4. A patient with confirmed lateral curvature, with or without osseous deformity, is so habituated to the vicious position, that attempts on his part to improve the spine, except with the help of the surgeon's instructions, generally increase the deformity.

5. Exercises of the spinal muscles, with and without resistance, by the surgeon or an assistant, while the patient is in an improved position, are absolutely necessary to the rational treatment of spinal curvatures not due to caries.

6. Good positions should be always assumed, not only at meals and at lessons, but whenever otherwise occupied. This is practicable in slight cases, even with ordinary backed chairs; in some cases, a couch, with horizontal seat and movable and moulded back, is necessary.

7. A moderate amount of walking, short of much fatigue, is beneficial.

8. Lying prone or supine does not tend to cure lateral curvature, as it does not strengthen the spinal muscles. Lying for a quarter or half an hour is useful when it rests the patient; but, if it be continued for several hours daily, only harm results from the physiological activity of the spinal muscles being prevented.

9. Sayre's plaster-jacket and other spinal instruments are injurious in all cases not due to caries, where the patient by an effort can maintain an improved position of the spine, even for a few seconds only. Sayre's jacket is only permissible when the sole object is to prevent further increase of extreme osseous deformity.

10. Swinging by the head does not strengthen the spinal muscles, and dates back to the time of Dr. Glisson, more than two hundred years ago. In Germany, "Glisson's swing" has been known and used for many years (see JOURNAL, July 26th, 1879).

11. By all vicious positions being avoided, good ones shown and maintained, and suitably prescribed exercises carefully carried out, better and quicker results are obtained in cases of lateral spinal curvature, than by any other treatment hitherto practised.

I intend publishing shortly an abstract of fifty cases of lateral and antero-posterior curvature treated by me in private practice since January 1st, 1881.

THE TREATMENT OF SPINAL CURVATURE BY MEANS OF THE CUIRASS.

By NICHOLAS GRATTAN, L.R.C.P. & S.Ed.,

Senior Surgeon to the County and City of Cork Hospital for Women and Children.

FOUR years have elapsed since Dr. Sayre's remarkable demonstration on the Treatment of Spinal Curvature by means of Suspension and the use of the Plaster-of-Paris bandage. As he has already written fully on the subject, it may seem presumptuous in me to make any further remarks. It is only, however, after the lapse of some time, that the true value of a remedy can be ascertained. When it is first discovered, those who have faith in it are apt to look on it as the remedy of the age, and to use it on every possible occasion, too often rashly and unwisely; whilst those who do not understand or appreciate it, and who have seen its bad results when it was injudiciously applied, are inclined to deny its value altogether.

Perhaps the man of genius who first discovers a really valuable remedy, and whose intuitive skill will save him from some of the blunders of his less gifted brethren, is not so capable of judging how far it is likely to be successful in general practice, or of seeing the dangers which may attend its indiscriminate use, as the man of ordinary ability who has carefully studied his own and his fellow practitioner's failures and successes. Surgeons all over the world are now called on every day to decide whether they will or will not use Sayre's plaster-jacket, in cases of spinal disease; both surgeons and patients have in many cases a strong prejudice against it.

Having employed this method of treatment both in hospital and in private practice, since Dr. Sayre's visit to Cork in 1877, with considerable success, I venture to make the following remarks as the result of my experience on the subject. I believe the prejudice to which I alluded, is caused by the fact that at first too much was expected from the use of the jacket, by practitioners who had not carefully studied Dr. Sayre's book. Unhappy results have certainly attended its use. These results have followed too severe extension of the spine in cases of caries, especially where ankylosis had already commenced. Serious injury has also arisen in cases of lateral curvature, from a too long continued use of the jacket, which produced atrophy of the spinal muscles, and consequent weakness, owing to the want of proper exercise.

The general impression of all surgeons with whom I conversed on the subject (an impression which I shared for some time), was that Dr. Sayre directed that the patient should be suspended until only his toes

touched the ground. Now he does unfortunately say in page 17, "The patient is to be gradually drawn up until the feet swing just clear of the floor", but he proceeds to add most emphatically a little further on, "Do not attempt the impossible: do not try to straighten curved spines, the result of caries, that have become partially or completely consolidated; do not break them up; but simply extend the patient very slowly, until the patient says he feels comfortable; and never extend beyond this point." This caution, more than once repeated, cannot be neglected without the most disastrous results ensuing.

It is an easy matter, in the case of an adult, to extend "until the patient says that he feels comfortable"; but with a young and often frightened child, it is extremely difficult to find whether his comfort is increased or not, except in cases of advanced spinal disease. I would suggest to the surgeon to use his own judgment, while extending, to watch the patient carefully, and to extend *just to the degree which* (when the jacket is applied) *will relieve the spine of the burden it has to bear, and no more.* I believe, as this advice is carefully followed, so will the patient be relieved, without any danger of producing an aggravation of his spinal mischief.

A young delicate child may be often best extended by having his hands held up, so that his elbows are level with the top of his head. The assistant who holds him up can keep the spine steadily extended in this manner while the bandages are being applied, if his own hands be supported by passing them through the axillary supports of the extension apparatus.

The extension apparatus which I prefer, is that manufactured by Cocking. The neck appliance, being of soft felt, does not hurt, and the head and the axillary supports can be regulated with the greatest nicety and ease.

At the Children's Hospital, we occasionally extend the children over the backs of two chairs, a pillow being placed under the child's shoulders and hips; the chairs are slowly separated to the required extent, and the bandages are easily applied. Hammock-extension I have found satisfactory with children; I had, however, the misfortune to injure an adult by its use; while in the hammock, he suffered so much pain from over-extension that he had to be at once lowered. I suspended him according to Sayre's method the following day, and applied a jacket. This gentleman is now quite well, having constantly worn a cuirass for eighteen months. With any weight such as that of an adult, there is a tendency in the hammock to sag in the centre; owing to this, I do not see how the danger of over-extension with this appliance can be avoided.

Whilst prolonged rest to the spine, procured by the continued use of the plaster-jacket, is essential for the successful treatment of Pott's disease, I hold that the long continued use of any jacket in cases of lateral curvature, (where caries does not exist), is injurious. Very many of these cases are best treated by means of self-extension without the aid of any mechanical appliance; but when the curvature is severe, in order to enable the patient to exercise in the open air without pain, some external support must be worn during the day. In treating these cases, I have found Cocking's felt jacket, or the plaster-jacket with a lacing arrangement, of great service. It is necessary to impress on patients suffering from lateral curvature the importance of suspending themselves as frequently as possible, and never less than three times a day. Before retiring to rest, the jacket should be taken off, and reapplied each morning, while the patient is suspended. This treatment, with fresh air and attention to the health, has always proved beneficial. With regard to extension, I have found it nearly impossible, on account of the trouble and expense involved, to make many of my patients use a neck suspension-apparatus, as recommended by Dr. Sayre; they will not take the trouble. I am more successful when I desire them to procure a piece of round timber suspended from the ceiling by a rope, just like a trapeze, from which to swing by the hands several times a day; this I can get them to do. They enjoy the exercise; but nearly all, more especially children, object to use the neck-piece. Nevertheless, where the curve is high up, I insist on the neck-piece being used, and self-suspension practised, strictly according to Dr. Sayre's directions. With regard to the jackets, I believe that Cocking's felt jacket, if worn at night, becomes soft.

The plaster-of-Paris jackets, whether used for caries of the spine, or for lateral curvature, I generally cut down and lace, according to the method described by me in the *Lancet* of November 20th, 1880; by so doing, I can more readily arrange the pads, or remove any portion I think likely to press upon projecting parts. Jackets laced in this manner will be found even stronger than before they were cut, and they can be removed at intervals for the purpose of cleaning the patient. I seldom use a dinner-pad, but make my patients have a good meal before operating. I believe the hips are best padded by sewing two or more layers of thick flannel outside the skin-fitting vest; but I find that the less I pad my patients, the better their jackets fit. I have had much loss of time and disappointment with my plaster bandages. Sometimes a

jacket would harden properly; sometimes, when I was most anxious to have matters all right, I found them to fail. At first I ascribed it to the dampness of our climate affecting the plaster-of-Paris, but no amount of care, with regard to keeping the plaster dry, appeared to improve matters. A short time ago, I came to the conclusion that the cause of the trouble existed in the bandage muslin. I had the muslin boiled, washed, and dried before I cut it into strips, in order to remove the dressing: the plaster-of-Paris was then well rubbed into it. It became very hard when wet, and made an unusually excellent jacket. I am happy to say I have had no disappointment since, with any of the bandages prepared in this manner.

I have been so often annoyed with jackets failing to harden properly, that I adopted the plan of making a miniature test-jacket before operating. This can be done by rolling ten or twelve layers of wet plaster bandage round a pint bottle; when it has set, it is cut down longitudinally. In half an hour it will have hardened, and it will be known if the other bandages similarly prepared will give satisfaction or not. It may be well for me to add that the plaster-of-Paris, which adheres so persistently to the hands and nails, can be easily removed by rubbing them with a little moist sugar.

ABSTRACT OF LECTURES

ON THE

ANATOMY, PHYSIOLOGY, AND ZOOLOGY OF THE EDENTATA.

Delivered at the Royal College of Surgeons of England.

By W. H. FLOWER, F.R.S., LL.D.,
Hunterian Professor of Comparative Anatomy.

LECTURE II.—ANATOMY OF THE BRADYPODIDÆ.

IN studying the anatomy of the Sloths, it is extremely important to bear in mind the distinction between the two genera indicated in the last lecture, as it is not only in the number of toes of the fore-feet, but throughout their internal structure, that important differences are to be found.

The skull of the three-toed Sloth (*Bradypus*) is high and compressed, with an extremely short face. The cranial cavity is oblong, elevated, and narrow. The olfactory fossæ are large. The plane of the occiput is vertical, or slightly sloping forwards and upwards. The frontal region is dilated with air-sinuses. The lacrymal is very small, and the canal is external to the margin of the orbit. The malar is attached to the frontal, lacrymal, and maxilla in front, curves downwards and outwards, and then divides into a descending and a high ascending branch; but neither of them joins the straight zygomatic process of the squamosal, the arch being thus incomplete. The nasals are short and wide. The anterior nares are nearly vertical, or rather inclining downwards. The premaxillæ are exceedingly rudimentary, only the palatal portion being present, without any ascending process; they unite with each other across the middle line, but not with the maxillæ, hence they are generally lost in macerated skulls. The palate is narrow, especially posteriorly, and not produced behind the molar teeth. The pterygoids form large plates with prominent rounded branches, compressed in some and inflated in other species. The glenoid fossa is narrow from side to side. The tympanic, squamosal, and periotic are ankylosed together, the former dilated into a bulla, but not forming a tubular meatus.

The skull of the two-toed sloth (*Choloepus*), though generally similar, presents some marked deviations. Even in aged specimens, in which almost all the sutures are obliterated, the tympanic is a mere ring, incomplete at the upper margin, and but slightly connected with the bones around. The premaxillæ are more developed, and become ultimately ankylosed into the maxillæ. The upper margin of the mandible is produced anteriorly with a spout-like process.

The vertebral column presents many peculiarities in both genera. As is well known, in almost all mammals, the number of vertebrae in the region of the neck is seven; but, in all known species of three-toed Sloths (*Bradypus*), there are nine, *i.e.*, nine vertebrae in front of the one which bears the first thoracic rib (or first rib connected with the sternum, and corresponding in its general relations with the first rib of other mammals); but the ninth, and sometimes the eighth, have a pair of short movable ribs. The eighth is perforated by the vertebro-arterial canal, but not the ninth. The common two-toed Sloth

(*Choloepus didactylus*) has seven cervical vertebrae, but a closely allied species (*C. Hoffmanni*) only six. Thus, within this small group, we have examples of the ordinary number, and of two distinct deviations from it, one in the direction of excess, and the other of deficiency in the vertebrae of the cervical region. The trunk vertebrae are numerous, especially those bearing ribs, the lumbar region being short. *Bradypus* has twenty altogether, of which from fifteen to seventeen are dorsal; *Choloepus*, twenty-seven, of which twenty-four may bear ribs, the numbers varying slightly in different individuals. The vertebral column generally is remarkable for the extremely broad flat laminae and very short neural spines, lying backwards on the next succeeding vertebrae, throughout the whole column down to the sacrum. The shortness of all the processes is in relation to the absence of function of the dorsal and lumbar muscles; the Sloth never running, jumping, or propelling itself with its hinder extremities, but merely hanging with its back downwards, below the boughs of trees, locomotion being chiefly effected by dragging itself forward by its fore-limbs. A character which does not appear to be adaptive, and is therefore more significant of affinity with animals to be spoken of hereafter, is a small backward projecting process (anapophysis) on the laminae of the lumbar vertebrae (best seen in *Bradypus*), which has a synovial articulation with the succeeding vertebrae, a sort of accessory articulation in addition to the normal zygapophysis. The sacrum is elongated by the incorporation of many of the caudal vertebrae, with which the innominate bones contract a second union in the ischial region. The free caudal vertebrae are very few: four to six in *Choloepus*, and ten or twelve in *Bradypus*.

The skeleton of the limbs presents many points worthy of attention. In the young of both genera, the acromion is a long strip of cartilage connecting the spine with the end of the coracoid, while the coracoid border of the scapula and the coracoid bone join each other in front, converting the coraco-scapular notch into a small oval foramen. The acromion and coracoid remain united at their extremities in *Choloepus*, but in *Bradypus* the acromion gradually becomes reduced in size, losing its connection with the coracoid, and finally remains a mere styliiform, or slightly flattened process. The clavicle is well developed in *Choloepus*, attached externally to the loop of bone on the scapula formed by the united extremities of the acromion and coracoid, and internally by the intervention of a ligamentous band to the manubrium sterni. In *Bradypus*, the clavicle is very small, and separated by a long interval from the sternum. It originally articulates at its scapular end, as in *Choloepus*; but, in consequence of the atrophy of the acromion, it is left attached to the end of the coracoid, in which unusual situation it remains through adult life. It can have no functional effect in steadying the shoulder, which in a climbing animal is rather remarkable; but the action of the Sloth's arm is probably principally directly backwards and forwards. The humerus is long and straight, slender, and cylindrical in the greater part, but flattened and laterally expanded at the lower end. In the two-toed Sloths, it is shorter and broader than in *Bradypus*, and has a large supracondylar perforation, which is wanting in the latter genus. The radius and ulna are long and distinct, and possess a certain amount of power of rotation. The hand is long, very narrow, habitually curved, and terminates in two or three large pointed curved claws, in close apposition with each other—incapable, in fact, of being divaricated; so that it is reduced to the condition of a hook, by which the animal suspends itself to the boughs of the trees among which it lives. The carpus is small, and articulates by a smooth rounded surface with the lower end of the radius. In *Bradypus*, it consists of distinct scaphoid, lunar, and cuneiform bones in the first row, but usually of only two bones in the second row—the cuneiform, and a connatemagnum and trapezoid, the trapezium being generally ankylosed to the rudimentary first metacarpal. There is also a small rounded pisiform. The first and fifth metacarpals are present in a rudimentary condition, but bear no phalanges. The three middle digits are nearly equally developed. The proximal phalanges are extremely short, and become soon ankylosed to the ends of the metacarpals, so that in adult animals one of the usual bones of the digits appear to be entirely wanting. The middle phalanges are long and compressed; the ungual phalanges are also long, much compressed, gently curved and pointed. Bony laminae reflected from their bases encase and support the roots of the claws. In *Choloepus*, the os magnum and trapezoid are distinct. The functional digits are the second and third, and there are rudiments of the first and fourth metacarpals, but not of the fifth. The proximal phalanges are extremely short, as in *Bradypus*, but do not ankylose into the metacarpals. The ungual phalanges are not so long as in *Bradypus*.

In both genera of Sloths, the pelvis is very short and wide, with tolerably broad flattened ilia, and slender pubes and ischia, enclosing a large oval thyroid foramen, the inferior boundary of which, and the extremely narrow and pointed symphysis, are formed by the pubis alone.