In doing an anastomosis of any two pieces of intestine, it will be found safer and easier to begin the stitch so that the corner between the anterior and posterior line of sutures be half turned, in order that when the end of the suture approaches the point where it was started, one does not have to sew deep down where the two walls of the bowel are held closely folded together by the posterior row of sutures. One should also be careful to avoid twists in the two strands of the suture, and these should all be taken out before the suture is inserted.

Care should also be taken not to leave the tail suture (that is, the suture to be grasped by the left hand and pulled back) any longer than is necessary to tie, because by doing so the length of the suture is sacrificed just so much, and a new suture is necessary so much sooner.

This suture has many advantages over the Turck suture. In the first place, it does not require as many stitches, because there is no overlapping, and that much distance is saved for every stitch. It may be inserted much more rapidly, because each stitch inserted really means one and one-half stitches inserted. It saves the extra stitch-hole which occurs in the overlap in the Turck stitch, the lock being all in one set of stitch-holes. Its pull in locking is one stitch on another, where they cross in the stitch-holes, and not on a piece of bowel which is within the grasp of the two stitches, as they lock in the Turck stitch. This seems to be a distinct advantage, for, if in the locking process there is much pull, there must be considerable pressure on the tissue included between the two stitches, if they are locked as in the Turck switch, by grasping a piece of tissue between them. While it is no advantage except to save one from confusing ends, one may tie each stitch as it is inserted, while in the Turck stitch the first stitch cannot be tied until the second one is put in.

Over Dr. Suggs' method this suture has the advantage of requiring no special needle, and of requiring no rethreading or unthreading. It also has the advantage of carrying through the bowel only the same thickness of suture material as would be carried through it in the use of any suture, that is, two strands, while in Dr. Suggs' method four strands must be carried through each time that the needle is inserted, since the needle is threaded with two separate sutures. It will also be found that, with a needle carrying two sutures on it, it is not easy to carry out the Lembert principle because of the difficulty of pulling four strands of suture material through the delicate wall of the bowel without ripping it.

I have applied this stitch to ten dogs, in some doing gastro-enterostomies and in some lateral anastomoses; I have inserted only one row of stitches, and in some of the lateral anastomoses the union has been made so near the knuckle of intestine that the strain on the anastomosis must have been very great. The dogs have all been killed and the specimens removed at the end of twelve days, and in all cases smooth union with no leakage has been found. There have been no adhesions from the free ends of the sutures, as they bury themselves by the infold caused by the mattress sutures.

I believe this suture to be the quickest, easiest and safest of all mattress or interlocking sutures.

I wish to express my thanks to Dr. Oliver Tinkham and Mr. Roy MacAusland, who have at various times acted as my assistants in these operations.

EPIDEMIC POLIOMYELITIS IN MONKEYS

THE ACTIVITY OF THE VIRUS *

SIMON FLEXNER, M.D., AND PAUL A. LEWIS, M.D.
NEW YORK

In our previous communications on experimental epidemic poliomyelitis[1] we described its successive transmission through two series of monkeys and discussed the nature of the virus that causes the disease. In the first place, we stated that by employing the intracerebral mode of inoculation of the virus the disease could be readily transmitted from monkey to monkey, possibly through an indefinite series, but that successive transmission could be accomplished also by means of inoculation into a large nerve (sciatic), into the circulation, the peritoneum and the subcutis. In the second place, we showed that the virus was filterable through a Berkefeld filter and withstood glycineration. In the present article we wish to describe certain additional facts that have been ascertained concerning the virus of epidemic poliomyelitis.

The virus was shown, by inoculation experiments, to be contained in the spinal cord and brain, but it was not known whether it was present also in the blood and other organs. We have produced the disease in a monkey by injecting an emulsion of the regional (axillary and inguinal) lymphatic glands, communicating with a nodule caused by a subcutaneous injection of the virus, that had induced paralysis. Two other monkeys were inoculated at the same time: one from the spinal cord and the other from the local subcutaneous lesion. The former developed paralysis and the latter is still well.

The degree of resistance of the virus is being studied. It has been determined that the spinal cord from a human case (Keefe) of poliomyelitis retains its virulence, apparently unimpaired, on being kept frozen at 2 to 4 C., in the Frigo apparatus, for a period of at least forty days; and when kept also for at least fifty days at a temperature about +4 C., during which time the latter specimen of spinal cord became slowly softened through autolysis and overgrown superficially with mold. These experiments have a bearing on the epidemiology of the disease and indicate that the cessation of the cases of the disease which occurs with the onset of cold weather does not depend on the destruction, although it may have to do with an effect on the multiplication, of the virus.

Moreover, the spinal cord of an affected monkey still transmits the disease, after having been suspended for at least seven days, over caustic potash, in a desiccator.

The activity of filtrates has been confirmed, and the possibility of their action being due to soluble toxic bodies and not to living organisms has been excluded by transferring the disease by means of the spinal cord obtained from the monkey that succumbed to a filtrate.

Can the virus be cultivated artificially? Portions of a bacteria-free filtrate were inoculated into bouillon containing 10 per cent. of rabbits' serum which had been rendered perfectly clear and sterile by being put through a Berkefeld filter; 1 c.c. of the filtrate was mixed with 9 c.c. of the bouillon and incubated. On the second day the fluid in the upper half of the tube was cloudy; the turbidity increased, and on the fourth day the fluid was used for inoculation into a monkey which developed

* From the Laboratories of the Rockefeller Institute for Medical Research.

1. THE JOURNAL A. M. A., Nov. 13, p. 1639; Dec. 4, p. 1913; Dec. 18, p. 2095, 1909.

paralysis on the thirteenth day. A single loop of this turbid fluid did not set up turbidity in other tubes of the same medium.

A second series of cultivation tests, which is still in progress, has been carried out with a human ascitic-fluid bouillon made perfectly clear by filtration through Berkefeld filters. Perfectly clear filtrates, prepared from the spinal cord of affected monkeys, added to the ascitic-fluid bouillon, develop turbidity in the thermostat in twenty-four hours or less, and this turbid fluid inoculated into fresh clear tubes of the same medium causes them to become turbid. The clear filtrates do not produce turbidity, on incubation, in simple bouillon. None of the turbid fluids contained bacteria that could be seen under the microscope or cultivated in nutrient agar, and the dark-field microscope showed no definite bodies.

In a few instances in which parallel injections were made into the subcutaneous tissues and the brain, the monkeys inoculated in the first way developed paralysis and the other escaped infection.

Does an attack of epidemic poliomyelitis followed by recovery afford immunity to reinfection? Experimental poliomyelitis in monkeys is a very severe disease and, in our series, it has caused death in fully 40 per cent. of the inoculated animals that developed paralysis. When recovery occurs, residues of paralysis remain, and when death occurs or these animals are killed some weeks later, atrophy of the gray matter of the spinal cord, corresponding to the paralyzed limbs, is present. We have reinoculated several of the recovered monkeys and have noted in some instances failure of the virus to act while causing paralysis in the control monkeys. A single example will be given:

Monkey 45 was inoculated into the brain on Nov. 6, 1909; on November 13, tremulous and sick; on November 15, left leg was weak. Next day the leg was paralyzed. On November 24 general health was good, but paralysis persisted. On November 30 health was excellent except for paralysis. On this day the animal was reinoculated, together with two controls. Both of the latter became paralyzed, but the reinoculated animal has remained well.

Can the course of an intracerebral inoculation be modified by the simultaneous injection beneath the skin of a virus altered by heating? In seeking for facts relating to artificial protection from or resistance to infection, a considerable quantity of an emulsion of virus-containing spinal cord, which had been warmed to 55 or 57 C. for one hour, or to 60 C. for half an hour, was injected beneath the skin at the same time that a usual intracerebral injection of virus was given. The two monkeys employed in the experiment developed paralysis in the usual manner.

Brief mention should be made of other species of animals that have been employed for inoculation. Besides many rabbits and guinea-pigs, 1 horse, 2 calves, 3 goats, 3 pigs, 3 sheep, 6 rats, 6 mice, 6 dogs and 4 cats have had active virus introduced into the brain, but without causing any appreciable effect whatever. These animals have been under observation many weeks.

In the literature on epidemic poliomyelitis in human beings, reference is made to sensory cutaneous disturbances. We have found lesions similar to those present in the spinal cord and brain in the intervertebral ganglia, obtained from the paralyzed monkeys, in every instance in which we have looked for them.

105 East Sixty-second Street.

BARIUM CHLORID POISONING

E. GARD EDWARDS, M.D.
LA JUNTA, COLO.

History.—An employee of the Holly Sugar Company, Holly, Colo., feeling the need of a cathartic, visited the chemical laboratory of the company and swallowed what he supposed was one and one-half drams of Rochelle salts, but which in reality was barium chlorid. This was at 2 p. m. Inside of thirty minutes he was attacked with violent nausea and vomited twice a very large quantity, which he said was mostly undigested food, he having partaken of a heavy meal just prior to the ingestion of the supposed salts. Three bowel movements, large and loose, followed immediately. He then rode half a mile to his room and was again attacked with vomiting and purging of an intense character, so violent in fact that he made no attempt to keep count of the number of movements. At this time, about 3 p. m., he was seized with a violent pain in the left side, over the sigmoid flexure, and retraction of both testicles. This lasted only a few minutes, and as the patient was feeling easier, no physician was called. During this time the kidneys were very active, moving freely and often. At 5 p. m. the patient noticed a sudden inability to move his limbs, rapidly extending over his arms and trunk, and, at last being alarmed, summoned Dr. O. W. Swope of Holly. Dr. Swope examined him a few minutes later, finding his condition as follows:

Examination.—Pulse 38, forcible; respirations not counted but breathing labored and irregular; temperature, 95 2/5; pupils dilated; total paralysis extremities and trunk. Morphin gr. 1/20 and strychnin gr. 1/30 were administered, hypodermically. No history could be obtained pertaining to any old or recent disease, and no suspicion was entertained of his having taken any medicine other than the Rochelle salts which he had intended to take, until the proximity of the barium chlorid bottle and the exclusion of any acute pathologic condition causative of the symptoms, sugested the possibility of barium chlorid poisoning. As the patient was without a nurse, no record was kept of his condition during the night and the next morning, but the patient was constantly nauseated and the bowels moved often. By noon the next day, on his arrival at the hospital in this place, his condition was as follows: Pulse, 64; temperature, 95 3/5; respiration, 30, shallow and interrupted. Patient could swallow with difficulty; extreme nausea but no vomiting; no bowel movement for six hours; not a muscle of his body could be moved; control of sphincters was normal.

Treatment and Course of Case.—A stomach lavage of boracic acid solution was used to relieve the nausea, if possible, and a high enema, four ounces of epsom salts in one quart of water, given. The abdomen and spine were surrounded with hot water bags, strychnin, gr. 1/30, administered hypodermically, and the whites of two eggs in four ounces of water ordered given every two hours. At 3 p. m. temperature was 97 2/5, pulse 86, intermittent. Strychnin gr. 1/30 given hypodermically. At 7 p. m. temperature was 97 4/5, pulse 86, regular and full. At this time the stomach lavage was again employed and a high enema of four ounces of magnesium sulphate in one pint of water given; also strychnin, gr. 1/30. Urinalysis showed a specific gravity of 10:26 with albumin 0.1 per cent. At 9:30 p. m. the patient began to move the fingers; at 11 o'clock he could move the arms; at 11:30 he turned over in bed, and at 1:30 a. m. he was able to move any part of the body. At 6 a. m. he was given half an ounce of epsom salts by mouth and egg albumin was ordered for every hour during the day. At this time temperature was 98 and pulse 76. Temperature reached normal by noon of the same day. The following morning he was given a light breakfast, and as this was found to agree with him a full diet was given thereafter. The patient was then discharged.

It is questionable, of course, whether the late employment of such simple remedies as were used had any effect on the recovery of the patient or whether he was saved by the facts that the stomach was full of albuminous food at the time of the ingestion of the drug and that the latter was immediately rejected from the body by vomit-