in a stage of rapid development. After the age of 6 the author's method lies almost regularly between the curves of male and female weights. For males, therefore, it gives a slightly higher dose than is necessary; for females a lower dose than is required. This latter feature is of importance, since, as already stated, females are, as a rule, more sensitive to drugs than males, especially at the age of puberty, at which time this formula gives a dosage decidedly lower than that demanded by the weight of the average female.

CONCLUSIONS.

1. Of existing formulae for the calculation of doses in children from imperial measures, those of Young and Gabius are of little value after the 10th year. Cowling's formula is the best of the older methods.

2. Sir Lauder Brunton's formula, for calculating dosage with metric weights, gives figures which are somewhat low at all ages and for both sexes; the calculation is also a little elaborate, and is not readily applicable to the imperial system.

3. The method suggested by the writer for the metric system $\frac{\text{Age} \times 5}{100}$, or for the imperial system $\frac{\text{Age}}{20}$, results in doses which correspond closely with those demanded by the average weights of non-adult individuals of both sexes at different ages; the calculation is simple, and the method can be employed for the metric and also for the imperial weight systems.

SUCCESSFUL REMOVAL OF A TUMOUR IN THE ADRENAL GLAND.

BY

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In the BRITISH MEDICAL JOURNAL, October 12th, 1907, I recorded a case of retroperitoneal haematocoele causing acute intestinal obstruction. The sequel to that case is recorded now.

History.

In July, 1907, I was asked by Dr. F. Pershouse, of Johannesburg, to see in consultation with him a lady, aged 39, who the previous day had shown typical symptoms of acute intestinal obstruction. The history was that three years previously, shortly after confinement, she discovered a lump in the left lumbar region, which caused a certain amount of dull, aching pain in the back. She suffered always from constipation, but could obtain relief by means of cascara. A year ago, while in London, she had symptoms of obstruction, but apparently not of acute character. Under the advice of a surgeon whom she consulted, massage was carried out, with complete relief to the symptoms. From time to time, however, she had left lumbar pain, and always more or less constipation.

Condition before Operation.

The patient had been confined twelve days before I saw her, having a perfectly normal labour. The facial aspect was anxious, vomiting was frequent, the vomited material being greenish-brown and inoffensive. The pulse was 100 and rising steadily. The abdomen was distended, though not greatly so, and in the left lumbar region a hard movable lump could be felt. On bimanual examination it was found to extend into the loin, and was movable antero-posteriorly but not laterally. It was dull on percussion. The impression conveyed was that of a para-renal growth of some kind. There had never at any time been any renal symptoms. The lump extended from the left renal region down to the umbilicus and over to the middle line. The nature of the swelling was quite uncertain, and beyond a vague suggestion that it was a para-renal "something," no diagnosis was made.

First Operation.

The condition of the patient was critical, since no relief had been obtainable by enemata, and the acuteness of the symptoms was hourly increasing. She was therefore removed to a nursing home, with a view to operation. Four hours later, Dr. Pershouse anaesthetizing and Dr. Stanley Heberden assisting, I opened the abdomen in the left linea semilunaris, over the swelling. There was no sign of peritonitis. The descending colon was completely flattened over a large tense swelling, which bulged forward the posterior peritoneum, the colon lying to its outer side. Some large vessels, apparently supplying the colon, ran over its surface. Above, the swelling was apparently continuous with the left kidney, and it extended well over to the middle line. An incision was made parallel with the vessels through the posterior peritoneum, and an attempt made to shell out the swelling. It was, however, completely fixed posteriorly and above, and a fresh layer was attempted in what looked and felt like a tumour capsule. Suddenly the finger slipped into a large cavity, from which rushed some fluid blood and large masses of blood clot, some recent

and some old. The peritoneal cavity had been well packed off, and there was no soiling of the peritoneum. The cyst cavity having been thoroughly emptied and sponged out, the cyst wall was stitched all round to the peritoneum of the anterior abdominal wall and the cavity stuffed with gauze. There had been free oozing from the wall of the cyst, but this ceased on pressure with the gauze packing. None of the cyst wall was removed, since there was none to spare when the cut edges were brought forward.

The subsequent progress of the case was uneventful, the patient leaving the home in a month.

Contents of Cyst.

The material removed from the cyst was submitted to Dr. Pakes, pathologist to Johannesburg Hospital, and his report was that it was old and recent blood clot, with fluid blood.

It seems clear that the origin of the trouble was a retroperitoneal haemorrhage during confinement three years ago—that at the recent labour a fresh haemorrhage occurred, rendering the cyst tense and flattening the colon over it. It is difficult to determine precisely the source of the haemorrhage whether from a mesenteric vessel, a renal branch, or a pancreatic vessel, it is impossible to decide.

Could the nature of the swelling in this case have been diagnosed, there is no doubt that drainage through the loin by an extraperitoneal operation would have been the ideal one. Fortunately, however, all went well by the method adopted.

If this earlier history of the case in 1907 can be considered of real interest, the subsequent events in regard to the same patient are still more worthy of record.

In March, 1912, I was again asked by Dr. Pershouse to see this patient, as she was once more threatened with intestinal obstruction. Since the operation in 1907 she had been remarkably well, only suffering from time to time from constipation and occasional left lumbar pain of quite moderate character. When seen the patient's general condition was good. For about twelve hours there had been some vomiting; she was decidedly thin, but presented no other abnormality in general appearance. There was no discoloration of the skin anywhere.

In the left loin was a densely hard tumour, movable antero-posteriorly, but not vertically, having the colon in front of it. It filled the loin space and extended to the middle line. There were no renal symptoms. A paper by Mr. Alban Doran¹ on cystic tumour of the suprarenal body successfully removed by operation was materially helpful to me in making a diagnosis of suprarenal tumour.

Second Operation.

The patient was removed to Johannesburg Hospital for operation. Dr. F. B. Mudd anaesthetizing and Dr. George Murray assisting, I made the usual oblique incision in the left loin employed for nephrectomy. On opening the loin space I came upon a large dense tumour, having a tough fibrous capsule which extended from the diaphragm downwards to below the iliac crest and over to the middle line. Below it was the left kidney pushed into the iliac fossa, with its upper pole flattened from pressure. The tumour was adherent to the kidney below, the descending colon and peritoneum in front, and the diaphragm above. Its separation from the kidney was clean and easy, from the diaphragm and colon more difficult, and the peritoneum was torn twice and sutured in the usual way. There was no definite pedicle, but vessels were ligatured with catgut as they were encountered. There was no difficulty in controlling haemorrhage, although some of the vessels were of considerable size. The kidney was pulled up into the loin and retained in place by sutures through its perirenal fascia, and a drainage tube inserted down to it. The patient left hospital well on the twenty-eighth day.

The tumour, which was about twice the size of a fetal head, was globular, with one small nodular outgrowth. It had a dense, laminated fibrous capsule, presenting on the inner surface thickenings here and there, which on section showed adrenal tissue. The interior of this fibrous capsule was filled with dense altered blood clot of old standing.

I am indebted to Dr. Watkins-Pitchford, Government Bacteriologist and Pathologist, Johannesburg, for microscopic sections and preservation of the tumour. Dr. Watkins-Pitchford was of opinion that the growth was a hypernephroma. The tumour and sections are now in the Royal College of Surgeons, England.

There can be no doubt that the lumbar route is the method of choice for the removal of growths of this character; it is easier, quicker, and therefore safer than by anterior abdominal section. This is, so far as I can discover, the first case of the kind removed through the

loin, and if I am not mistaken the first one diagnosed as suprarenal growth prior to operation. I refer, of course, to growths in the adrenal itself, not to growths of adrenal origin embedded in the kidney.

REFERENCE.

¹ BRITISH MEDICAL JOURNAL, June 27th, 1908.

SOME EXPERIMENTS WITH IONIC MEDICATION.

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(Performed under a grant from the Royal Society at the Laboratories of Pathological Chemistry, University College, London.)

THE subject of ionic medication is so technical as to involve in considerable difficulties those not continually applying it. One source of error that the beginner is very apt to fall into is that of not recollecting which pole should be used to drive in each particular ion: for instance, I recently came across a case in which a surgeon ordered the ionization of cocaine and employed a nurse to do this for him: both he and the nurse agreed that the cocaine should be placed on the negative pole. Now, as basic radicles, including alkaloids, are driven in at the positive pole and acid radicles at the negative pole, the result of this, of course, was that, cocaine hydrochloride being the salt used, no cocaine was driven in at all, but only chlorine ions. Another error is exemplified by a simple experiment which the author has performed upon himself, which can easily be repeated and which will also serve to emphasize some of the essential points of the treatment. A pad of cotton-wool soaked in cocaine hydrochloride was placed on the forearm over a square window cut in a piece of oil silk; this was connected with the positive pole: a similar pad was placed on the other forearm with an oil-silk window of exactly the same size and connected with the negative pole: the size of the window in the oil silk was 3×3 cm., and the current used was from 10 to 15 milliamperes for ten minutes, the time being reckoned after the needle had first reached 10 milliamperes. It was found at the end of this time that the skin in the square area covered by the *positive* pad was completely anaesthetized, while no anaesthesia whatever was obtained beneath the *negative* pad, showing that the cocaine had been introduced from the anode (or positive pole), not from the kathode (or negative pole). Now, anybody who repeats this experiment will find that the anaesthetic effect of cocaine ions so administered is extremely transitory, passes off in a few minutes, and is followed by hyperaesthesia and hyperaemia, which persist for some days and which are succeeded by brown pigmentation. Obviously, therefore, this method is a bad one for local anaesthesia.

A further experiment was performed with cocaine; this drug was first driven in (from the anode, of course) over an area of 2×1 cm. An attempt was then made to extract the cocaine from half this area by covering half the patch and reversing the current, but this was not successful, the reason being either that cocaine is deposited in the tissues in an insoluble form, or else that the ions of sodium, potassium, etc., which abound in the tissues, are extracted in preference to the heavier cocaine ions.

In order to determine as far as possible the path which various ions took when they were introduced into the tissues, a series of experiments was performed on animals.

The method used was as follows: The part to be treated (generally the animal's back) was first of all shaved. After a few days had elapsed to allow any abrasions due to the action of parasites or to minute lesions incidental to shaving to heal thoroughly, the animal was anaesthetized by chloroform or ether. A thick pad of pure cotton-wool was thoroughly wetted with a solution of the salt containing the ion to be tested and a piece of metal gauze connected to the source of current placed over it. The whole was then completely enveloped in a piece of oil-silk in which a window 2×1 cm. had been cut on the side opposite to the gauze, and this window placed against the skin: a similar pad was prepared and connected with the other pole. By this method there was no possibility of

short-circuiting even if the pads touched. In order to obtain uniformity one-twentieth normal solutions were used in all cases, so that they all had the same number of molecules per unit volume, that number being sufficient to provide an adequate supply of ions. For convenience the pad on the right side of the back was always connected with the anode.

The current was obtained from a shunt rheostat across a constant current main. The resistance handle was moved rapidly until the ammeter registered 6 milliamperes; the resistance had to be varied to keep the current constant during the experiment. The current was allowed to flow for a definite time, and in the case of some of the ions the effect of passing the current for different lengths of time was observed. The skin containing the ionized patches was then removed and in most cases the subcutaneous tissue and muscle beneath it also, the animal being killed by an overdose of the anaesthetic. An attempt, where possible, was then made to stain the ions *in situ* by immersing the tissue in a solution which caused the formation of a coloured compound with the ions in the skin. When this method could not be used the tissue was merely fixed and hardened in alcohol and stained in various ways. In all cases the tissue was properly hardened and embedded in paraffin and microscopical sections were made. In one experiment in which it was desired to observe the late effect of the action of zinc ions the animal was allowed to recover and was killed at a later date.

The experiments were performed on cats, rabbits, a monkey, and a dog.

The ions experimented with were:

Acid Radicles (from Kathode).	Basic Radicles (from Anode).
Hydrogen	Hydroxyl
Sulphide	Calcium
Ferrocyanide	Zinc
Ferricyanide	Copper
	Ferrous
	Ferric
	Mercuric

It would be as well in the first place to describe a very important experiment bearing on the whole question of the ionic treatment of joint diseases. A monkey was anaesthetized by chloroform, and a pad soaked in potassium ferricyanide was placed over the front of its knee, the area which the solution touched being limited by a window cut in a piece of oil-silk. This pad was connected with the negative pole, that attached to the positive pole being placed on the back. A current of 10 milliamperes was passed for thirty minutes, and then the animal was killed. Before its death, however, the knee was removed by cutting through the thigh and the leg, and was placed in a solution of ferrous sulphate. A control experiment was performed in which a pad of potassium ferricyanide was fixed on a monkey's knee for the same length of time, no current being passed, and the knee was subsequently treated in exactly the same way. The next day the knee was opened, and it was found in the case in which the current was used that the skin, subcutaneous tissues, and patellar tendon over which the window had been placed were stained an intense blue from the interaction of the ferricyanide ions and the ferrous sulphate, and further that this blue extended right into the joint, there being a stained patch on the cartilage which penetrated right down to the bone. In the control the blue did not even penetrate the skin. This definitely proves that it is possible to introduce the ions of some substances directly into a joint, even into the cartilages; at any rate of a comparatively superficial joint like the knee.

Very few ions driven in at the kathode, that is to say, acid radicles, can be traced in this way, but it is possible in various ways to trace certain of the basic radicles driven in at the anode.

The penetration of different ions varies enormously, and it is possible to tell from the movements of the needle of the milliammeter whether a drug is entering the tissues freely or not. In using two ions which penetrated the tissues freely, it was found that if the handle of the shunt resistance was moved to a certain point and left there the milliamperage gradually increased, which means that the resistance of the skin had diminished so that the ions were entering in greater number. With ions which

*In most of the experiments this was found the most convenient current to use.