle with long-continued disease, and even if they do recover their health, it is not before they are rendered unfit for many of the active duties of life.

It seems reasonable to suppose that all diseases of the bones, are seated in the cellular, vascular, or medullary tissue lining the cells or reticulated structure, and not in the osseous matter itself. These tissues, when inflamed, sometimes furnish pus in abundance, hence abscesses: when the pus is less abundant it may be entirely removed by absorption. The cells of the bony tissue will be distended by the inflammation of their lining membrane, and, by its subsequent disorganization, may be deprived of their materials of nutrition: this will explain the total disappearance of bony substance, without ulceration, and also how in some cases, the vertebræ will be crushed by the superincumbent weight, and sudden curvature sometimes produced. The necessity of an undeviating horizontal position, is absolutely re-

quisite, while proper means are adopted for the restoration of the health. It cannot be too often asserted, or too forcibly urged, that this affection of the bones is the consequence and not the first cause of constitutional derangement. Restore the powers of the system at large, and you destroy the disease. A state of disease, the progress of which has been slow, and so little perceptible as to escape notice, until it has made considerable advances, is not to be removed in a few days, almost as much time is required for its removal as it took to be established. We are constantly baffled in our attempts to remove chronic diseases, because our object is speed, and in many instances, we relinquish our efforts when by patience and perseverance, we might have accomplished our purpose. These remarks especially apply to that state of constitution, which engenders this malady, as well to scrophula, and other causes of diseased bone. The afflicting instances of deformity resulting from the disorders of which we are treating, should operate on the minds of patients and their friends, in adopting every means to prevent or remove such melancholy accidents. The encouragement is sufficiently great, for we know that deformity may be altogether prevented if proper means are used at an early stage of the disease: when its ravages have caused ulceration or absorption of the bone, our only attempt can be, to arrest its progress and to encourage anchylosis.

Among the cases examined after death, where the disease had not existed long, the ligaments connecting the vertebræ implicated in the curve, have been found thickened and relaxed, and the bodies of the bones spongy. In more advanced stages of the malady, the ligaments become still more thickened, relaxed, and altered, the bodies of the bones more soft and spongy, and inclining to become carious. The fibro-cartilages are compressed and lessened in size. In those who are destroyed by the disease, the vertebræ are found in various degrees of ulceration, the intervening cartilages sometimes totally destroyed, sanies among the rotten bones, and effused on the theca of the medulla spinalis.

Analogy would lead us to expect, that here, as in the other articulations of the body, extensive caries has its origin, sometimes in an ulceration of the fibro-cartilages, and sometimes in a morbid condition of the reticulated structure of the bodies of the vertebræ. In many dissections, the destruction of the intervertebral substances, has been found greater than that of the bones themselves; the latter having for the most part, retained their ordinary structure, and hardness, the caries being either entirely confined to, or most extensive on those surfaces to which the cartilages had been connected.*

Ulceration of the cartilages takes place prior to

* Brodie.

caries of the bones in the hip and other joints, the same occurs in the spine, and some cases of diseased bone are secondary. The analogy is even upheld by the success of the same kind of treatment, caustic issues, in both diseases. In the articular cartilages, Mr. Brodie states that ulceration may go on for a considerable time without suppuration, and it is in this stage of the disease that timely measures will prevent abscess or caries.

In some cases, caries occurs in consequence of simple chronic inflammation of the bodies of the vertebræ, and differs from that morbid condition which constitutes the true scrophulous affection of the bones. These must again be distinguished from cases arising from long-continued pressure of an abscess, which had originated in the neighbouring soft parts, or of an aneurism, or other tumor; in these, we find the fibro-cartilages, little or not at all affected, so that they are left projecting nearly, if not quite of their natural size, while the bones are in a great measure consumed.

The cancellous structure of all the lumbar and dorsal vertebræ, has been found of a dark red colour, and so soft that it might be easily cut with a common scalpel, or crushed under the pressure of the fingers.

Delpech considers that the disease first described by Mr. Pott, and known by his name, depends on a tuberculated state of the bones, having in nume-

rous dissections, detected tubercles in different stages of their progress; and he proposes to name the malady, the tubercular affection of the vertebræ.

These tubercles are sometimes developed in the interior, and sometimes on the surface of the vertebræ. In the first case, no change occurs in the form of the spine, until the morbid structure, having hollowed by its development the body of the bone, forms a cavity, the walls of which become too thin to support the weight of the upper portion of the body; these walls give way, and the upper part of the vertebral column, falls forwards towards the lower, forming an angle at the diseased part. In the second case the destruction operates from before backwards, or in any other direction, and the deformity occurs at a later period: in fact, not until the bodies of the diseased vertebræ, are reduced to a thin shell, on the opposite point to that where the malady began. Generally speaking the curve is forwards, but if the destruction of the bone occurs towards one side, we shall also have some degree of lateral curvature, a complication which is not uncommon.

As the malady proceeds the periosteum becomes inflamed, and in favourable circumstances furnishes materials of a new organization, by the deposition of ossific matter, which cements the two ends of the spinal division, and re-establishes the continuity of the two halves of the vertebral column. It is obvious, that a most essential condition, towards

the success of so important a process, is repose: every motion will obstruct the union of the new osseous plates or columns, with the two limits of the devastation. In this point of view, the dorsal region is the most favourable, in which the disease can occur, because the ribs render this part of the spine, the least moveable. The cervical region presents many unfavourable circumstances: here are no surrounding bones which can support the diseased vertebræ: the surfaces of the bodies are of small extent: numerous and powerful muscles produce, in this part, extensive mobility. Patients afflicted with the disease in this situation, commonly support the head by one or both hands placed under the chin; this attitude is so constant that it becomes an essential symptom of the malady, and an indication of its situation.

With respect to the diagnosis, to avoid repetition, I shall refer to the observations, in the preceding chapter, which are equally applicable to the subject of this. The early symptoms of this disease, are so very similar to those of inflammation of the fibro-cartilages, that it is almost impossible to distinguish the incipient stages of these two maladies. Fortunately the mode of treatment is equally proper in each of these diseases, and it is only important to distinguish them from the more simple results of defective muscular action. Cases have occurred, where the spine has been forcibly extended, when

the cause of the deformity has been destruction of the bodies of the vertebræ: such occurrences sufficiently point out the necessity of forming a correct diagnosis.

Treatment.—There are several stages in this disease, each requiring its appropriate treatment. The first stage will be before any deviation of the vertebral column can be detected: it is characterized, by general disturbance of the health, loss of activity, debility, and some degree of emaciation, want of appetite, and many of those symptoms to which the epithet "nervous" is applied. In such cases, where we can trace these anomalous complaints to no other cause, we should examine the spine; from delicacy, and other causes, this is too often neglected, the disorder is either disregarded, or treated as nervous and hysterical, while the latent mischief in the spine is pursuing its uninterrupted course. If at this period of the disease, the vertebral column be carefully examined, we may possibly detect some irregularity, or tenderness, and further mischief may be prevented by repose, leeching, counter-irritation and gentle aperients. It is only in an early stage of this malady, that all its traces may be removed, and deformity prevented. We must pay especial attention to the peculiarity of constitution for which we are prescribing: if it partakes of that character which is understood by the term lymphatic, tonics to the

system generally, will be more beneficial than local abstraction of blood: in these and scrophulous cases, the internal exhibition of steel, blisters or setons as counter-irritants, with due attention to the functions of digestion and nutrition, will be the proper line of treatment, to which must be conjoined, absolute rest in the horizontal position.

At a more advanced stage, ulceration or absorption of the bodies of one or more vertebræ, will have taken place, and a decided curvature, or angular projection will be established. In the worst cases there will be loss of power, or total paralysis of the lower extremities, from extension of inflammation to, or pressure upon, the spinal marrow. In these cases we must have recourse to that mode of treatment, the principle of which originated with Mr. Pott: to produce eschars on each side of the curvature, by the application of caustic, or what is in my opinion more efficacious, by moxas. In young children some practitioners prefer a seton. An immediate amendment is often perceptible, on the use of the seton or the caustic: a degree of warmth and motion is imparted to the limbs, but this does not continue, nor does any real good result until a free discharge is established. The amount of the discharge, so far from being injurious, is beneficial, health and strength improving under its influence in the removal of the disease. As the discharge continues, the mischief ceases in the bones, and is fol-

lowed by the deposition of new ossific matter, and anchylosis between the remaining portions of the affected vertebræ: but however perfect the restoration of the health and of the use of the limbs, the curvature must ever remain. The useless state of the limbs does not always depend on the altered figure of the spine, or of the disposition of the bones with regard to each other, as is apparent from this circumstance, that although the use of the legs is restored, the curvature will remain in the same state, as when they were paralysed.

After the discharge has continued for some time, the patient evidently improves in health, begins to recover his appetite, gets refreshing sleep, and loses that distressing sensation of tightness at the pit of the stomach: the extremities afterwards recover their proper degree of warmth, and sensibility, and control over the bladder and rectum is re-established. The first return of sensation and motion, is rather disagreeable, involuntary and spasmodic twitchings occur, and are generally attended with pain in the muscles. The knees and ankles lose their rigidity, but remain very weak. The first attempts to walk are of course feeble, irregular and unsteady. The period of cure will vary from two or three months, to as many years. There are few diseases requiring more patience than this, the progress of recovery will sometimes be arrested, but the numerous instances of cure at all stages of the malady, should

encourage the unremitted continuance of the remedial means.

The most important feature in the treatment of these cases, is absolute repose, and so essential is it, that mechanical means must be sometimes resorted to, fully to effect it. Stays are recommended by some practitioners to prevent any motion of the ribs, or bones of the spine amongst themselves, and may be beneficial if well made and confine the motions of the trunk, without compressing the diseased parts. The new osseous productions, which restore the continuity of the spine, are at first of a very delicate structure, and the slightest motion will endanger them. The density of the ligaments is diminished, and in cases where the abraded surfaces of the bones rub on each other, perfect immobility is most difficult to accomplish. The patient must be placed on a bed, to which his body can be fixed in an efficacious manner, and which is so contrived that his issues may be easily dressed without any change of position.

If the deformity produced by this disease has not made much progress, the constant horizontal position of the body, may effect a reduction, or an entire removal of the spinal deviation. These are the cases where we are justified, in keeping our patients for a year or more, in an undeviating recumbent position, and it is only by perseverance in this, with the assistance of other means, that we can hope to

remove any degree of the deformity. When anchylosis has already taken place, no amendment can be expected, but where this process is going on, constant repose will not only favour its progress, but position may also modify the deposition of ossific matter, so as to produce but little comparative deformity.

Anchylosis takes place early in young subjects, but is a very tedious process in more advanced life. However long the diseased surfaces of the vertebræ, may take to consolidate, we may always expect confidently that it will at length be accomplished, if no abscess has occurred. It is only in neglected, and very advanced states of the disease, that we are condemned to witness that wretched condition, which entirely deprives the unfortunate sufferer of the use of his lower limbs, and places him beyond the reach of all the powers of art.

In speaking of the utility of moxas in this disease, I might remark that, in discarding the actual cautery, English surgeons have abandoned a most efficacious remedy, and many are equally prejudiced against the employment of the moxa. From personal experience, I can assert, that the pain produced by this remedy is not greater than that of a blister, nor so great as that of a mustard cataplasm, and, were it again necessary, I would more willingly have a moxa burnt on my skin, than apply a blister to it.

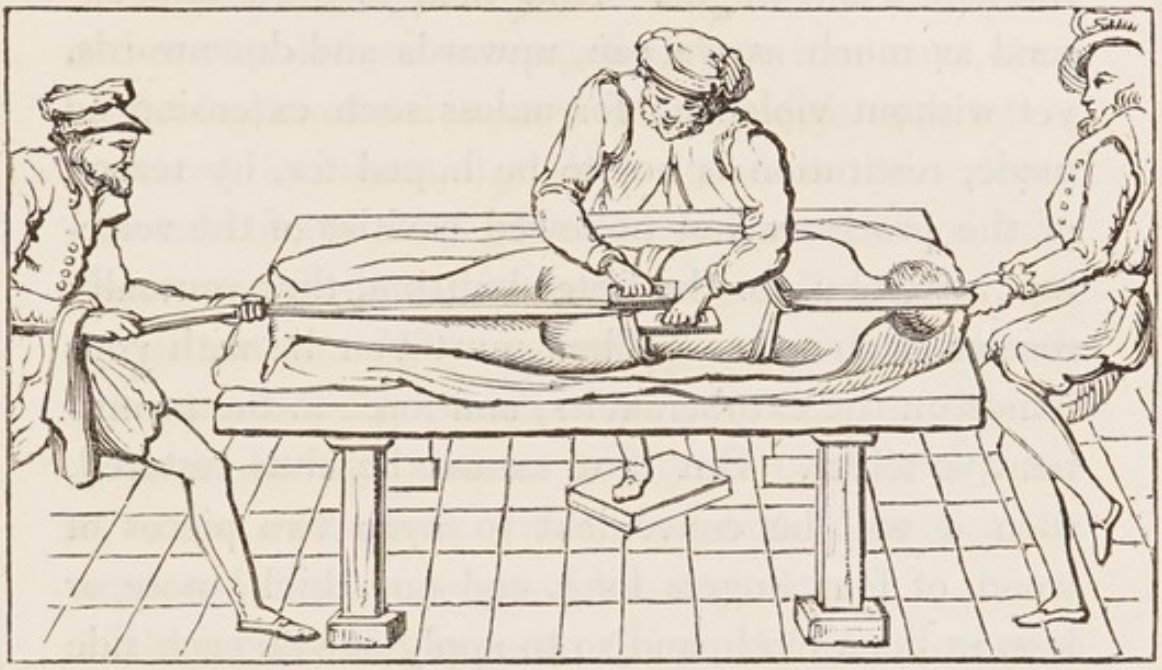
CHAPTER XII.

On the Mechanical Apparatus used in the Treatment of Deformities.

To describe a tenth part of the machinery, invented for the cure of deformities, would alone require a larger volume than the present. I shall therefore confine my observations to some of the instruments employed in distortions, and to the principles on which they are applied.

Before the knowledge of anatomy was much diffused, the spine was considered by many as a single bone, and its curvatures were treated in the same manner that a bent stick would be, when the object was to make it straight. Force was applied to the two extremities to draw them into their proper position, and pressure was applied to the prominent part to thrust it into its place. Projections of the spine were afterwards considered to depend on dislocation of the vertebræ, a circumstance that can rarely happen among the cervical or lumbar vertebræ, and never among the dorsal, without fracture of some part of the bone, or most extraordinary relaxation of the connecting bonds of the ribs, and vertebræ. This opinion, however, is still maintained, and the

modern as well as the ancient practice is well illustrated in the wood-cut below, copied from Ambrose Parée.*



The following description is from an English translation of "the works of that famous Chirurgeon Ambrose Parée, 1649."

CHAP. XVI. *How to Restore the Spine Outwardly Dislocated.* "The vertebræ outwardly dislocated, when as they stand bunching forth, then

* In looking over the works of the old surgical writers, we never fail to meet with descriptions of machinery, and instruments which pass for modern inventions, Hey's saw is a familiar instance, which is to be found figured by Ambrose Parée.—Many of the exercises and machines proposed of late years to ameliorate the condition of the vertebral column are recommended by Andry in his "Orthopédie," in which will be found many useful hints with regard to the physical education of children.

it is fit to lay and stretch forth the patient upon a table, with his face downwards, and straitly to bind him about with towels under his arm-pits, and about the flanks and thighs. And then to draw and extend as much as we can, upwards and downwards, yet without violence: for unless such extension be made, restitution is not to be hoped for, by reason of the processes and hollowed cavities of the vertebræ, whereby, for the faster knitting, they mutually receive each other. Then must you lie with your hands on the extuberancies, and force in the prominent vertebræ. But if it cannot be thus restored, then it will be convenient to wrap two pieces of wood, of four fingers long, and one thick, more or less, in linen cloth, and so to apply one on each side of the dislocated vertebræ, and so with your hand to press them against the bunching forth vertebræ, until you force them back into their seats, just after the manner you see before delineated.

"In the mean while have a care, that you touch not the processes which stand up in the ridge of the spine, for they are easily broken. You may know that the vertebræ are restored by the equal smoothness of the whole spine. It is fit after you have restored it to bind up the part, and lay splints or plates of lead neatly made for that purpose upon it: but so, that they may not press the crists, or middle processes of the vertebræ, which I formerly mentioned, but only the sides: then the patient

shall be laid upon his back in his bed, and the splints long kept on, lest the vertebræ should fall out again." Page 386.

Although the principle on which such extensions and manipulations were applied, was erroneous, they might be beneficial in some cases, and the reputation acquired for them, by these instances of success, covered the mischief which must have resulted from their indiscriminate employment in all cases of spinal distortion. We may readily conceive the dreadful consequences, which must have occasionally ensued, in tearing asunder newly formed anchylosis by these extensions and endeavours to reduce the supposed displacements of the vertebræ.

During the last century, all spinal distortions were mechanically treated, many complicated and ingenious instruments were invented for this purpose, and the treatment of these infirmities became almost entirely the province of mechanics.* Various collars, backboards, stays and spine-supporters, were employed, and the great object appeared to be, who should produce the most complicated machine. We

* If the fact was not well established, we should doubt the possibility of such an occurrence, as that of placing a deformed person in a kind of napkin-press, and reducing the distortion by the force of screws. A celebrated case occurred in France, of Madame de Montmorenci, whose death was occasioned in this manner, and among the plates of Le Vacher will be found one representing a girl in a machine of this kind.

have had occasion to dwell on the mischief which must result from the use of instruments to fulfil the office of the spinal muscles, which necessarily lose their powers, when their action is superseded or prevented by such means.

The ill consequences of the mechanical treatment of deformities of the spine, frequently presented themselves. Slight distortions were rendered worse, and bad ones were not mended, and on the recommendation of Mr. Baynton it became the fashion to condemn all persons, who either had, or were threatened with spinal deformity, to an undeviating horizontal posture for months and years. This is excellent practice in many cases of diseased bone and cartilage, but in debilitated states of the muscular system, the evil will be increased by such total inaction. Frequent failures threw this system and the inclined plane, which was a modification of it, out of fashion.

From the universal application of machinery, and of the recumbent position, we are now in danger of running into the opposite extreme,—of neglecting mechanical means and repose, and trusting too much to muscular exercise, gymnastics and callisthenics, which are not only to prevent, but to cure all varieties of spinal deformity.

All the means which have been enumerated are beneficial when applied to the proper cases. Various exercises in muscular debility, and in convalescence

from diseases of the cartilages and bones: with the occasional use of spine-supporters in the intervals of repose and exercise: friction, manipulation and even pressure to lateral curvatures and projecting ribs: and undeviating rest in cases of caries.

Machinery is used in the treatment of deformities on two principles—1, to take off the superincumbent weight, from bones, cartilages, and ligaments, when these are diseased, softened, or relaxed, and incapable of performing their respective offices: 2, to act on shortened, contracted or rigid parts, and by extension to elongate them, or to bring them to their natural positions. On the first principle we make use of instruments to support the weight of the upper parts, when the limbs or spine, from any cause, are incapable of doing so. The various back-boards, collars, &c. used in curvatures of the spine and the machinery employed in cases of distorted knees, and bent legs, are applied on this principle. Contrivances for extending the spine, for extending or bending contracted joints, for restoring club-feet &c. are used on the second principle. In some instances both principles are combined. I shall say a few words on some of the various instruments used for these purposes in the order in which they are enumerated above.

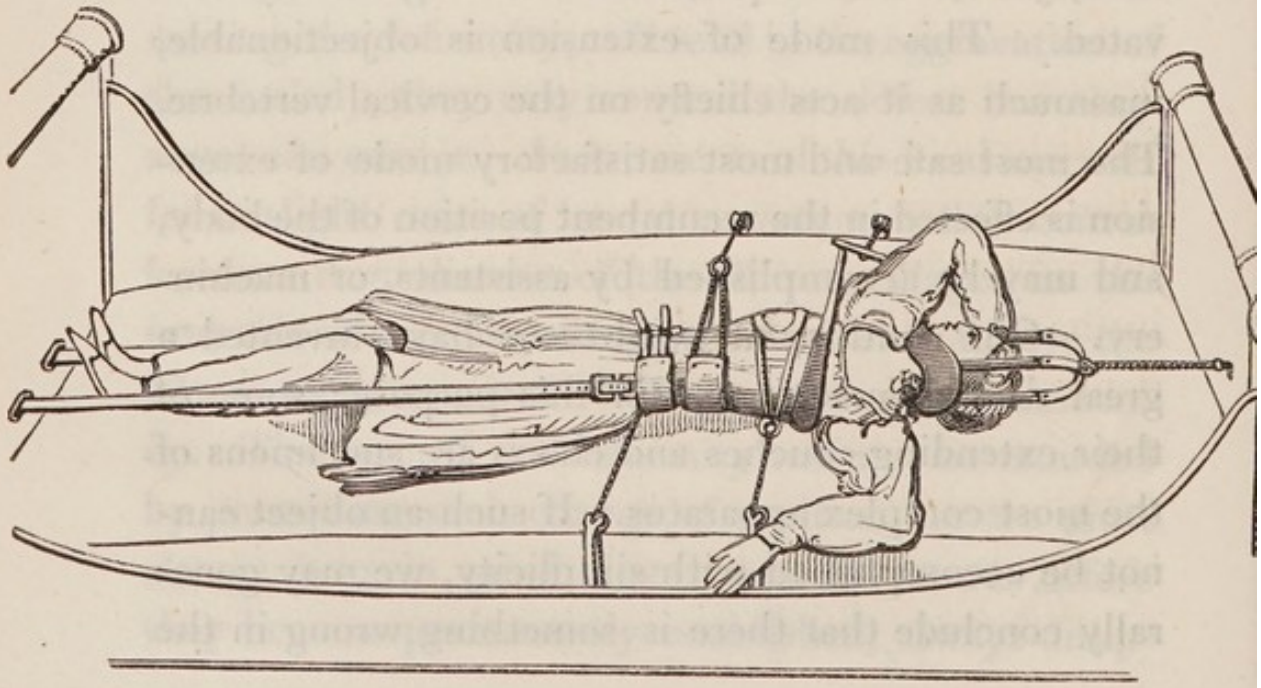
Crutches are the simplest contrivances used on the first principle, when the lower limbs lose the power of supporting the weight of the body. The

various backboards, collars, &c. used in curvatures of the spine are employed with the same view. Crutches have some advantage over corsets, and collars, inasmuch as they support the weight of the upper part of the body, without confining the muscles to total inaction. In walking, crutches should be of sufficient length to allow the extremity of the foot alone to touch the ground, and when attached to a seat, they should be high enough to raise the shoulders in the same manner as in the common mode of using them. The corsets employed in cases of distorted spine are occasionally useful, but much mischief has accrued from their indiscriminate employment. It must be obvious to every one, that where the primary source of distortion, is a debilitated state of the muscles, instruments which are employed to support the spine, to do, in fact, what the muscles should of themselves effect, so far from removing the deformity, will tend to the aggravation of the malady, they may conceal the defect but they never can cure it. Instruments of this kind are useful in slight cases of lateral curvature, and in convalescence from disease of the fibro-cartilages, in the intervals of exercise, during meals, and to relieve the irksomeness occasioned by long-continued recumbency. The cure of the deformity will not be retarded by permitting such change of position, for we must always bear in mind that lateral curvatures before they become permanently established, always disap-

pear when the body is in exercise, and that it is in sitting or standing that the muscles first give way. Seats with crutches, spine-supporters, &c. may be employed in such cases of muscular debility without mischief, but when the bones are diseased, on no account should they be permitted, at no period of such malady can they be otherwise than prejudicial; repose is the fundamental principle in the treatment of these cases and should be most rigidly adhered to. When such instruments are employed the simpler their structure, and the more easy their application the better.

Several contrivances have been adopted for extending the spine. By some the compound pulley is employed: the patient being seated in a chair in a door-way or other convenient place, and the cord fixed to straps connected with proper pads under the chin, jaws, and occiput, the head is gradually elevated. This mode of extension is objectionable, inasmuch as it acts chiefly on the cervical vertebræ. The most safe and most satisfactory mode of extension is effected in the recumbent position of the body, and may be accomplished by assistants, or machinery. Our continental neighbours have invented a great deal of machinery for this purpose: some of their extending couches and chairs are specimens of the most complex apparatus. If such an object cannot be accomplished with simplicity, we may generally conclude that there is something wrong in the

means. In France there are establishments called "Maison's Orthopèdiques," for the cure of deformities, and it seems to be an object with the proprietors of these houses to surpass each other in the invention of the most complex machinery. They not only stretch the spine, but apply mechanical means to act on the lateral contortions and inflections of the column. It is the practice in these institutions to keep up extension during the night as well as the day, and the patients sleep on beds to which they are fixed by the extending apparatus. In the wood-cut below, is seen a figure undergoing this process, which is effected by machinery concealed in the frame of the bed. The extension is rendered elastic by means of springs. The lateral bracings are intended to operate on the respective curves or twists of the spine.



The foregoing sketch is taken from Delpech, and but for his well-established reputation as a surgeon, we might be disposed to smile at the apparent absurdity of such complicated machinery. Concealed within the frame of bed are pullies, wheels, and springs innumerable, to effect the simple purpose of extension. Any benefit that can result from such an apparatus, must be derived from the power of extension, in overcoming the rigidity of ligaments and the contractions of muscles, exactly on the same principle that it is employed in the contracted joints of the extremities. The essential purpose of all the complex machinery of the French will be effected by a screw, similar to that of the tourniquet, acting on a bandage round the pelvis, the head being fixed in one of the common head-pieces of the inclined-plane, or by an apparatus similar to that represented in the sketch.

Those who are curious in machinery will find descriptions of a great variety of instruments used for distortions in the works of Delpech and Lafond. The latter has a large Orthopèdique at Paris, where he employs what he terms "Machines Oscillatoires" in the cure of every kind of deformity. He is evidently a most ingenious machinist, and no doubt many inveterate cases have yielded to such means, which had resisted the more common modes of treatment. But M. Delpech appears to have been equally successful in his mode of treatment, with

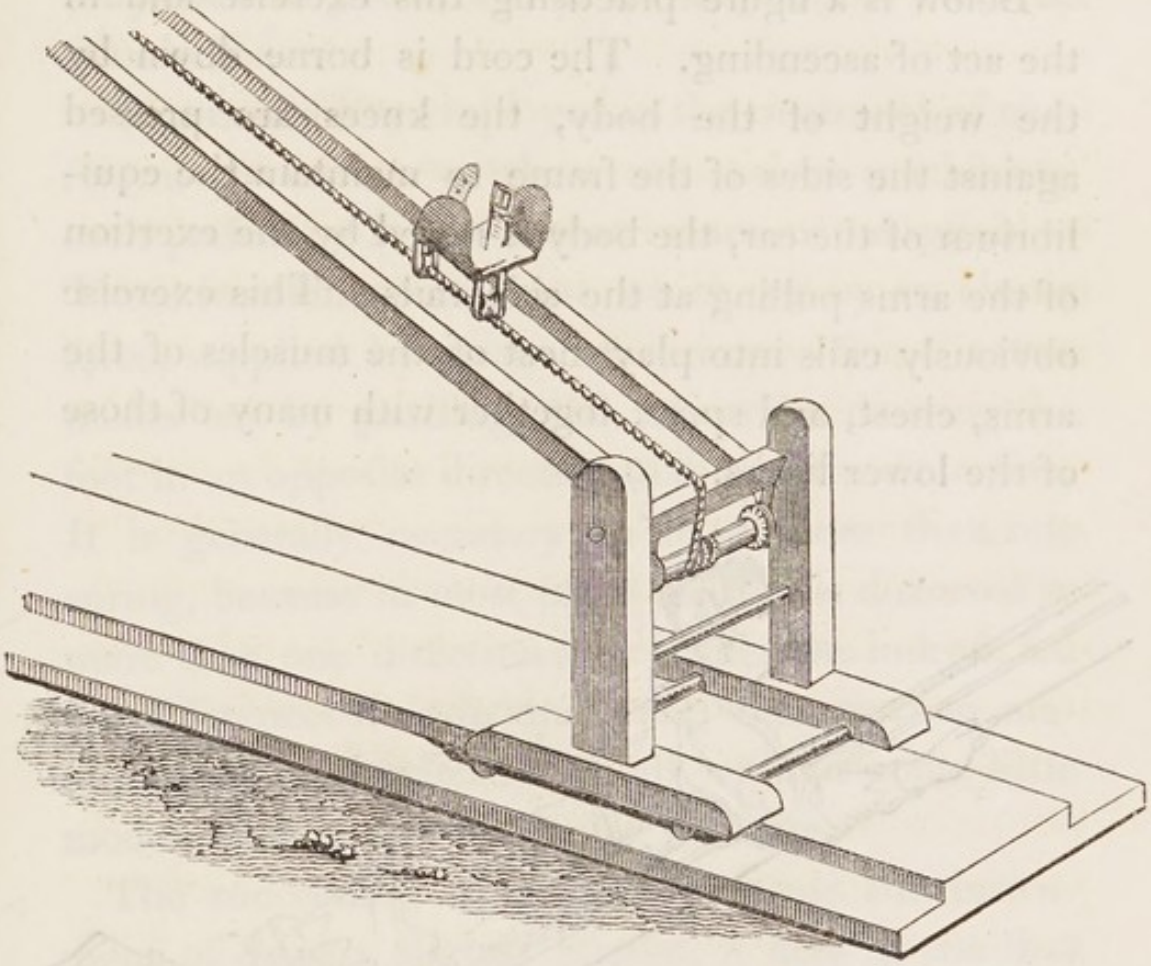
machinery more approaching to simplicity than that of Lafond.

Mr. Shaw has given a representation of an apparatus employed by him for extending the lumbar region of the spine: it consists of moveable boards on an inclined plane, and will be readily understood by referring to his folio plates, or to the wood-cuts in his octavo volumes, in which will also be found many ingenious contrivances applicable to the treatment of spinal curvatures.

In recent and slight cases of lateral curvature, the elevated shoulder and projecting hip may be removed by extension, and we may demonstrate the opinion, the accuracy of which is generally doubted, that these are merely consequences of spinal curvature, and not primary and essential deformities.

The following wood-cut is copied from Delpech, and represents a contrivance by which exercise can be employed by convalescents from spinal diseases, and in all cases where it is not yet proper to allow the weight of the upper parts of the body to press on the spine. By means of this apparatus, as with Mr. Shaw's inclined plane, a person can take exercise while in the recumbent position. The inclination of the machine with the horizon, may be altered to suit the strength of the individual using it: when perfectly horizontal the exertion required to move forward is trifling, by raising its inclination, the exercise will be rendered more difficult, and better

adapted to increase the power of the muscles when the patient is sufficiently advanced towards recovery to permit such exertions.



The machine is supported on a basis, which moves on four rollers, in a grooved platform. The frame on which the cord is stretched, is connected with this basis by a pivot, by which the angle formed with the horizon may be altered. Below the axis there is a windlass in the frame which increases the tension of the cord. The car is mounted on the tense cord by two pullies, one anterior and one posterior: its sides cannot be supported on the

sides of the frame, without impeding motion, which renders it necessary to maintain the equilibrium, by the action of the lower extremities.

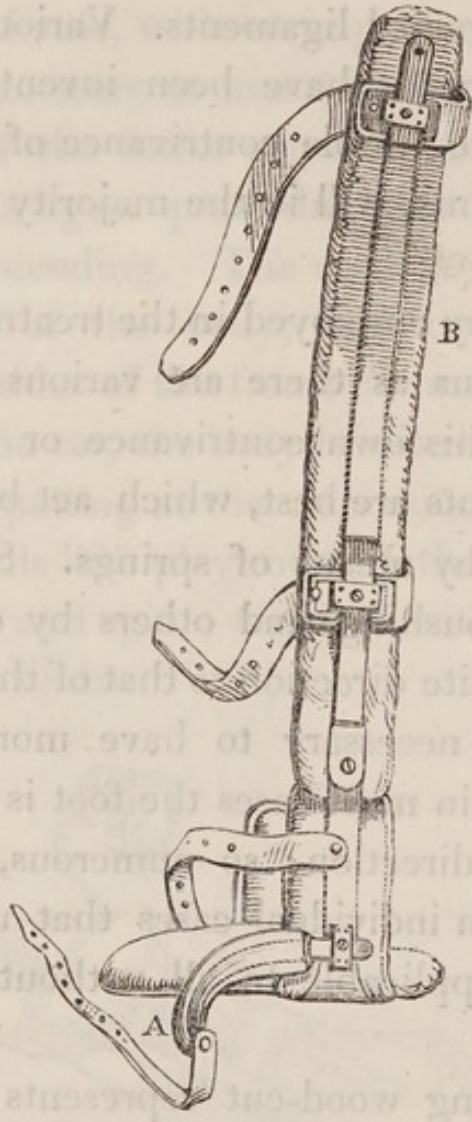
Below is a figure practising this exercise and in the act of ascending. The cord is borne down by the weight of the body, the knees are pressed against the sides of the frame to maintain the equilibrium of the car, the body is raised by the exertion of the arms pulling at the side rails. This exercise obviously calls into play most of the muscles of the arms, chest, and spine, together with many of those of the lower limbs.

For the cure of contracted joints, in the intervals of friction and exercise, it is necessary to have a permanent force acting either for the purpose of flexion or extension, to effect an elongation of the shortened

muscles or contracted ligaments. Various and complicated instruments have been invented for this purpose, but the simple contrivance of Mr. Amesbury for stiff joints, will in the majority of cases be found efficient.

The machinery employed in the treatment of club feet, is as various as there are various machinists, each preferring his own contrivance or adoption.—Those instruments are best, which act by an elastic force, supplied by means of springs. Some instruments act by pushing, and others by drawing the foot in an opposite direction to that of the distortion. It is generally necessary to have more than one spring, because in most cases the foot is distorted in more than one direction: so numerous, indeed, are the differences in individual cases that no one machine can be applicable to all without some little modification.

The succeeding wood-cut represents the instrument of Scarpa, slightly altered, it acts in the first instance by drawing the toes outwards, and then by bringing the whole foot into its proper direction with the bones of the leg. This figure represents the instrument, as it is required for the common cases, where the foot and toes are turned inwards.



This figure represents an instrument for the left foot.—A is a horizontal spring attached to the stirrup of an iron shoe, it bends outward from the foot, and when this is bound to it by means of straps, acts by drawing outwards the phalanges, metatarsus and part of the tarsus; in the original instrument of Scarpa this spring passes backwards to the os calcis, and by a strap acts on this bone when it is drawn much inwards.—B is a vertical spring attached to the stirrup by a joint at the ankle, it bends outwards

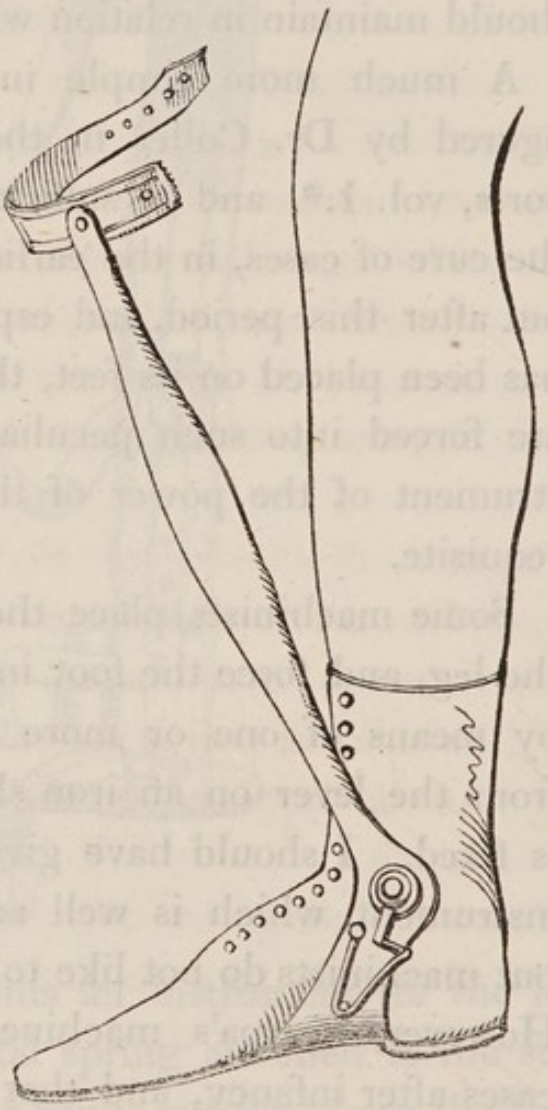
from the leg, and it must be obvious, that the closer this is bound to the upper part of the leg, the more will the foot be drawn out, towards the position it should maintain in relation with the tibia and fibula.

A much more simple instrument than this is figured by Dr. Colles in the Dublin Hospital Reports, vol. 1.*, and is sufficiently powerful to effect the cure of cases, in the earlier months of infancy: but after this period, and especially when the child has been placed on its feet, the bones of the tarsus are forced into such peculiar positions, that an instrument of the power of that of Scarpa, becomes requisite.

Some machinists place the lever on the inside of the leg, and force the foot in the direction required, by means of one or more curved springs, acting from the lever on an iron shoe into which the foot is fixed. I should have given an engraving of this instrument, which is well adapted for many cases, but machinists do not like to part with their secrets. However, Scarpa's machine will answer in most cases after infancy, and that of Dr. Colles will be efficient in all new-born infants. In fact, if the instrument is made to act by an elastic force, and is properly applied to the resistance, it matters little what particular kind we employ: the grand secret of cure, in these cases, is perseverance.

* This instrument is much improved by having the splints attached to the shoe by hinges.

In Mr. Amesbury's Syllabus is figured an instrument well adapted for the pes equinus, where the heel is retracted by rigidity of the muscles of the calf and the tendo achillis. This figure represents one for the same purpose used by a celebrated orthopédiste of Paris, M. D'Ivernois, but the engraver has represented the foot in too natural a position, and has not properly expressed the joint at the ankle; however, very little mechanical knowledge will supply his omissions. It will be obvious, where the toes point downwards, the nearer the lever is approached to the leg, the more the foot will be brought into its proper position.



In the figures of instruments, I purposely select such as are in use on the Continent, because they may suggest hints for the improvement of those employed in this country.

PLATES.

PLATE 1, represents the three varieties of Club-foot. The central figure represents a slight case of Valgus, but in bad cases of this variety, the foot will be drawn up and the dorsum will be approximated to the outside of the leg.

PLATE 2, from Scarpa. *Fig.* 1, is an anterior and *Fig.* 2, is a posterior representation of the bones in a case of Varus, that variety of Club-foot, in which the part is inverted and the outer margin of the foot bears on the ground.

PLATE 3, *(see Frontispiece)* represents the outward form of lateral curvature, and its effects on the skeleton.

PLATE 4, from Cruveilheir, shews the extent to which the spine may be deformed, without paralysis.

The individual to whom this belonged was not paraplegic, although the angle was so acute, but the pressure of the spinal marrow was probably prevented by the meeting of the eleventh with the fifth

dorsal vertebra, the first of which was received into a kind of groove, hollowed in the body of the former. The bodies of the sixth, seventh, eighth, ninth and tenth dorsal vertebræ have almost completely disappeared, their confused remains form a mass covered with osseous vegetations. The foramina were all preserved but deformed, and diminished in size.—The spinous processes corresponding to the lost vertebræ, had undergone a remarkable deviation, instead of projecting more than usual, they were much inclined and even slightly curved, so as entirely to fill up the interval which separated the eighth from the ninth, and the ninth from the tenth dorsal vertebræ, and to complete posteriorly the medullary canal. The manner in which Nature had preserved the spinal canal in the midst of such devastation is remarkable. The vertebral column being sawed lengthwise we see *(Fig.* 2) with what apparent art the canal has been protected.

ERRATA.

Page 57, last line, *for* "matters," *read* "matter."
„ 59, line 20, *for* "when," *read* "where."
„ 65, line 4, *for* "brachilis," *read* "brachialis."
„ 81, line 26, *for* "bending," *read* "extending."
„ 164, last line, *for* "CHAP. XI." *read* "CHAP. XII."
„ 190, line 8, *for* "in," *read* "of."

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Three Varieties of Club Foot.

Plate I.

Varus

Valgus

Pes Equinus.

Pub.d by Callow & Wilson, March, 1830.

Plate 2.

Fig. 1.

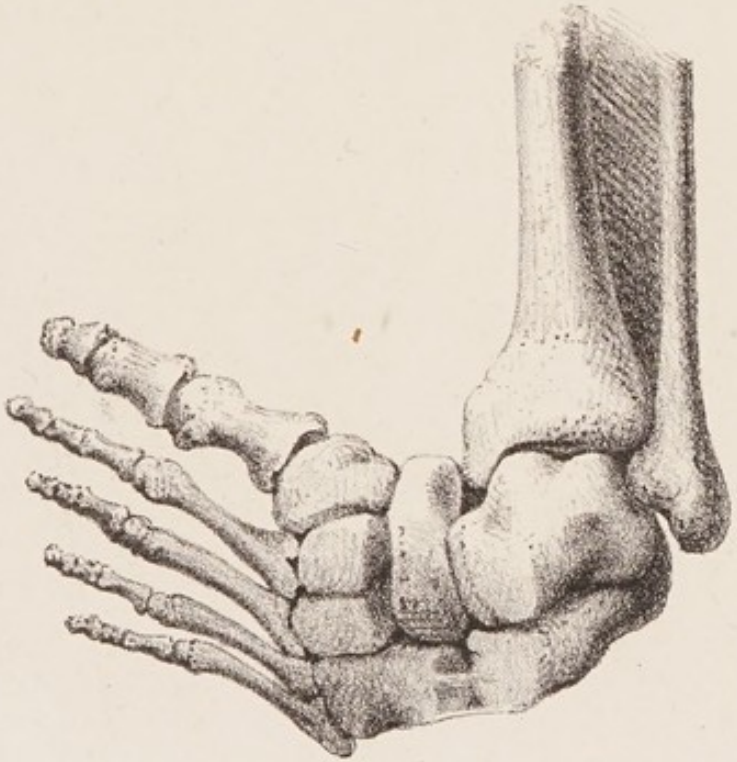
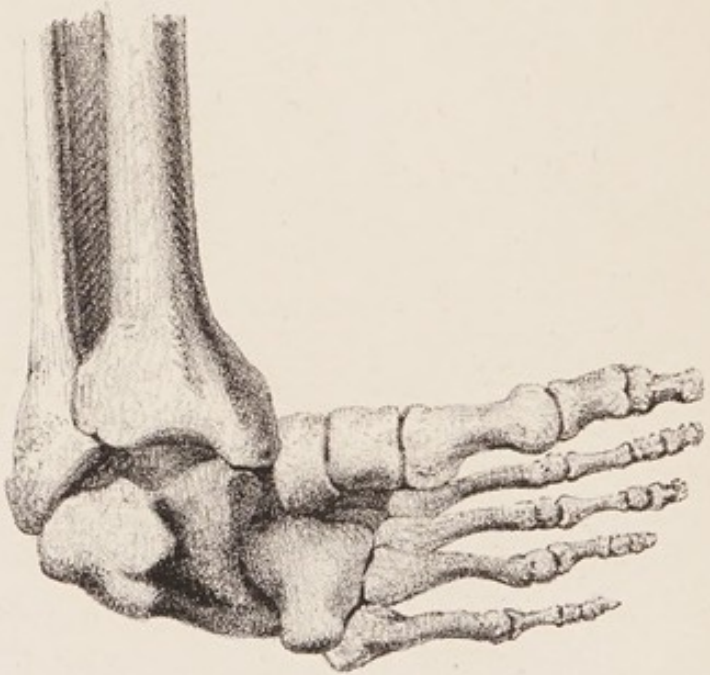


Fig: 2.



Pub.d by Cullow & Wilson, March 1830.

Fig. 1.

Fig. 2.

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