saucer, and the penknife upon the gas-stove, then put the brush next to the spoon, then go and open the door, then sit down on the armchair, and then get up and put the matches which are on the table inside the matchbox."

There is a discrimination of lengths test, and one or two others before reaching the tests with geometrical figures. For these tests the child is practised for a week in recognizing a triangle, a circle, and a square; he is then provided with several sheets on which two or more of these figures are drawn, the figures frequently overlapping. There is a different colour for each of the three figures. The figures are then covered and the child is given an order, such as "Point inside both circles," or "Point in the triangle and square but not in the circle," according to the drawing he has at the moment. Each order is given twice carefully, making sure the child understands; the figure is then uncovered and the stop-watch started. If it is done incorrectly, the figure is covered and the order given again; the time taken in this case is added to that taken in the first instance. Abelson has eighteen geometrical figure tests; they promise to be of considerable value.

Fig. 3.

Fig. 4.

An excellent single test recommended by Tredgold is to send a mentally defective person to open a locked door, the key being hung on the wall just by the door. An intelligent child will use the key, a mentally defective one will come back and say he cannot open the door. A mentally defective child or adult, if told to hold out his hand or put out his tongue, frequently maintains the position till told to desist.

I could describe many other useful tests; I have explained sufficiently, however, the lines upon which we may work to try and obtain facts which will corroborate our opinion as to the presence or absence of mental defect.

ARREST OF SEVERE EPILEPSY IN A CHILD AGED FOUR.

By J. STEWART MACKINTOSH, M.D. Durrh.,
M.R.C.S., L.R.C.P.,
HAMPSHIRE.

I THINK the following case worth recording in detail, because it affords clear evidence that it is not necessary to abandon hope in a case of inveterate epileptic habit that does not yield promptly to routine treatment.

The child was born on March 4th, 1906. I attended the mother in her confinement, and induced labour at the beginning of the ninth month at the suggestion of Dr. Herman, who saw the mother early in her pregnancy for retroversion of the gravid uterus, and judged that labour would prove difficult at term from the size of the child. He weighed 8 lb. when born.

The child was breast-fed for two months, and the maternal milk then failing, he was bottle-fed with diluted cow's milk, cream, etc., with occasional raw meat juice, on which he thrived till 9 months old. About this time the family left London for the country. He was fed on Savory and Moore's food till 2 years old, and the mother then gave him "gravy and bread, puddings, etc.," and a little later added finely-chopped raw meat to his diet, which therefore from the age of 9 months consisted chiefly of soft farinaceous foods, according to the present custom of feeding young children. However, up to the age of 2½ he was apparently a healthy child, good tempered and happy, but precocious for his age and restless in temperament.

In August, 1908, the mother came up to London to be attended by me in her fourth confinement. When she returned home two months later she found a marked change in the child for which no cause could be ascribed by those she left in charge. He had become irritable and spiteful towards his nurse and two elder brothers (both of whom were healthy children); he had also become very frightened of the trains which ran near his house, though formerly they delighted him. During the ensuing year he suffered from "gastric attacks" which appeared to have been due to carbohydrate dyspepsia, and the change in temperament continued.

In the spring of 1909 he was twice bitten by a chained bulldog and suffered a severe nervous shock. Following this he grew shy of strangers and said passers-by "looked at him."

He would no longer play with his brothers, and would carry on conversations with the moon, the rain, or the wind. In September, 1909, he was seized with a characteristic epileptic fit when playing on the golf course. It lasted about ten minutes. The fits recurred three or four times daily. He was seen by a doctor, who prescribed potassium bromide gr.v t.d., and was examined by Sir Victor Horsley for a possible focal lesion, with negative results. Sir Victor Horsley thought the prognosis unfavourable. The potassium bromide checked the fits for six weeks, after which they returned. He was then seen by a well-known specialist in diseases of children, who also thought the outlook grave, but suggested that his enlarged tonsils and adenoid growths should be removed. This was accordingly done, the tonsils being enucleated by Mr. Waugh.

No immediate benefit as regards the fits resulting, a neurologist who has made a special study of epilepsy was consulted. He also was not hopeful of the future, but recommended a trial of Gelineau's dragées, which contain potassium bromide, picrotoxin, and antimony. This did not, however, improve the fits, which had increased (possibly temporarily) in number after the operation, and, on the mother giving on her own responsibility two dragées at a time instead of one, the seizures rose in number to thirty per diem. The mother now despaired of a cure, and brought the child to me asking if I could think of any other procedure likely to improve matters. In view of the history of "gastric attacks" I cut down the carbohydrate element in the diet to a minimum,* and prescribed the following mixture to be taken thrice daily: Sodium bromide gr.iv, strontium bromide gr.ij, tincture of belladonna miv, orange flower water to 3ij, and also urged that the child should live in the country under the quietest possible conditions. Small doses of calomel were also given for a few days.

The result far exceeded my expectations, for from this time (September, 1910) onwards the fits rapidly diminished in intensity, though not at first in number, until they became imperceptible. At Christmas, 1910, the child showed some symptoms of atropism with visual hallucinations, and, becoming frightened, had two slight fits. On cutting out the belladonna from the prescription no further fits occurred, except on one occasion, when after a fright a single attack occurred. But apart from these interruptions, the child has been free from fits for ten months; he has no gastric trouble, and his mother reports his temperament has changed again to that of a normal, if somewhat excitable, child, and his intellectual progress, which came to a standstill, if not worse, with the onset of the fits, has resumed its due advance.

I do not think the arrest of the fits should be ascribed offhand to a lucky combination of drugs. The removal of "adenoids" has at times been attended with success, though not necessarily immediate, after drugs have failed. I believe there was a source of irritation in the carbohydrate dyspepsia with which adenoids are frequently associated. A child with nasal obstruction can only make four chews on an average between each breath, as he is using his mouth for respiration as well as mastication, whereas the normal child bites his mouthful fourteen to twenty times before gulping the bolus.

The mere removal of the adenoids and tonsils is, however, not always sufficient to cure the digestive troubles. The child's mastication requires re-education in order to deal with his carbohydrates, and there appears to be in some cases a chronic infection of the colon, subject to recurrent exacerbations, which requires treatment before the source of irritation can be removed. It is worth noting that in this case the tonsils were totally ablated, as it is now, of course, well known that the stump of a guillotined tonsil may still be a source of infection of the alimentary tract if sufficient tissue be left.

As regards drugs, the sodium and strontium salts were selected in case the failure of potassium bromide was due to idiosyncrasy. The occasional value of belladonna when bromides have failed is well known. Orange flower water had much repute on the Continent as an antispasmodic before bromides came into use, and cures of epilepsy have been ascribed to its use as a simple. The value of "antispasmodics" comes in as a check to the "habit" after the original source of irritation has been removed.

It is of course difficult to forecast what the future may have in store for the child whose case I have set forth. Some writers on epilepsy draw a strong line of demarcation between "essential" and "accidental" epilepsy, assigning the former term to cases in which, with a strong family history, fits arise without apparent provocation in children dull of intellect, unexcitable, commonly dark in complexion and sallow of skin; the epithet "accidental" being reserved for those cases in which the child is of highly neurotic temperament and the fits are traceable to a definite predisposing and frequently maintaining cause.

*An excellent account of the range of dietary suitable in carbohydrate dyspepsia is found in *The Child's Diet* (Curgeven), Lewis and Co. 1905. 1s. 6d.

If this distinction be admissible, the case here described belongs to the latter category, being very excitable, blonde in complexion (though sub-brachycephalic) and, up to the time of onset of the fits, intelligent to the point of precocity. There was no epileptic history on either side. There seems, therefore, reason to hope that, if the fits do not eventually return, the child may grow up to fill a useful place in society instead of falling a victim to the progressive mental degeneration which at one time threatened to be his lot.

P.S.—About a year after the apparent arrest of the fits the mother reported that epileptiform attacks had re-appeared, occurring at bedtime and on awaking. On inquiry I learnt that the child had, in contravention of strict orders to the contrary, been having porridge for breakfast. Unfortunately, stopping this forbidden luxury has produced no amelioration of the fits up to the present, but the child continues to progress otherwise bodily and mentally. Just before receiving the proof of this paper the mother reported to me that she had noticed "something like a piece of tapeworm, about 4 in. long," in the child's stool. Unfortunately she did not save it for inspection, but thought it was segmented. It may, of course, have been mucus, but it should be noted that the child was fed with raw meat for a time. It would be interesting if a tapeworm were at the bottom of the trouble, and should this prove to be the case I will report it.

ON RADIUM EMANATIONS IN MINERAL WATERS.*

By T. PAGAN LOWE, M.R.C.S., L.R.C.P. EDIN.,
SURGEON TO THE ROYAL MINERAL WATER HOSPITAL, BATH.

THE year 1903 was an important one in the history of balneology, for then it was that Ramsay and Soddy demonstrated that helium was one of the products of the disintegration of radium; in the same year Professor the Hon. J. R. Strutt discovered radium in the deposit of the Bath waters. In the same year, again, the late Lord Blythwood published in *Nature* the fact of the radio-activity of the gases from the springs of Bath.

In his presidential address to the Section of Balneology of the Royal Society of Medicine in October, 1909, my friend Dr. Leonard Williams attempted to redress the balance between science and empiricism, which, in matters balneological and climatological, had, in his judgement, too long shown a bias in favour of the latter. The burden of his argument, as it seems to me on re-reading that address, was that the methods which we employ exercise an influence upon the internal secretory glands, and he brought a considerable mass of evidence in support of his theory. He did not, however, offer any explanation as to how and by what means these internal secretory glands were influenced by such methods. I think the time has come when we can venture a step further by suggesting that the means by which our results are produced are, in some cases at any rate, brought about by radio-activity.

[Mr. Pagan Lowe then gave an outline of Sir William Ramsay's observations, recently reported,¹ and continued as follows:]

The radio-activity of all mineral waters exists only at the source, and such waters rapidly lose this quality. Nevertheless it is possible by artificial means to render them permanently radio-active. Does the therapeutic potency of natural mineral water depend upon niton alone, or is the credit to be divided between it and the other, the chemical constituents—that is with those constituents which we have till now endowed with the entire beneficence? We are told that radio-active waters can be prepared by adding one milligram of radium sulphate to one litre of distilled water, which can then be used as a subcutaneous injection without harm. Is this artificial water as potent as natural radio-active water, or does it more quickly lose its acquired qualities? Can the radio-active water, as we find it at our springs, be used as a subcutaneous injection with advantage? These as well as other questions present themselves for our consideration.

Such, for instance, as those connected with the statement that niton, although it has the power of rendering all substances radio-active, cannot itself, according to some

authorities, be absorbed by the skin. If this were true it would seem that bathing, as far as any special benefit from the radio-activity is to be obtained, was at a great disadvantage. But a little more consideration modifies this view. In addition to the immediate relief which experience tells us occurs from mineral water baths, such, for instance, as increased mobility and lessened pain, the patient is in the best position for taking the full advantage from niton. The orifices of the body are soaked in it, and the surrounding air is more or less saturated, and thus when the patient is in the bath, with his nose and mouth just above the surface of the water, he must be most favourably situated to reap the benefits of the induced radio-activity. Moreover, contrary to the belief of those who say that niton cannot be absorbed by the skin, Professor Lazarus is of opinion that it can, and in this he is supported by Ramsay and others.

In the administration of baths much longer periods of immersion seem to be called for, and I have no doubt that the custom of spending many hours in the bath, as is the custom at Leukerbad and other resorts, has a good deal to recommend it. The large public baths, as used there, however, seem to be inadvisable, and I cannot but think that the small bath-room, due regard being of course given to ventilation, is preferable. The probability is that niton is not too strong, and we want to concentrate, perhaps to augment, it as much as possible.

Some authorities are of opinion that natural waters are not sufficiently radio-active to be of much service therapeutically, but on this question of their potency there are very conflicting views, and Professor Farr, of New Zealand, in an interesting discussion on the effect of radio-active spring water on trout, refers to radium emanation (niton) as a gas which physically is a hundred thousand times more active than radium.

Hitherto details of the effects of niton given off at the fountain head are not very numerous, notwithstanding the immense amount of research which has been made with regard to radium and artificially prepared radio-activity. It is urgent that those of us who have access to natural radio-active waters should fill up the deficiencies. Fortunately, at Bath the waters are sufficiently charged with niton for all purposes, and may be considered saturated, and we have 500,000 gallons coming up daily at a temperature of 118° F. There is also available more than 5,000 litres of gas.

Has the presence of niton any subtle action on the salts of magnesium, sodium, lime, and so on, which are found in indifferent waters rendering them more absorbable or potent when brought into contact with mucous membrane? The free absorption of radio-activity by mucous membranes and by the lungs will probably alter our treatment by those routes, and we shall in the future rely upon them much more. Inhalations will be more frequent and drinking more resorted to, for longer time and in greater quantity. The same, too, will apply to vaginal and rectal douching. This latter—the so-called Plombières method—is very popular at the present time at certain spas. Certainly its effect in suitable cases is very striking. It is also almost certain that the future will see a great increase in the combined use of electricity and radio-active waters.

Sir William Ramsay, referring to the ingenious spraying machine invented by Mr. Jones, the engineer to the bathing establishment of Bath, for use in throat and eye affections, suggests that the natural gas should be used instead of the mineral water. If this were adopted—and I have no doubt it will be—Ramsay is of opinion that "an agent nearly twenty times as potent would be available." He also thinks that in a similar way niton might be applied directly in the treatment of local rheumatism, especially if the patient were insulated and connected with the negative pole of a battery. He further outlines a method by which the intake of niton could be very much increased by giving electric baths with a continuous current; he says:

If the patient in the electric bath were connected with the negative pole of a battery giving, say, 100 volts potential, or even more, and the other electrode were placed in the water, of course not in contact with the bather, the niton would rapidly reach the skin. It is, indeed, not unlikely that it would enter the system by so-called "ionization," and in this way a considerable dose might be given.

In the estimation of the value of natural waters it is

* Introduction to a discussion at the Royal Society of Medicine.