20. Preble (THE JOURNAL A. M. A., Aug. 19, 1899,) reported 4 observations, in 3 of which he obtained the pneumococcus in cultures and in all by direct smears of the blood. Two died and two recovered.

21. F. W. White (Jour. Experimental Med., 1899, p. 425) reported 19 cases, 3 of which were positive; all fatal. Seven of the negative cases were also fatal.

22. Sello (Zeitschr. f. klin. Med., 1899, p. 112) reported a series of 48 cases after Sittman's method. Of these 36 were negative with 27 recoveries and 9 deaths. Twelve cases were positive with 2 recoveries and 10 deaths.

23. Silvestrini and Sertoli (Riforma Medica, 1899, No. 16, Ref. Centralbl. f. innere Med., 1900, vol. xxi, p. 135) out of 16 cases reported the diplococcus present in 15; and in 24 investigations, present 22 times. The authors are inclined to attribute negative results to failure in technic.

24. Beco (Revue de Médecine, 1899, p. 461) had 50 cases with 11 positive findings. Twenty-nine recovered, of which 2 were positive; and 21 died of which 12 were negative and 9 positive. One of Beco's cases showed the Friedländer pneumobacillus.

25. Prochaska (Centralbl. f. innere Med., 1900, No. 46) reported his first series of 10 cases, all of which were positive. He had 4 deaths and 6 recoveries after long periods. No other colonies were found. The cases were not selected.

26. Lenhartz (Man. of Clinical Microscopy. Ref. Burt, Amer. Med., April, 1902) in 1901 reported 20.7 per cent. of positive results in a continuous series of 30 pneumonias.

27. Lenhartz (Muench. med. Woch., 1901, No. 28) found the pneumococcus 3 times, streptococcus 8 times, staphylococcus pyogenes aureus 4 times and the albus once in 16 cases of pneumonia with endocarditis.

28. Prochaska (Deutsch. Archiv f. klin. Med., vol. lxx, p. 559) in 1901 reported 40 additional cases of fibrinous pneumonia, in all of which micro-organisms developed, and, in the great majority of cases, the pneumococcus. In two instances pneumococci were not found, but micrococci in chains, which Prochaska did not know whether to regard as irregular forms of pneumococci or as separate germs. Eight of the 40 cases died and the rest recovered. In none of the cases was there contamination from the skin or from the air.

29. Landi and Cionini (Deut. med. Woch., 1901, p. 296, v, reported a series of 27 pneumonias in which investigation of the blood during life gave positive results.

30. A. Fraenkel (Deut. med. Woch., 1901, Nov. Ver.) in speaking of the pneumococcus in the blood said, "I have myself very often obtained cultures in the blood. One finds them when he takes large quantities of the blood (5 to 10 c.c.) and a liquid medium like bouillon, in every case. They seem to multiply better in a liquid culture medium. In other words, since we no longer take 1 c.c. of blood for our experiments, but 6 to 8 c.c., we find the pneumococcus in the blood in every instance.

31. Cole (Johns Hopkins Hospital Bulletin, June, 1902) made cultures in 30 cases of pneumonia, all lobar except one, which was a pneumococcemia with arthritis and meningitis. Of these 30 cases 9 were positive, with death in every instance. Four of the negative patients died also.

32. Herrick (Amer. Jour. Med. Sci., July, 1902) reported a case of pneumococcus arthritis in which puncture of the median basilic and growth on agar was negative.

33. Prochaska (Deut. med. Woch., 1902, No. 21) reported his third series of cases. He had 4 pneumonias, in all of which pneumococcus was found. He had 3 recoveries and one death.

34. Baduel and Gargano (Gazzetta degli ospedali e delle cliniche, Jan. 4, 1903,) reported an epidemic of pneumonia involving 8 children in one house, many of whom had complications. The pneumococcus was found in the blood of all these cases. Method not stated.

35. Rosenow (Medicine, June, 1903) reported cultures from 83 cases, with positive results in 77.

THE USE OF SILVER FOIL TO PREVENT ADHESIONS IN BRAIN SURGERY.

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The formation of adhesions involving the cortex of the brain and its covering membranes is the rock on which the ultimate success of many otherwise brilliant and successful operations on the brain is wrecked. The harmful influence of posttraumatic and postoperative adhesions of the surface of the brain in the production of epilepsy is universally recognized, and many suggestions have been put to application by the surgeon to prevent this occurrence, but only too often do we find that after a brilliant localization of a brain tumor or other cortical lesion by the neurologist, and a faultless operation by the surgeon, the terrible fits after a momentary pause recur with all the old vigor and frequency. It is

unfortunately true that operative treatment in the large majority of the cases of epilepsy due to distinct local lesions is a failure, owing to the formation or re-formation of adhesions. The adhesions which are the most harmful are those which take place between the dura and the brain. Concerning these, Schär¹ says: "One may be able to elevate a depressed bone, remove a cyst or a connective tissue scar, or a mass which is pressing on the brain, but on the other hand, it is useless to divide adhesions between the dura and pia, or pia and brain, because the same immediately after the operation inevitably re-form."

Fortunately not all surgeons entertain such a hopeless view of the subject, and many of them have devised plans for preventing the re-formation of the adhesions, which are frequently successful. When a bone flap is formed which can be replaced, it has been suggested that the dura be removed entirely over the affected area, or that a flap of dura be brought out and turned over on the outer surface of the bone flap when the latter is replaced, after the methods of Keen and Chipault. These methods, which have apparently been followed by success, permit the brain or its covering pia to lie in direct contact with the inner surface of the bone, to which adhesions are not so likely to form. As a firm dura, however, is the best means of preventing the formation of that very unpleasant complication of brain surgery, namely, hernia cerebri, it is very desirable to retain this membrane whenever possible. It has, therefore, been proposed to interpose certain substances between the dura and the brain, in the hope that thereby the formation of adhesions might be prevented.

Beach,² in 1890, first suggested the use of gold foil for this purpose, and two years later used it in a case of epilepsy in which convulsions had returned after an operation done two years previous. Improvement followed the use of the gold foil at the second operation. Following this, cases in which gold foil was used were reported by Estes,³ Oliver,⁴ Summers,⁵ Wier and others. Oliver's case, one of epilepsy, had been operated on before and some bone removed. Convulsions recurred and a second operation was done, adhesions separated and a plate of gold foil interposed. The patient had no more convulsions up to the time of his death, which occurred suddenly at the end of four months. At the autopsy the gold plate was found in position, and had served its purpose in that it had prevented the formation of adhesions. Woolsey⁶ reports a case in which he used gold foil. The case was one of traumatic epilepsy, and had been operated on previously, at which time a piece of thickened dura about two inches in diameter was removed. As no improvement had taken place at the end of ten days, the wound was reopened and "a piece of gold foil was inserted between the scalp and the brain. The gold foil was sterilized by heat, but unfortunately it came in paraffined paper, and some of the melted paraffin had adhered to its surface. There were probably some small tears made in separating the paraffin from the paper." The patient was in perfect health for several months, when his attacks recurred. Dr. Woolsey reopened the wound and found that the gold foil had not prevented adhesions of the scalp to the brain. The gold foil had broken up into particles and

1. Arch. klin. Chir., lix, 670.

2. Bost. Med and Surg. Jour., April 3, 1890, and March 25, 1897.

3. THE JOURNAL A. M. A., April 1, 1896.

4. Ibid., May 30, 1896.

5. Med. Rec., April 24, 1897.

6. Ann. Surg., 1897, vol. xxv, 630.

between them newly formed fibrous tissue had grown, forming a layer of considerable thickness, embedding the gold foil and forming firm adhesions between the scalp and the brain. Dr. Woolsey was unable to say whether this would have been the result had the gold foil been entirely intact. It was the thickest foil kept in stock by a large dental manufacturing establishment. Freeman⁷ says: "I possess a specimen of foil (gold) which I placed in the trephine opening in the posterior fossa during the course of an operation for cerebellar tumor. The patient lived about three months, and during that time considerable new connective tissue had formed." No details of this case are given. He does not state the nature of the tumor, whether it was removed or not, where the new connective tissue was formed, nor where the foil was placed.

The use of thin rubber tissue as recommended by Abbe has been tried by a number of surgeons, and with apparent success by some. McCosh⁸ says: "One patient on whom I operated thirty months ago carries without signs of irritation a piece of this tissue on the surface of his dura. That it may, however, act as a foreign body is shown in Case 13, and there is no proof that the so-called 'life' should be longer in its new home than it would be in the external world." The case mentioned was one in which a piece of rubber tissue had been inserted. The patient did well for about twenty months, when his convulsions recurred. Another operation was performed. "A scalp flap was lowered over the old trephine opening, which was found filled with dense connective tissue, to which the scalp was intimately adherent. A layer about one-sixteenth of an inch thick was dissected off. Under this was felt a mass of apparently cicatricial tissue, very hard except near the center, where there was a roundish nest consisting of soft, almost granulation-like tissue, in which were seen blackish particles, which were found to be scraps of rubber tissue amalgamated with the soft connective tissue into a mass the size of a small cherry. This was cut out by scissors."

The case was then treated by placing over the brain a piece of platinum foil about the thickness of a sheet of note paper. Primary union and at the end of eight weeks he had no return of attacks.

Dr. Abbe,⁹ who performed the first operation on this case and introduced the rubber tissue, says that "he was not surprised that development of granulations about the rubber had ultimately broken it up and enveloped it. It simply showed nature's effort to expel it when suppuration had once started. No argument could be based on this case as to the behavior of tissue in non-suppurative cases."

In 1898, Freeman¹⁰ recommended the lining membrane of an egg in place of the inorganic substances. He tried the membrane in two experiments on animals, but had not used it on the human subject. In 1900, Greer¹¹ used egg membrane in an operation on a lad who eleven years before had sustained a compound fracture of the skull and who had suffered from epilepsy since. The skull opening, which resulted from the fracture, was found filled with dense tissue. In separating this tissue some brain substance was removed. Two pieces of eggshell membrane were placed—one between the brain and the skull and the other outside the skull. The scalp was

then replaced and primary union occurred. Four months after the operation the old scar broke open and left a small hole in the scalp, through which the eggshell membrane could be seen. This was pulled out in its entirety. It was still tough and showed no apparent change in its structure. The wound then closed. The subsequent history of the case is not given, so we are left in doubt whether any good was accomplished by the operation or not.

The question of closing defects in the bone by celluloid or thick gold or silver plates or by plastic operations, is not under discussion, but simply the question of the prevention of adhesions between the brain and its membranes or the bone.

The general principle of the introduction of some foreign substance has been tried in a sufficient number of cases, and with results, too, which seem to justify our belief in its efficacy.

The best material to be used and the details of technique, however, are questions still to be worked out. There are some points which appear to be well established. For instance, the traumatism incident to the operation should be as slight as possible. A bone flap which can be replaced is preferable, when possible, to the trephine opening with the bone left out. Before the introduction of any substance hemorrhage should be perfectly controlled and all blood clots removed. The substance should extend well beyond the edge of the area involved in the adhesions. There should be no openings or breaks in the substance. The material must be one which can be sterilized. The wound must heal in a perfectly aseptic manner. The question of material is not so well settled. Whether the organic substances, such as egg membrane, prepared ox peritoneum, etc., will prove of value remains to be determined. They have not been used often enough to relieve one of the theoretical doubt of their efficacy, as the case of Greer, mentioned above, is unsatisfactory. Thin rubber tissue has been used a number of times with good results. The author has a patient who has carried a good sized piece of rubber tissue in his skull for several months with an excellent result. One disadvantage of the rubber is its tendency to roll up after it has been inserted. It then not only fails to fulfill its purpose, but may be an actual cause of irritation. The author knows of one unreported case in which the rubber, which had to be removed some months after it was introduced, was found all rolled up. The rubber may also be disintegrated by granulations, as in McCosh's case.

The use of the thick, unyielding metal plates or the heavy foils, such as the No. 60 or thicker dental gold, the author believes as a rule undesirable. The heavy plates may become tilted and act as irritants or gradually work their way to the surface; or late suppuration may occur, necessitating their removal, as the author has known in one case. Of the materials thus far proposed, the author believes the thin foils are the best, and of these he prefers the silver foil. It is so thin and soft and smooth. It conforms to all irregularities of the surface on which it is laid. As many layers may be applied as may be necessary to secure a smooth, unbroken surface. It is not only tolerated very kindly by the tissues, but exerts a beneficial influence on granulating or healing surfaces. The foil may be placed directly in contact with the brain tissue, between the pia and dura, or wherever it may be necessary to accomplish the purpose desired.

7. *Ann. Surg.*, 1898, xxviii, 455.

8. *Amer. Jour. Med. Sci.*, 1898, cxv, 549.

9. *Ann. Surg.*, xxvii, 671.

10. *Ann. Surg.*, xxviii, 455.

11. *Bristol Med. and Surg. Jour.*, 1901, xix, 42.

The author has used the silver foil in a number of cases of brain surgery, and while no claim for anything new is made, he wishes to urge its more frequent use for the purpose indicated, and with greater care in reference to the technical details above mentioned.

The following case will illustrate the application of the principle:

George P., aged 12. When three years old he fell out of a chair and injured his head. He was taken to a hospital, where he remained two weeks. After returning home he was all right for about two years, when he developed epilepsy. The attacks were of the jacksonian type, beginning in the left arm. In addition there was partial paresis of certain muscles of the left arm, and to a very limited extent of the left leg. He entered my service at the Children's Hospital, June 22, 1900. Dr. H. T. Patrick saw the case with me, diagnosed a cortical lesion involving the left arm center, and advised operation. This was done July 10, 1900.

A large osteoplastic flap was turned down, uncovering the area indicated. A subdural calcareous mass was found about 3 cms. in diameter by $1\frac{1}{2}$ cms. in thickness. It was firmly attached to the inner surface of the dura as well as to the brain tissue. A dural flap was turned down and freed from the mass. In removing the mass the cortical surface of the brain was unavoidably injured, and quite a depression remained in the brain tissue. After controlling the hemorrhage, the dura was replaced and sutured, as was also the osteoplastic flap. Primary union occurred and recovery was without incident. He left the hospital Aug. 5, 1900.

Notwithstanding the fact that active treatment with the bromides was pushed after the operation, relief from the attacks only lasted about two months. They then recurred and gradually increased in frequency and severity until in February, 1902; when he again entered the hospital he was having from five to eight fits a day. The left arm was quite weak and movements impaired.

The second operation was performed February 17, 1902. The same osteoplastic flap was turned down, and the dura opened. Firm adhesions were found between the dura and the brain tissue. These were carefully separated and hemorrhage controlled. Several layers of very thin silver foil were then placed over the brain tissue, extending some distance beyond the area involved in adhesions. The dura was then replaced and sutured, and the skull closed as before. Recovery from the operation was perfect, and he left the hospital March 23, 1902. The bromid treatment was continued as before. He has been under observation up to the present time, and although it has been a year and ten months since the last operation, he has not only not had a single fit, but has improved materially in his left arm as well as in his general condition. He attends school regularly and says that he feels perfectly well.

A METHOD OF DISPENSING WITH RUBBER GLOVES AND THE ADHESIVE RUBBER DAM.

A PRELIMINARY NOTE.

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The disadvantages, inconveniences and dangers of rubber gloves and dam, as well as their theoretical advantages, are well understood and will not be commented on here. For several months past I have been endeavoring to find a material that might be applied to the hands of the surgeon and skin of the patient which would practically seal these surfaces with an insoluble, impervious and practically imperceptible coating—a coating that would not allow the secretions of the skin to escape and will not admit secretions, blood or pus into

the pores or crevices of the skin, at the same time one that will not interfere with the sense of touch or impair the pliability of the skin. I have ascertained that a 4, 6 or 8 per cent. solution of gutta-percha in benzine fulfills all of these requirements, while a similar solution in acetone also meets most of the requirements. In my clinical experience in the last four months I have found that the 4 per cent. solution of rubber in benzine is the most serviceable for the hands, as it wears better on the tips of the fingers under handling instruments, sponges and tissues than the acetone solution. For the abdomen the acetone solution has the advantage, as it dries in from three to four seconds after its application, while the benzine solution takes from two to three and a half minutes to dry to a firm coating. The acetone coating when dry is only slightly adhesive while the benzine coating is sticky.

The method of application to the hands and forearms is that of simple washing as with alcohol, care being taken to fill in around and beneath the nails. The hands must then be kept exposed to the air with the fingers separated until thoroughly dry. They may then be washed in alcohol, bichlorid or any of the antiseptic solutions without interfering with the coating or affecting the skin. It wears off on the tips of the fingers if the operations be many or prolonged, when another application may be made between operations; on the remaining portion of the hands one application is sufficient for a whole morning's work.

My routine method of hand preparation is as follows: First, five to seven minutes' washing with spirits of green soap (5 per cent.) and running hot water; second, three minutes' washing with alcohol; third, after thoroughly drying I pour on the rubber solution after the method above stated, allowing it to dry without rubbing, after the surface is thoroughly covered. The coating is so thin it can only be recognized by its glazed appearance. The coating will resist soap and water washing to cleanse the hands between operations. It is removed by washing in benzine.

The abdomen or surface preparation is five minutes' scrubbing with spirits of green soap (5 per cent.), then washing with ether, followed by alcohol. The surface is then swabbed over thoroughly with the acetone or benzine rubber solution.

The gutta-percha solution is prepared by dissolving pure gutta-percha chips in sterile benzine or acetone. This was accomplished first for me by the chemist, E. von Hermann. These solutions do not stand boiling as it impairs the adhesiveness and elasticity of the coating. The advantages of this method of avoiding the dangers of infection from the hands and skin of the patient are very evident. In addition to the bactericidal properties of the benzine it prevents perspiration beneath the coated surface, and also the rubbing off of epithelia from the hands and skin surface into the wound. It does not puncture like the rubber glove, and where it wears off on the finger tips there is no accumulated epithelium or secretion beneath. It is, moreover, impermeable and precludes the ingress of infective flora or blood to the operator's skin. After operating, the surface washes clean as readily as the surface of a rubber glove. At the end of the day's work, when the hands are washed in benzine to remove the coating, the skin is very soft and smooth. The surgeon's hands are thus protected from all of the deleterious effects of daily operating, which is in itself a safeguard against infection. Inoculation and bacteriologic tests are being made and will be reported in detail