to 800.7 of water. After the loss of about ten ounces of blood, the proportion of solids in 1,000 parts was reduced to 187, while the water had increased to 813. A horse suffering from tetanus had his carotid artery opened: 1,000 parts of the serum of the blood which first flowed contained 106 parts of solids; while, after fifteen pounds of blood had flowed, the proportion of solids in the serum was reduced to 100.5 in 1,000. (Heller's *Archiv für Chemie und Mikroskopie*, 1847, p. 385.)

The explanation of the rapid passage of water from the tissues into the blood appears sufficiently obvious. Normally, there is an equilibrium of pressure within the blood-vessels and in the surrounding tissues. A partial emptying of the vessels by an escape of blood tends to lessen the pressure within them, and the equilibrium is restored by water being pressed from the tissues through the capillary walls. Thus the fullness of the blood-vessels is maintained, while the blood is diluted with water, and its proportion of solids is lessened. We have illustrations of the same hydraulic principles in some morbid phenomena and in the practice of therapeutics. Thus, a dropsical patient has his blood-vessels overfull, and his tissues flooded with excess of water. A dose of elaterium excites copious watery discharges from the bowel; this escape of liquid tends directly to deprive the blood of its water. Then the drain of water from the blood, and the consequent diminution of pressure within the vessels, cause an absorption of the dropsical fluid, which is now pressed from the tissues through the capillary walls; and thus, by a copious purging, a dropsical accumulation may be removed. Sir Thomas Watson mentions the case of a man in whom a profuse purging, excited by intoxicating doses of rack punch, led to the disappearance of a large hydrocele in the course of one night. Here it is clear, as Sir Thomas remarks, "that the expenditure of serous fluid from one part led to its absorption into the blood from another". In other words, the pressure within the blood-vessels having been lessened by a copious drain of liquid, the equilibrium was restored by water from the hydrocele being pressed through the walls of the capillaries into the blood.

Now let us consider the physical effects of copious watery purging upon a subject not dropsical, but previously in a normal condition. Mere diarrhoea, however copious, has no appreciable influence in thickening the blood or increasing its specific gravity, and the explanation of this is sufficiently obvious. As venesection causes a rapid dilution of the blood by water passing from the tissues through the walls of the vessels, and as the operation of a hydragogue purgative often results in the removal of a dropsical accumulation, so profuse choleraic purging first tends to lessen the contents of the blood-vessels, and then, to fill the vacuum and restore the equilibrium, water passes from the soft tissues into the blood, which thus maintains its fluidity notwithstanding the copious discharge of liquid through the bowels. When the watery discharges from the bowels have ceased, the hydraulic currents are reversed. During the stage of diarrhoea, absorption of water through the mucous membrane of the alimentary canal is prevented by the outward flux of liquid; the current is entirely outwards; but, when the discharges have ceased, water taken into the stomach rapidly enters the blood-vessels, and is thence transferred to the tissues, which have before given up a large portion of their water to the blood. So great is now the demand for water by the tissues, and so strong is the current towards them, that for a period, varying in different cases from a few hours to several days, little or no urine is secreted, the main stream of water being into the dehydrated tissues: a direct reversal of the tide of liquid which sets from the tissues through the blood-vessels, towards the alimentary canal, during the diarrhoeal stage. The stream of liquid from the blood into the tissues may carry with it urea and other excreta, and thus may contaminate and poison the tissues. This tissue-poisoning is probably in part the cause of the consecutive fever of choleraic attacks. On the other hand, we have evidence that, when, in consequence of degeneration of the kidneys, the blood and the tissues are contaminated with urine, a hydragogue purgative removes not only water, but also some urinary excreta from the blood, and thus counteracts the tendency to uræmic poisoning. We know from experience that the surest way to restore the secretion of urine after a copious watery diarrhoea is to supply an abundance of water to the blood and the tissues through the stomach and through the skin by an occasional immersion in a tepid bath. If frequent vomiting interfere with the introduction of liquid through the stomach, tepid water may be injected into the rectum.

[To be concluded.]

NAVAL MEDICAL PROMOTIONS.—The undermentioned surgeons have been promoted to the rank of staff-surgeon in Her Majesty's fleet, with seniority from November 20th; Edward Mulcahy, George Curtis, Ingham Hanbury, Alexander Scott, William Jabez Inman, George Robertson, M.D., John Richard Burke, M.D.

ON A CASE OF DIABÈTES INSIPIDUS TREATED BY (1) BELLADONNA AND (2) ERGOT.

By WILLIAM MURRELL, L.R.C.P.

RESPECTING the treatment of a large number of diseases, it must be confessed that our knowledge is almost *nil*. In this number may be included that group of symptoms to which we apply the term diabetes insipidus. It is only by the study of pathology and of the physiological action of drugs, combined with careful clinical observation, that we can hope to attain success in the treatment of disease, and to establish the science of therapeutics upon a firm scientific basis. In the following case of polyuria, the remedies employed—belladonna and ergot—were administered on purely theoretical grounds. That their exhibition not only modified the excessive urinary secretion, but also removed some of the most distressing accompanying symptoms, will be seen by the record of the case.

The patient (Isaac C.) was on several occasions under the care of Dr. Ringer, and, at the time at which the belladonna treatment was commenced, was an inmate of the Children's Wards in University College Hospital. He was at that time between 13 and 14 years of age. There was no history of the disease being hereditary. The father was in the enjoyment of good health, and was in constant and active employment as the proprietor of a dairy. The mother was a strong healthy-looking woman, suffering from nothing but a little chronic bronchitis in winter. She had spat blood, but never more than in streaks, which had occasionally followed a paroxysm of cough. There was no suspicion of her being phthisical. She had seven children, three girls and four boys, all of whom, with the exception of the patient, were perfectly healthy. Of the paternal grandparents nothing was known. The patient's maternal grandfather was an asthmatic, and his maternal grandmother was still living and in good health. The parents were apparently temperate in their habits. There was no history of consumption in the family, and none of neurotic disturbance, such as apoplexy, chorea, or paralysis. The history of the patient's illness obtained from the parents was as follows. When six months old, he had the measles, and, four or five months later, it was noticed that he drank much more than is usual with children of his age. When about fifteen months old, he fell and cut his head against the stairs, leaving a scar still visible on the margin of the right orbit. The mother attached but little importance to the accident, and appeared not in any way to have associated it with the subsequent illness. Since that time, he had suffered greatly from thirst. He was "always thirsty"; was drinking all day long; and they had "almost to drag him away from it". They had tried to keep him from drinking so much, but it "always made him sick and bad". He occasionally had half a glass of beer, but it had no particular effect on him. He was fairly intelligent and good tempered; but his mother stated that he was "not so sharp as his brothers"; that "he took his learning badly". His appetite had never been good; he lived chiefly on milk, of which he took between five and six quarts daily. He never cared for butcher's meat or vegetables, but liked pork and German sausages. His skin had always been very dry and harsh. His mother said that no amount of exercise ever made him perspire, and she did not believe "he ever sweated more than once in his life". He suffered greatly from cold; always seemed chilly; "was shrivelled up by it"; and was over the kitchen fire all day long, even in summer, "just like an old man". He suffered a great deal from cramps in his hands and in the calves of his legs; the pain in the hands came on whenever he attempted to write, but that in the legs was almost constant. He was sick every morning, sometimes more than once, and nearly always after eating. The motions were thick and dry, and were often passed in lumps. There was occasionally oozing of blood from the gums. The mouth and lips were usually dry and parched. He was not subject to boils. During the time he was under observation at the hospital, he was always well nourished, fairly healthy-looking, and rosy cheeked. There was an absence of the emaciation frequently associated with excessive diuresis. He was carefully examined upon several occasions, but, with the exception of the state of the skin and the passage of the large quantity of urine, he appeared to be perfectly healthy. The urine was repeatedly examined. It was clear, almost colourless, acid, ranging in specific gravity from 1005 to 1008, free from albumen and sugar. His temperature was taken twice daily, and varied between 98 deg. and 99 deg. Fahr.

For eight days after his admission, he took no medicine, and the average daily quantity of urine was 2819 cubic centimètres (about five pints). There was no diminution in the urine during this time, the quantity being as great on the eighth as on the former days. He then took five drops of the tincture of belladonna for four days, the daily average

being 2691 cubic *centimètres*. During the next seven days, he took ten minims of tincture of belladonna thrice daily, and during this time his daily average quantity of urine was 2547 cubic *centimètres*. For the four following days, he took fifteen minims of the tincture of belladonna, and the average daily quantity of urine was 1822 cubic *centimètres*. During the next eight days, his medicine was increased to twenty minims three times a day, and during this time the average daily quantity of urine was 1485 cubic *centimètres*. For the next four days, he took twenty-five minims of the medicine, and passed during this time daily 1350 cubic *centimètres*. During the following six days, he took half a drachm of tincture of belladonna thrice daily, during which time his daily average quantity of urine was 1258 cubic *centimètres*. He left the hospital for ten days, taking no medicine, and was then readmitted for two days, during which time he passed an average of 1190 cubic *centimètres* daily.

The specific gravity remained the same throughout, undergoing no increase with the diminution of water. His appetite improved considerably whilst in the hospital, and he complained less of thirst.

The patient was lost sight of for a time, but, in December 1874, again came under the care of Dr. Ringer as an out-patient. There had been no material change in his condition since leaving the hospital, and he was still suffering from the same group of symptoms. Upon this occasion, the treatment by ergot was adopted. Being an out-patient, it was impossible to make any minute or systematic observations as to the effects of the drug upon the character of the urine or on its constituents. The boy was kept from school, and the urine was measured daily by the mother, a remarkably intelligent woman, accustomed to the work, and fully alive to the necessity for accurate observation. The patient was kept for some days without medicine, and was found to be passing an average daily quantity of 3174 cubic *centimètres*. He was then ordered twenty minims of the liquid extract of ergot, to be taken in half an ounce of water three times a day. During the following week, his daily average was 2493 cubic *centimètres*, which, in the next week, was reduced to 2351 cubic *centimètres*. The ergot was then given in fifteen-minim doses every four hours, with the reduction during the next eight days of the quantity of urine passed to an average of 2069 cubic *centimètres* daily. The ergot was then further increased to half a drachm every four hours, the average daily excretion of the week being 1983 cubic *centimètres*. During the next twelve days, the average had fallen to 1842 cubic *centimètres*, the maximum quantity passed being 2267 cubic *centimètres*, and the minimum 1700 cubic *centimètres*. The patient's appetite being extremely poor, a quassia mixture was substituted for the ergot during the next fortnight, but without any increase in the amount of urine passed. The ergot was then resumed in half-drachm doses every four hours, the daily average of the first four doses being again 1842 cubic *centimètres*, and of the next four 1615 cubic *centimètres*. The medicine was taken continuously during the following month in aggregate daily doses of two drachms, but without any further influence on the urinary secretion, the quantity passed varying from 1700 to 1983 cubic *centimètres* daily. The ergot was then permanently discontinued, and during the following month simple bitters were given, but without any increase of urine.

During this course of treatment, there was a marked improvement in the patient's general condition. The morning vomiting and sickness after taking food entirely ceased. The cramps in the calves of the legs, which had frequently kept him awake at night, were speedily controlled by the medicine, but returned, though with less severity, on its omission. The skin and hair were moister, and the thirst was much less troublesome. The ergot failed to improve the appetite, and had no action on the bowels, which remained obstinately confined. He gained in flesh, and his mother stated that he was "better in himself, more lively, and not so much over the fire". The urine was examined at intervals; but there was but little variation in its specific gravity, which was always about 1.006. The patient's extremities never at any time during the administration of the medicine exhibited any tendency to become gangrenous.

Respecting the ultimate termination of the case, it may be stated that, a few weeks later, an opportunity was afforded the patient of making a short sea-voyage, of which he, by the advice of his friends, availed himself. He suffered greatly from sea-sickness, missed the milk to which he had been so long accustomed, and was unable to take more substantial nourishment.

On several occasions, he bled copiously from the gums, the hæmorrhage, in the absence of proper medical aid, proving extremely obstinate, and rapidly reducing him to a state of complete prostration. He was brought back to London as quickly as possible, where, after lingering a few days, he died. At the time of his death, the patient had just completed his fifteenth year. Nothing is known respecting

the quantity of water passed whilst away from home; but, during the last few days of his life, his mother stated that he passed very little: not more than a pint in the twenty-four hours. No *post mortem* examination was made.

Before inquiring into the mode of action of the drugs administered in this case, it is necessary to consider briefly the pathology of the disease. It has long been recognised that the essential seat of the disorder in diabetes insipidus must be looked for elsewhere than in the kidneys. The diverse organic conditions found in these organs *post mortem* are evidently secondary changes resulting from the abnormal demand upon their functions caused by the long-continued diuresis. It has been stated that the organic change upon which the disease in these cases depends was to be found in the suprarenal capsules, which, upon this theory, were supposed to be endowed with the function of regulating the activity of the renal secretion. This statement has not received general acceptance; several *post mortem* examinations have been made in cases of diabetes insipidus without the detection of any morbid change in the suprarenal capsules; and, on the other hand, the suprarenal capsules have been found extensively diseased in cases in which it was known that the patient had not during life suffered from polyuria. The connection between diabetes insipidus and Addison's disease, supposing it to exist, must be extremely slight. Bernard's experiment of producing an excessive flow of urine by puncturing a certain spot in the floor of the fourth ventricle, has shown that the essential lesion is situated in the nervous system. It is probable that the polyuria is due primarily to dilatation of the renal capillaries. It is now universally admitted that the calibre of the blood-vessels is regulated by vaso-motor nerves derived immediately from the sympathetic, and presided over by cells contained in the medulla oblongata. This general vaso-motor centre exerts a constant influence over these blood-vessels, maintaining them in a state of semicontraction. Division of these nerves is immediately followed by vascular dilatation. It can be shown experimentally that division of the great splanchnic, the largest vaso-motor nerve in the body, causes dilatation of the vessels of the kidney, with hyperæmia of the parenchyma and secretion of an abnormally large quantity of urine. It is probable that diabetes insipidus consists essentially of paralysis of that portion of the sympathetic which is distributed to the renal vessels. The situation of the general vaso-motor centre in the floor of the fourth ventricle and its neighbourhood affords a ready explanation of Bernard's experiment. The influence of blows on the head or stomach acting as exciting causes of the disease is readily explicable upon this theory. That mental excitement will cause an excessive flow of watery urine, which may be regarded as a state of transitory diabetes insipidus, is a matter of every day observation.

This, then, being the essential pathology of the disease, a consideration of the physiological action of belladonna will afford an explanation of its mode of action. Harley has found that, after the administration of a moderate dose of belladonna, the arteries are contracted; but that, when a large dose is given, this contraction is replaced by dilatation. The primary contraction is due to stimulation of the sympathetic system, and the subsequent dilatation to the exhaustion resulting from the previous overstimulation. It is probable that it is in this manner that belladonna exerts its beneficial influence in cases of polyuria by stimulating the paralysed sympathetic and contracting the arterioles. Brown-Sequard maintains that belladonna contracts the arterioles by exerting a powerful influence on the unstriated muscular fibres, although he adduces no proof of the correctness of this statement. Supposing this view to be correct, an explanation is still afforded of the action of the drug in cases of polyuria. On the one theory, it stimulates a paralysed sympathetic; on the other, it acts directly on the muscular fibres of the blood-vessels, and itself becomes, if one may use the expression, an artificial sympathetic. What has been said respecting belladonna is equally applicable to ergot. Our knowledge respecting the physiological action of this drug is small; but it is known to contract the arterioles, whether it act on the sympathetic, or directly on the unstriated muscular tissue.

CONGENITAL LARGE-CELLED ALVEOLAR SARCOMA.

By JOHN STEVENSON, M.B., Edinburgh.

THE following case is remarkable on account of the congenital occurrence of a large sarcomatous tumour of a rare anatomical type, presenting physical characteristics which at first resembled another form of disease.

The patient was a baby aged about fourteen days, when first seen by