will be but little danger of wounding the peritoneum. To reach the bladder easily, however, it is important to fairly distend it previously to operating, and in Case 2 it was noticed at the time that proceedings would have been decidedly facilitated had more liquid been injected. The bladder wall is sometimes remarkably tough; therefore, for opening it, a very sharp-pointed knife should always be provided. To extract the calculus neatly is not always so easy as might be imagined, for it being important to keep the opening in the bladder as small as possible, manipulation with the tips of the fingers, as advised, is not always practicable, and so little grasping force can be employed in that position that the stone, if large or smooth, may readily slip from between them. Polypus or some such forceps may be used, but I think a lightly made pair with fenestrated blades, on the same principle as the ovum forceps, would act admirably. In Case 4 the much greater rapidity with which the complete power of micturition returned, and the absence of any severe constitutional disturbance, strongly point, I think, to the advisability in uncomplicated cases of perfectly closing the bladder wound after the extraction of the stone, and this should be done with numerous unirritating sutures, such as carbolised or chromic catgut (Mr. Bond used silk), and undoubtedly the great point to be aimed at being to render the bladder water-tight, as in Mr. Anderson's case,¹ in which no catheter was used throughout, and no escape of urine took place through the wound, notwithstanding repeated and violent attacks of coughing. That surgeon further advises the bladder to be tested before closing the skin wound. It may, however, be necessary to draw off the urine in some cases, and this is best done with a soft india-rubber catheter every few hours after the operation, but should be omitted as soon as possible, particularly in children, who are sometimes very intolerant of the use of that instrument. The supra-pubic operation is much less difficult to perform than lateral lithotomy; it is sometimes almost bloodless, and, by careful attention to the points already mentioned, should have no additional risks; and in the cases of children and large calculi, where lithotripsy is inadmissible, it would seem probable that it may become the operation of the future.

Amoy, China.

ELECTROLYSIS OF ANIMAL TISSUES.

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A PAPER on this subject is being published in a volume of *Memoirs from the Physiological Laboratory of the Owens College, Manchester*. A preliminary account of part of the work was given in the *Proceedings of the Royal Society of Edinburgh*, June 18th, 1888, p. 399, and a short description of later results at a meeting of the *Physiological Society* in March last. I wish to give here a brief summary of the work and of the chief results. This paper was restricted to the chemico-physical changes, the physiological effects being left for a future communication. There were two preliminary questions to settle. 1. How much of the conduction in animal tissues is electrolytic? 2. What are the electrolytes? I have found that practically the whole of the conduction is electrolytic, and that the electrolytes are chiefly the inorganic constituents. When a tissue is electrolysed, almost the whole of the current passes by the salts. The changes produced in the proteids must therefore be brought about by secondary electrolytic actions. These changes were investigated (1) in simple proteid solutions, (2) in animal liquids, (3) in isolated tissues, and (4) in living animals.

1. In simple proteid solutions the effects vary to some extent with the current density (this was calculated from the intensity measured in milliamperes). But in the solutions used alkali-albumin is always formed at the cathode, and acid-albumin at the anode, while in solutions of coagulable proteids there is also coagulation at the latter. With a strong current the proportion of coagulated proteid to acid-albumin formed at the anode is greater than with a weak current.

2. Blood, bile, and urine were the chief animal liquids

investigated—blood for its own sake; bile and urine merely to illustrate the action of the current on complex solutions. Blood serum, entire defibrinated blood, and pure hæmoglobin solutions were used. There was no indication whatever that hæmoglobin or any derivative of it acts the part of an ion. At the anode in a pure hæmoglobin solution the reaction becomes acid, and acid-hæmatin is formed, which remains partly in solution and is partly thrown down, the liquid becoming less deeply coloured. When the current is strong or long-continued the hæmatin suffers further change, and is decolourised apparently by the nascent oxygen or chlorine set free. If a reducing agent is present at the anode, the hæmoglobin is not affected there by electrolysis. With proper adjustment of the strength of the current methæmoglobin may be seen to appear at the anode before acid-hæmatin, and they may be found together there. At the cathode alkali-hæmatin is formed; but its spectrum does not appear so soon as that of acid-hæmatin at the anode. In entire blood the changes in the hæmoglobin were similar to those described. The proteids of the serum and the corpuscles were partly coagulated at the positive pole. At the cathode they were more or less completely changed into alkali-albumin, according to the strength and time of flow of the current.

3. Striped muscle was the chief solid tissue observed. Microscopically, great changes were found in the fibres, the nuclei becoming very prominent in the parts near the anode, and the sarcous substance granular, the general appearance suggesting the action of a dilute acid, while at the cathode the fibres became more homogeneous than before. The striation was impaired. The chief chemical changes in the proteids were an increase in the neutralisation precipitate of the watery extract, and a corresponding decrease in the globulin at the cathode. At the anode the neutralisation precipitate was increased, but not so much as at the cathode. On the other hand, the globulin extract was more than correspondingly diminished, doubtless because part of the proteid was coagulated. The effect of electrolysis on the salts of muscle was studied by estimating the ash. Striking changes in the distribution of the salts were produced—changes sufficient, if produced within the body, to modify nutrition profoundly.

4. Experiments on electrolysis of tissues within the body (frogs and rabbits).

The effects of the current are discussed under four heads: 1. The chemical action of the poles. 2. The effect of the changes in the distribution of the salts (actual or potential). 3. The changes of temperature produced by the current. 4. The cataphoric action of the current. The antiseptic action of the current was studied in the case of ordinary putrefactive organisms, and it was shown that it is chiefly, if not entirely, around the anode that this action takes place. This is in accordance with the observations of Apostoli on *charbon bacilli*, published since my paper was written, and it explains the observations of Cohn and Mendelsohn on the effect of strong currents on micrococci. An attempt is made in the paper to connect our knowledge of the action of electrolysis with one or two of its applications in practical surgery and gynaecology.

Cambridge.

ON NYSTAGMUS.

By GORDON NORRIE,

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DR. HADDEN'S paper on "Head-nodding and Head-jerking in Children, commonly associated with Nystagmus" in *THE LANCET* (Nos. 3485-3487) has been very interesting to me, because I have for some years attentively examined, as oculist, all cases of nystagmus which I have seen in my practice in Copenhagen. Dr. Hadden mentions a short paper on nystagmus which I two years ago published in the *Centralblatt für Praktische Augenheilkunde*, but since then I have seen several interesting cases. Alfred Graefe, and possibly the greatest number of ophthalmologists, supposes that nystagmus is caused by a myopathia, while I am convinced that the real cause is to be found in the innervation, and I think it is possible to show that this really is the case. I believe that it is much more natural to seek the disease in an abnormality of the innervation of the eye muscles than in the muscles themselves. In some few cases

¹ THE LANCET, April 26th, 1890.