majority of diseases, and especially for infectious diseases, cannot be obtained till we have found out their causes and nature. But, apart from this, I imagine we already have a very considerable advantage from the discovery of the comma-bacillus. I think, first, of how we can utilise it in a diagnostic direction. It is highly important that a correct diagnosis should be taken of the first cases which occur in a country or locality. According to my view, by showing the presence or absence of cholera-bacilli, we can say with certainty whether we have cholera before us or not. This seems to me to be a very essential advantage.

I further think that, after having become acquainted with the real cause of the disease and its qualities, the etiology of cholera can be constructed on definite and fixed lines, and that we shall at length get rid of many contradictions. We shall now obtain a firm basis for an uniform action that knows the end at which it is aiming. I anticipate special advantage from the observation that comma-bacilli are killed by being dried.

It is true that the fact that the infectious matter of cholera is destroyed by being dried, ought properly to have been discovered before by experience, but experimental supports were wanting, and people were never certain on this point. Now we can regard this as a positive property of the infectious matter, and in future take this property into account. But, above all, we can deduce this advantage, that an end will at length be put to the fearful squandering of disinfectants, and that millions will not again, as in the last epidemics, be poured into gutters and cesspools without the slightest advantage.

For the rest, I hope that the recognition of the comma-bacilli can be turned to account therapeutically. We shall be able in future, even in the less severe cases, and in the first stages, to take a diagnosis. In accordance with this, therapeutic experiments, also, will have more certainty when it is known that the patient is really suffering from cholera. An early diagnosis must, however, be of all the greater value, as the chance of therapeutic success is precisely greatest in the first stages.

Professor VIRCHOW, after thanking Dr. Koch for giving this long and detailed account of his views, said: "I say decidedly for myself that, from the beginning, I thought it very probable that the bacillus was, indeed, the *ens morbi*: but, from what I have heard to-day, my conceptions on the subject have arrived at a much greater degree of certainty."

STATISTICS OF EXAMINATIONS.—At the recent pass-examinations for the diplomas of the Royal College of Surgeons of England, 352 candidates presented themselves; from St. Bartholomew's Hospital, 53; University College, 39; Guy's Hospital, 27; St. George's Hospital, 23; King's College, 19; St. Thomas's Hospital, 15; London Hospital, 15; Charing Cross Hospital, 13; Middlesex Hospital, 13; St. Mary's Hospital, 12; and the Westminster Hospital, 11. The provincial schools were represented by Manchester, 24; Cambridge, 13; Leeds, 11; Birmingham, 8; Bristol, 8; Liverpool, 7; Newcastle, 5; and Sheffield, 3. Edinburgh and Glasgow sent respectively 21 and 4; Dublin, 3; Madras, 2; Calcutta and Bombay, 1; McGill, Montreal, 3; Toronto, 2; and Amsterdam, 1. Of the 352 candidates, 60 passed in surgery, and, when qualified in medicine and midwifery, will be admitted members of the college. Of those who failed to acquit themselves to the satisfaction of the examiners, 1 was referred for twelve months, 6 for nine months, 108 for six months, and 40 for three months. The total number admitted members was 137, against 120 at the corresponding period last year.

ST. THOMAS'S HOSPITAL.—The following appointments have been made, for three months, from September 2nd. Resident House-Physicians: G. D. Johnston, M.R.C.S., L.R.C.P.; F. F. Caiger, M.B., B.S., M.R.C.S., L.R.C.P. Non-resident House-Physician: F. W. S. Stone, M.R.C.S., L.R.C.P. (ext.). Assistant House-Physician: R. Lawson, M.B.C.S., L.S.A. House-Surgeons: J. Orford, M.R.C.S., L.R.C.P., L.S.A.; H. B. Robinson, M.R.C.S., L.R.C.P. Assistant House-Surgeon: C. D. Green, M.R.C.S., L.R.C.P. Resident Accoucher: W. Hull, M.B., M.R.C.S., L.R.C.P. Clinical Assistant in the Skin and Ear Department: T. Glover Lyon, M.R.C.S., L.R.C.P. (ext.). Clinical Assistant in the Special Department for Diseases of the Throat: H. W. G. Mackenzie, M.A., M.B.

THE MANUFACTURE OF TEETH.—It is said that the tooth manufacture of the United States amounts to 10,000,000 teeth per annum. The value of these teeth is a million dollars. The materials of which they are composed are felspar, kaolin, and rock crystal. There are twelve manufactories, but one of them, founded in 1864, makes half the number.

BRITISH MEDICAL ASSOCIATION

FIFTY-SECOND ANNUAL MEETING.

PROCEEDINGS OF SECTIONS.

THE SURGICAL AND ORTHOPÆDIC TREATMENT OF INFANTILE PARALYSIS.

Read in the Section of Surgery.

By BERNARD ROTH, F.R.C.S.

I wish to refer in this paper to the treatment of infantile paralysis after the acute stage has passed, when it is possible to recognise which muscles are likely to recover more or less complete power, and which will be more or less hopelessly destroyed as far as voluntary contraction is concerned.

It is during this stage, while the previously paralysed muscles are beginning to recover their power, various deformities of the trunk and limbs are prone to occur; deformities which frequently cause more grief and hardship than the permanent paralysis left, and which yet, with care and perseverance, can be nearly always prevented. The two guiding principles in the surgical and orthopædic, or after-treatment of infantile paralysis, are:

1. To improve the power of those affected muscles which have still some voluntary power left.
2. To prevent the onset of any deformity, or, if this has already occurred, to reduce it to a minimum.

With reference to the diagnosis of infantile paralysis, this presents little difficulty when the chronic stage has been reached. In all cases a thorough examination should be made of the trunk and limbs; each joint in turn should be examined; and the patient's will is to be strongly urged to exert voluntary contraction to effect all the movements possible in the given joint, *i.e.*, flexion, extension, rotation, etc. By first doing the movements on the opposite limb, if that be normal, he will more readily understand what is required of the partially paralysed one. When the patient is unable of himself to execute a movement, the surgeon should do it passively, and if there be any contraction or limitation of motion in a joint, this will be at once noticed, and errors of diagnosis avoided.

1. *To Improve the Power of those Affected Muscles which have still some Voluntary Power Left.*—The first thing to be done is to correct the lowering of temperature, nearly always present, of the limb or limbs. If one leg is affected, the parents should be told not to be satisfied unless it is as warm as the healthy one. It will be generally found that, after a night's rest in bed, the paralysed leg will be perfectly warm. The patient should be quickly sponged all over, on rising, with tepid water, followed by good rubbing and drying, and sufficient extra clothing applied to the affected limb. Loosely knitted woollen stockings, thick cloth leggings, or, best of all, cloth leggings lined with cat's skin, or other fur, should be constantly worn during the day.

Warm baths, temperature 98° to 100° Fahr., for from ten to twenty minutes every evening, are most useful. For young patients of from five to ten years old, a small barrel standing on end answers admirably, as the patient can stand in it up to the waist or neck in water if required, and a smaller quantity of hot water is needed. The bath should be followed by a rapid sponging of the whole body with cold water, so that no undue sensitiveness to changes of temperature be induced. If properly applied, the cold sponging produces such a reaction after the bath, that the pale paralysed limb becomes as red as a boiled lobster.

Next, *massage* or rubbing is specially indicated, and although many medical men employ it, it is seldom practised sufficiently long daily, or with enough force. Half-an-hour, or an hour, twice daily, is often hardly enough. In every case the rubbing should be practically superintended by the surgeon for the first time or two. In cases of long standing, more or less of the situation of the wasted muscle is frequently taken up by tenacious adipose tissue, through which the pressure of the rubber's hands has to be transmitted to reach the diminished mass of the muscle.

The rubbing or massage I employ may be roughly classed as *kneading*, *circular friction* with the thumb, *pulling*, and *firm stroking down*. "*Kneading*" is a combination of grasping, and large pinching and pressure, with the two hands used alternately, one after the other, so that whatever is left of the wasted muscle, is thoroughly squeezed and

moved about. As considerable force is required, the skin should be protected from abrasion by lubrication with olive oil, or vaseline, or other innocuous fatty substance.

"Circular friction by the thumb" is done as follows. The operator's thumb-end is firmly placed on any given spot, and while considerable pressure is exerted, describes small circles, ten times from right to left, and ten times from left to right. A spot an inch higher or lower, or to one side, is then treated in the same way, and so on until every part of the muscle has been thoroughly manipulated. This method of rubbing is very useful when the space occupied by the wasted muscle is small, as in the case of the anterior tibial muscles, or of the muscles on the anterior or posterior aspects of the forearm, etc. It is, however, equally efficacious for large muscles—for example, the quadriceps extensor of the knee, or the glutei.

"Pulling" acts less directly on the muscles, but rather on the whole of the tissues of the paralytic limb; it is effected by a rapid to-and-fro alternate gliding of the two palms on opposite sides of the limb, which is at the same time as firmly compressed as possible. If the leg is to be "fulled," the operator begins close to the groin and gradually works his way down to the foot, moving the hands rapidly to and fro the whole time. The first time, the hands should be on the outer and inner aspects of the leg; the next, they should be placed higher on one side and lower on the other; the third time, this position is reversed; and, finally, the hands are placed posteriorly and anteriorly to the limb. Such a manipulation, for five minutes vigorously carried out, will seldom fail in producing a most wholesome glow, and increased circulation in the blue-looking and chilly limb. A dozen or two firm "stroking down" of the leg ends the rubbing.

Even more important than the rubbing or massage is the methodical exercise of those muscles which have partially recovered. Every muscle which is still under control of the will, if it be ever so slight, should be acted upon; for whenever, by a great voluntary effort, a patient can contract a paralytic muscle, an increased amount of power can be obtained by long continued perseverance in methodical exercise. Medical gymnastics, or so-called "Swedish exercises," where each muscle or group of muscles is made to contract, and then gradually relax, at first actively, and then against resistance by the surgeon, are most efficacious. Although faradisation is useful when the voluntary power is very feeble, or not yet present, it cannot be compared to this treatment by exercise, with resistance alternately by the surgeon and the patient.

The following is a short description of some of the simple exercises required in ordinary cases of infantile paralysis. As it is always necessary to have a good *point d'appui*, I shall begin with the proximal joints. If there be any weakness of the spine or thorax, I must refer those interested in the subject to my article, "The Treatment of Lateral Curvature of the Spine," in the BRITISH MEDICAL JOURNAL of May 18th, 1882.

Hip-joint.—The gluteal muscles are by far the most important of the muscles of the lower extremities, for, if their power be left, or if they can be sufficiently developed, the patient may eventually be made to walk, with or without sticks, even if all the other muscles of the legs are utterly wasted. Thus, if the quadriceps extensor muscle of each knee-joint has been lost, the patient may sometimes be able to stand erect or walk, by keeping the knees extended, without any posterior splint, by means of the posterior and crucial ligaments of the joint, with the help of the gluteal muscles, and a slight inclination forwards of the trunk. I have had several patients who were enabled to walk fairly well without any thigh-muscles, front or back, in whom the gluteal muscles had become sufficiently developed under treatment, a back-splint for the knee being all that was required to prevent hyperextension of the knee and consequent relaxation of its ligaments.

An efficient exercise for the gluteal muscles is for the patient to lie prone and to raise the leg, with knee kept extended, from off the ground; if the gluteal muscles are too weak, the surgeon, or the properly trained assistant, helps the patient by supporting more or less of the weight of the limb, by placing the hand under the front of the knee; this is really an extension of the hip. After a few days, circumduction of the hip from right to left, and *vice versa*, is to be tried ten or twelve times each way. By the time the patient has increased in power, and finds this circumduction easy, its severity can be augmented by the surgeon's hand pressing downwards with more or less force against the back of the heel, or by placing a double bag of shot or bullets over the tendon Achilles. If the abductor muscles of the hip are weak, the simple expedient of making the patient lie sideways, and doing the hip-circumduction with the uppermost leg, will bring them into action. For the flexors of the hip, the same circumduction is to be done with the patient lying on his back and

the knee kept extended (if this cannot be done voluntarily, by means of a lightly applied wooden back-splint). The patient can be easily taught to rotate the limb out at the hip, at first if necessary, with assistance, and, finally, against resistance.

Knee-joint.—For exercising the extensors, the patient, lying supine, has the knees flexed, and the legs hanging vertically over the end of the padded table on which he lies; he is requested slowly to extend one knee; if the weight of the leg is too great, the surgeon assists by supporting the foot while the patient voluntarily performs the movement. The flexors of the knee generally escape paralysis, but are easily brought into action by the patient lying prone and trying to lift the foot off the ground by slowly flexing the knee, against the surgeon's resistance, if necessary, applied to the back of the heel.

Ankle-joint.—The patient, sitting, has the leg supported on a chair, with the foot projecting beyond; flexion, extension, adduction, abduction, and circumduction, are executed either voluntarily by the patient, or passively by the surgeon; if the former, when strong enough, also against the surgeon's resistance. If there be any contraction of the tendo Achillis preventing normal dorsal extension of the foot, passive extension of the foot, with considerable force, should be daily employed; and if there is not sufficient elongation at the end of three or four weeks, tenotomy must be performed. This operation should be avoided, if possible, when voluntary dorsal extension is absent, or so deficient as not to be able to overcome the weight of the foot. Whenever I employ tenotomy, I recommence systematic exercise as soon as the skin-incisions are sufficiently healed, i.e., on the third or fourth day. The previously learned exercises are found much easier by the patient after the tenotomy, which gives at once greater range of movement. (See my article, Treatment of Non-spasmodic Wry-neck, in the BRITISH MEDICAL JOURNAL of June 14th, 1884.) We now take the upper extremities.

The Shoulder-joint.—The patient lying on the back, circumduction from before backwards is one of the exercises most easily taught, if there be any voluntary power; the elbow and wrist being kept extended, either voluntarily, or, if that be impossible, by means of a wooden splint. To bring the scapular muscles into action, the patient, lying supine, with the arms down by the sides of the trunk, or abducted at right angles to the body, or extended upwards by the side of the head, is told to resist the arms being brought forwards by the surgeon from either of the above positions, and then voluntarily returned to the initial position against the surgeon's gradually yielding resistance, the elbows being kept well extended. The rhomboidei and subscapularis muscles are chiefly brought into action in the second movement, with the arms at right angles to the trunk.

The Elbow-joint.—The upper arm being fixed by the surgeon against the table on which the patient lies, the motion of flexion or extension is easily resisted by the surgeon's other hand, the elbow being either flexed or extended to begin with. Pronation and supination, also flexion and extension of the wrist, present no difficulty if a little time and attention are devoted to carrying out similar exercises to those already described. So, again, the same remarks apply to flexion, extension, adduction and abduction of individual fingers.

Throughout all these exercises, care should be taken that, while the patient is trying to contract (that is, exercise), he is prevented involuntarily contracting other stronger or normal muscles which should be kept at rest.

2. *To Prevent the Onset of any Deformity, or, if this be already present, to reduce it to a Minimum.*—Where one limb is affected, it is most important to prevent shortening of the bones as the result of a less active nutrition as compared with the opposite sound limb. Where one leg has already become shortened as the result of a quicker growth of the healthy leg, before the patient has come under observation, it is nearly always possible to prevent further increase of the difference by religiously carrying out the suggestions already given. It is essential for the prevention of lateral spinal curvature to have the lengths of the two limbs equalised by a thicker sole on the boot of the shorter.

In the upper extremities, where one arm only is paralysed, it is often most useful to bandage the healthy one close to the body for some hours daily, so as to induce the patient to use the weak arm as much as possible. In all cases, it is essential to stop at once all unnatural modes of progression, such as crawling, or walking on the hands and feet, hopping, or running with the legs much flexed at the hips and knees. So, again, if there be flat-foot, properly shaped laced-boots, with felt-pads, should be prescribed, and other special treatment followed, as given in my article, "Early Treatment of Flat-foot," in the BRITISH MEDICAL JOURNAL of November 18th, 1882.

If the toes are much deformed, or curled over one another, stockings with toes will be found efficacious. In no case should garters be worn, but suspenders used instead.

With reference to the general health, I attach much importance to milk forming a large element in the food. I strongly advise tepid water enemata, on alternate days if necessary, rather than purgatives, when there is any tendency to chronic constipation. The patient should be in the open air for several hours daily, and should always remain in the best possible positions, whether sitting or lying.

I have not referred to the subject of division or excision of tendons for shortening partially paralysed muscles, as I have not yet seen any cases in which this treatment appeared likely to be of the slightest use.

Prognosis.—If there be ever so small an amount of voluntary power left, some improvement should be obtained by a month's treatment, and a very decided and marked improvement by the end of three months. Afterwards, the friends, having been properly trained, as well as the patient, can carry on the treatment almost as successfully at home for as long as is necessary.

THE RADICAL CURE OF HERNIA BY TORSION OF THE SAC.

Read in the Section of Surgery.

By CHARLES B. BALL, M.Ch., F.R.C.S.I.,

Surgeon to Sir P. Dun's Hospital and Examiner in Surgery in Dublin University.

DURING the last few years, in this Association and elsewhere, the radical cure of hernia by operation has been freely discussed; and I take it that the general opinion of practical surgeons is in favour of operating in properly selected cases, and that some of the many methods by which the neck of the sac is exposed by incision, and directly treated, are much to be preferred to the subcutaneous operation of Wood, Spanton, and many others.

Obviously the most radical of these in conception, and the one which contains the most essential elements of success, is that in which the sac is excised, its neck ligatured high up, and sutures applied to the hernial orifice. Of this operation, there are several modifications, with the object in view of making the closure of the opening more complete, such as scraping the edges before suturing, as recommended by Messrs. Steele of Bristol, and Marcy of Boston; the use of the cautery for the like purpose, as recommended by Dr. Warren of Boston; and when difficulty is experienced in bringing the edges of the ring together, making liberating incisions through the tendon of the external oblique, parallel to the pillars of the ring, as recommended by Reverdin.

This operation has been performed sufficiently frequently for us to draw deductions as to its safety, and as to the resulting cure. It would appear from the published cases, that it is practically as devoid of danger to the life of the patient as any other method, but that the proportion of failures to effect a complete cure is somewhat large.

According to Dr. Guénod, during the space of three years in the surgical clinic of the hospital at Bâle, forty-four operations of this kind had taken place, and of these thirty-four had been found and examined by Dr. Guénod at different periods. Twelve had a return of the hernia, and twenty-two had been completely cured; in other words, over one-third were failures.

The results obtained by the Liverpool surgeons, who have practised this operation on a very large scale, would appear to justify similar conclusions. Mr. Banks having stated that, with an experience of between fifty and sixty cases, he did not believe in the radical cure, but considered the use of a truss necessary afterwards.

It is, therefore, evident that we must look for something more if we hope to be able to cure hernia so absolutely, that the further use of a truss will be unnecessary; and I believe that torsion of the sac will prove to be a right step in this direction. It is probable that this addition to the operation has suggested itself to other surgeons, but hitherto I have failed to find any allusion to it in published cases.

At the adjourned discussion on the Radical Cure of Hernia at the Academy of Medicine in Ireland, held January 22nd last, I suggested twisting of the sac as a procedure likely to effect a more permanent cure; and, owing to the favourable reception accorded to it, I have practised the operation, and it has also since been performed by other Dublin surgeons.

The advantages which may be claimed for this operation are these. First, a more thorough closure of that portion of the sac situated in the inguinal canal is obtained than can possibly be obtained by any simple ligature, no matter how high up it is placed. Secondly, the twisting has the effect of tightening and throwing into ridges the peritoneum for a considerable area surrounding the abdominal opening. This I believe to be a matter of extreme importance; for, as Lawrence pointed

out many years ago, one of the most fertile predisposing causes of hernia is an abnormal laxity and fullness of peritoneum in the neighbourhood of the hernial opening. Thirdly, the danger of septic peritonitis is diminished; for, if by any imperfection in the dressing the wound become septic, it is highly improbable that inflammation would spread up the tube of peritoneum closely twisted into apposition without producing limiting adhesion.

The first case upon which I operated by this method was a male, aged 23, who had a large scrotal hernia on the right side, which gave him a great deal of pain, and could not be properly controlled by a truss. He had a small hernia on the left side, which occasioned but little trouble. He was unable to follow his employment as a labourer in gas-works, and stated that, unless something were done for him, he would have to go to the union. On January 25th last, I exposed the neck by incision, and isolated the sac from the cord. This proceeding was a little tedious, as the component structures of the cord were spread out over the hernia. Separation having been completed, the sac was grasped with a clamp-forceps high up, and given six half-turns, that is, three complete revolutions. A decided resistance was now felt, and it was evident that any further torsion would be attended with risk of rupture. A ligature of carbolised gut was tightly tied round the neck, and a salmon-gut suture passed through the pillars of the ring, and also through the twisted stump, with the view of preventing untwisting. The wound was closed, a drainage-tube inserted, and gauze dressings applied. Recovery was retarded by slight supuration about the wound, and by the formation of a scrotal abscess; but in four weeks the healing was perfect, and there has not been since the slightest tendency to recurrence. The patient is working regularly, a light truss being sufficient to keep up the small hernia on the left side.

The scrotal abscess which retarded recovery in this case, and which has been frequently noticed by other surgeons after excision, is no doubt due to the difficulty of efficiently draining the large cavity from which the sac was removed; and in future I shall always bring a drainage-tube out through the most dependent portion of the scrotum, and completely close the wound over the neck. In order to obviate the disturbance of parts necessary in the complete removal of the sac, the recommendation of Buchanan to divide the sac in two may be adopted, but I believe this is only suitable in cases of the congenital form of hernia. In this variety, as the lower portion of the sac is the tunica vaginalis, its attachments to the testicle would render extirpation impossible; but this close relation would also insure the vitality of the portion of sac left; so that, were I called on to operate in a case of the congenital form, I would divide the sac, suture the lower portion to form the tunica vaginalis, and twist up the upper portion.

In acquired hernia, the case is different, for here the entire vascular supply comes from above; and if any portion of the sac be left after ligature or division, sloughing is apt to occur.

In effecting separation between the sac and the cord, it is essential to remember that the three normal coverings of the cord are common to it and the hernia, so that it is necessary to ensure the thorough division of these on a director before attempting to isolate the sac, and to twist nothing but the thickened peritoneum and subperitoneal tissue.

In inguinal hernia in the female, in femoral or other forms of rupture, when the cord is not present to complicate matters, it is evident that the operation of twisting the sac can be carried out with much greater facility.

In quite a different category from the operation for radical cure of reducible hernia, must be placed the addition of an attempt to ensure permanent obliteration, to the ordinary operation for strangulated hernia. In the latter, the surgeon is unable to select his cases, and is frequently called upon to operate under circumstances in which nothing short of the most dire necessity would justify any surgical interference. In these cases, twisting of the sac adds nothing to the risk, and may effect a permanent cure; indeed, it would seem probable that this addition renders the ordinary operation safer, by preventing hemorrhage into the abdominal cavity, and, as above noted, by lessening the risk of septic peritonitis. It is obvious that, for statistical purposes, the cases should be kept absolutely distinct.

I have adopted torsion of the sac in one case of strangulated femoral hernia. The patient was a female, aged 54. The hernia had been strangulated for three days when I saw her, and she was suffering from chronic Bright's disease. Upon opening the sac, which was much thickened, the intestine was found to be adherent to the interior; this was carefully separated, and the hernia reduced. Five half turns were now given to the sac; and a catgut ligature applied. As there did not appear to be any tendency to untwist, no suture was used. About