mined should an opportunity arise of puncturing the vertebral sac immediately after death in a suitable case.

EXAMINATION OF THE FLUID.

Appearance, Colour, etc.—In all the cases of general paralysis tapped during life the fluid was perfectly clear and pellucid, and of a very faint straw tint (only noticed on looking through a fairly long column of the fluid in a glass cylinder) or else colourless. In one case, after flowing for a short time it became tinged with blood. After death (Nos. VIIIa, xa, A. B.) it becomes turbid, and the turbidity seems to increase with the time that elapses after death before tapping. Shaking the fluid up with ether removes most of this turbidity.

Reaction.—Normal cerebro-spinal fluid is neutral or faintly alkaline, becoming after death acid, and Meynert⁶ states that probably in certain pathological conditions the same change occurs during life. Dr. Batty Tuke assumes that in general paralysis the nerve cells are bathed in a poisonous acid fluid. As the pericellular and perivascular spaces are continuous with the subarachnoid space, this would mean that the reaction of the latter would be acid, but in every one of the cases I tapped it was distinctly alkaline. The reaction was tested in most of the cases with litmus, but in No. xiv with phenolphthalein as well. The specific gravity presented no departure from the normal.

Proteids.—Fibrinogen was not tested for in all cases; in the two cases in which I did test for it, it was absent. Serum globulin was practically the only proteid present beyond traces (not tested for in all cases) of albumen.

I adopted Hammersten's method to determine the presence or not of serum albumen. The fluid was saturated with magnesia sulphate, and the tube which contained the mixture was shaken continuously for two hours to ensure thorough saturation with the salt. This procedure precipitates the serum globulin and albumose, leaving any serum albumen there may be in the solution. The mixture was filtered, and the perfectly clear filtrate, mixed with an equal volume of water, rendered faintly acid with acetic acid, and boiled.

Of the 14 cases 2 were not tested, 8 showed absolutely no trace of serum albumen, and the remaining 4 showed a very faint trace; that is, the fluid became very slightly opaque on boiling; but the opacity was so slight as only to be noticeable if the tube was held in a favourable position in front of a dark surface.

The total proteids were estimated by Hoppe-Seyler's method described in Halliburton's and Gamgee's textbooks. To 20 c.cm. of the fluid 80 c.cm. of spirits of wine were added, and the mixture allowed to stand till the precipitate formed had settled. This takes several hours. The mixture was then filtered through a previously dried (120° C) and weighed filter paper, the precipitate thoroughly washed out of the beaker with more spirits of wine, then the precipitate on the filtered paper washed with hot alcohol, then with ether, and then with warm water. Finally, the paper and precipitate were washed with more spirits of wine, and then dried for four or five hours (till it no longer lost weight) in a hot oven at 120° C., then cooled in an exsiccator, and weighed. Subsequently the filter paper and precipitate were burnt in a platinum crucible, and the weight of the ash deducted from the weight of the dried precipitate.

It will be seen, on referring to Table II, that the amount of proteid present is small, and does not materially differ from that which Halliburton obtained in his analysis of normal cerebro-spinal fluids. The amount is too small to give any countenance to the idea that the cerebro-spinal fluid in general paralysis is an inflammatory product.

The reason I specially tested for the presence of serum albumen was that this proteid is, as far as I know, invariably present in all inflammatory exudations. Although Halliburton (p. 344) states that the ratio of serum albumen to serum globulin (the proteid quotient) is of no importance in determining whether a fluid is or is not of an inflammatory character, I venture to think that the complete absence of serum albumen in a fluid is of some diagnostic importance in this respect.

COPPER REDUCING SUBSTANCE.

This, which is stated to be pyrocatechin, is an aromatic substance of the benzene group, and is a product of proteid decomposition. It is supposed to be a normal constituent of cerebro-spinal fluid. Halliburton found it, although sometimes in very small amount, in all the samples of cerebro-spinal fluid that he examined; and he always found it in increased quantities in second and subsequent tappings.

Probably other copper reducing bodies besides pyrocatechin may sometimes be present. In nine out of twelve of my cases it was present in what I should consider large amounts; in two in small quantities, and in one it was absent (that is, no reduction took place in the unconcentrated fluid). After death even in those cases where its presence had been demonstrated during life it was absent, except in one in which the fluid taken four hours after death contained a copper reducing substance in very small amount.

The amount of copper reducing substance was determined as follows: An excess (5 c.cm.) of Fehling's solution diluted to 40 or 50 c.cm. was boiled; to this was added 10 c.cm. of the fluid, which had been freed from its proteid matter by acidulation and boiling, and subsequent filtering. The boiling of the mixed Fehling and cerebro-spinal fluid was then continued till no more copper was reduced, then filtered through an ashless filter paper, thoroughly washed with hot water, dried, and burnt in a platinum capsule. Some experiments were made with solutions of pyrocatechin of known strength to find out how much was equivalent to a milligramme of CuO. The pure pyrocatechin in solution reduces the Fehling much more slowly than the cerebro-spinal fluid. I found that 10 c.cm. of a 0.1 per cent. solution reduced 27 milligrammes of CuO; 9 c.cm. reduced 25 milligrammes, and in a third trial 20 c.cm. reduced 53 milligrammes. The average of these three experiments shows that 10 milligrammes of pyrocatechin reduced 27.1 milligrammes of CuO.

It was on the supposition that pyrocatechin was the only reducing substance present, and that it behaves in the cerebro-spinal fluid in the same manner towards Fehling's as when in pure solution, that I worked out the percentages in the last column of Table II. In only one case, No. iv, was it estimated volumetrically in terms of dextrose, giving a percentage of 0.046. This is high when compared with that obtained by Halliburton (0.002) in a first tapping in a case of chronic hydrocephalus.

Pyrocatechin has an acid reaction, so that its presence in an uncombined form to any great amount would render the cerebro-spinal fluid acid. But, as we have shown, all the fluids examined were alkaline, so that it would appear that its amount, if in excess, was not sufficiently large to materially influence their reaction. In the analysis of some urines of general paralytics⁷ I found that in an advanced stage of the disease the combinations of the aromatic substances with potash and soda were markedly increased, and that this increase was most noticeable just before or during seizures. It would be interesting in this connection to determine definitely whether pyrocatechin, also an allied aromatic substance, was in excess in the cerebro-spinal fluid in general paralysis.

SUMMARY.

The observations here recorded seem to show conclusively that, at any rate in fairly advanced general paralysis—and it was in just such stages that the operation of trephining was performed—the injurious pressure that Drs. Claye Shaw and Batty Tuke postulate does not exist. By this I mean that there is no evidence of any pressure beyond that due to the blood pressure. Further, the results obtained from the analysis of the fluid lend no support to, if they do not, indeed, negative, the assertion that it is an inflammable product.

ON A CASE IN WHICH THE UPPER HALF OF THE FIBULA WAS EXCISED FOR A SARCOMA.

By J. BLAND SUTTON, F.R.C.S.,
Assistant-Surgeon to the Middlesex Hospital.

CONCERNING tumours of long bones there is nothing more astonishing than the fact that a periosteal sarcoma of the femur or the humerus is the most malignant tumour known to surgeons, such a tumour being three times more deadly than a sarcoma identical in histologic details growing from the bones of the leg or foot. In the face of these facts it has often seemed to me a very severe measure when surgeons amputate the leg for sarcoma of the fibula. The upper two-thirds of the fibula is in man almost vestigial, and its persistence is probably mainly due to the fact that it affords attachment to the muscles of the leg. The lower one-third has undergone excessive development to meet the demand of the ankle-joint for greater security, necessitated by the upright position of man.

⁶ Quoted by Macpherson and Wallace, BRITISH MEDICAL JOURNAL, July 23rd, 1894.

⁷ Journ. Ment. Sci., January, 1895.

For many years I determined, when a suitable case of sarcoma of the fibula presented itself, to excise the upper half of the bone instead of amputating the leg. In November, 1895, Dr. McDowell consulted me in regard to a woman aged 23, who had a swelling on the outer side of the leg, a little distance below the knee, which we had no difficulty in recognising as a periosteal sarcoma of the fibula. As the patient suffered a great deal of pain in the leg she did not hesitate to submit to operation.

The tumour was exposed by a longitudinal incision on the outer side of the leg, and the musculo-cutaneous nerve, which ran in the groove shown on the surface of the tumour (see figure) was divided and the ends turned aside in order to facilitate the dissection and preserve the nerve from injury. The anterior tibial nerve and artery were, unfortunately, so incorporated in the tumour that they were sacrificed. The superior tibio-fibular ligaments were cut through

Periosteal sarcoma of the fibula, entire and in section.

and the fibula, with the tumour, freed from the interosseous membrane and surrounding muscles; great care was taken to avoid injury of the posterior tibial vessels and nerve. The bone was divided a little below its middle. Many vessels required ligature, and the two ends of the musculo-cutaneous nerve were united with fine catgut. The various layers of muscles were sutured with catgut and the skin secured with silk. The wound was drained, dressed, and fixed on a splint.

On the third day the tactile sensibility was tested and found normal everywhere on the leg except the narrow territory supplied by the anterior tibial nerve. Healing was rapid and recovery satisfactory. In consequence of the implication of the anterior tibial nerve there is talipes equinus, but this has been rectified by an orthopaedic arrangement which enables the patient to walk excellently. On microscopic examination the tumour was found to be a round-celled sarcoma.

It is noteworthy in regard to operations for very deadly tumours that it is easy to collect a score or more of cases in which the subsequent history of the patient is known. Thus

our knowledge of the remote results of excision of the tongue for epithelioma, or the kidney for sarcoma, is full enough. The clinical records of sarcomata of long bones are very extensive, but when they come to be analysed it is easy to find complete records of ten or more cases of periosteal sarcoma of the humerus or femur. By a complete record I mean a history of the case, the operation, an account of the tumour, including its microscopic characters, and the subsequent history of the patient, including the mode of death, and a description of the condition found *post mortem*.

In the case of the fibula I endeavoured, before carrying out a method of treatment so contrary to the traditions of surgery, to collect the complete histories of six cases of periosteal sarcoma of the fibula in order to ascertain if my proceeding would be justifiable. I failed after a rigorous search to find three records complete in the sense indicated above. This paucity of records in a way indicates that periosteal sarcoma of the fibula is neither a common nor a very malignant tumour; by this I mean it does not run its course so rapidly as to kill within two years of a timely operation. The infrequency of periosteal sarcoma of the fibula may be estimated in this way: A surgeon may be in active operative practice for a quarter of a century in a hospital situated in a large town, and not be called upon to deal with more than three examples.

THE ECONOMY OF THE TREATMENT OF WOUNDS AND ULCERS BY OXYGEN GAS.

By GEORGE STOKER, M.R.C.P.I., Etc.,
Physician to the London Throat Hospital.

THE above treatment has proved so successful that now, after more than a year's experience of it, it is thought desirable in this present paper to bring one aspect of it before the medical public. Let us lay aside for the present its humanitarian aspect; the relief of suffering that it gives; the cessation of foul smells and discharges that it causes; the rapid healing it promotes of what had hitherto been considered incurable sores, and which had resisted all other forms of treatment; and let us shortly consider its manifest economical advantages, its money-saving power both to individuals and to institutions, infirmaries, hospitals, homes, etc., where such cases are treated.

We can best appreciate these points by the consideration of two cases which are samples of many others, though perhaps in a more marked degree.

The first is one in which the oxygen treatment was carried out in a metropolitan infirmary by the permission of the medical superintendent. The patient, S. E., aged 58, had suffered for thirty years from a chronic ulcer of the leg. The ulcer was most painful, and prevented him from working, which he was otherwise able and quite willing to do—in fact, the ulcer was the sole cause of his being idle, and costing the rates about fifteen shillings a week. He had been in the infirmary for eighteen months at the time the oxygen treatment was commenced, and after six months under the treatment he left with the ulcer completely healed.

Now it is fair to expect that if the oxygen treatment could have been applied when he first entered the infirmary, the ulcer would have been healed in six months, and the rates thus saved his expenses for eighteen months, *minus* the cost of the treatment—that is, about £50.

The second case is as follows:—The patient, a man, received a wound on his leg fifteen years ago, and an ulcer gradually formed. For ten years the ulcer prevented him from working, and was a source of constant pain. For many years he had been an inmate of the British Home for Incurables at West Norwood, and it was there, under the care of Dr. Rugg (whose permission I have to publish the case), that the treatment was carried out. The ulcerated surface extended from a little below the knee, nearly to the middle of the instep, and in some places right round the leg, the extreme measurements being 13 inches by 7 inches (*vide* Fig. 1 on p. 1088). There was a profuse discharge, and so foul smelling was the leg, that the patient had to be kept in a separate room with carbolic sheets hung over the door. The patient suffered constant and acute pain. Under the oxygen treat-