never had syphilis, and did not drink. The affection began with severe pain at a spot about the middle of the anterior surface of the forearm, followed by stiffness and difficulty in moving the wrist-joint, which rapidly increased until all use of the hand and wrist was lost. His work was heavy, and consisted in shovelling coal. There had been no injury of any kind to the limb. On examination the wrist was slightly extended and the hand adducted; the flexor tendons at the wrist were also rigid and prominent under the skin, the fingers were flexed at the metacarpal, and extended, though not fully extended, at the phalangeal joints; the thumb was flexed at all joints and adducted so as to be bent in towards the palm of the hand. The hand was persistently blue and cold; there was no wasting of any of the muscles. Both wrists and fingers were rigidly fixed in the above-described position, and could not be moved; attempts at passive movement gave rise to pain, felt in the wrist, but most acutely at a point three inches above this joint on the flexor surface of the forearm, and at this spot there was a small area, over which the skin was hyperæsthetic; elsewhere sensation of all kinds was normal. He could very slightly move the fingers, but otherwise could not move the hand at all. Flexion of fingers also gave rise to pain at a point on the posterior and inner aspect of the arm, just above the internal condyle. The electrical reactions showed slight diminution to both forms of current, as compared with the left arm. The progress of the case was slow and tedious, and he complained much of pains in the hand and forearm; he very gradually improved, the spasm slowly decreasing and finally disappearing. After about ten weeks' treatment he recovered the use of the limb, was able to return to work, and, so far as I know, has not relapsed. The measures adopted were hot fomentations for the relief of pain at first, with massage and faradism to the affected muscles; subsequently blisters were applied over the seat of the pain; iron and quinine, bromide and valerian, were given internally. No satisfactory reason for the pain in the forearm could be made out. He was carefully examined as to the presence of some of the more characteristic phenomena generally present in hysteria, but no modifications of the general or special senses—other than the hyperæsthetic patch on the forearm—could be at any time determined. An engraving from a photograph of the position of

the hand is appended. On looking up the case afterwards I found descriptions and figures of similar contractures by Professor Charcot,² one occurring in a blacksmith and affecting the left hand seven weeks after he had received a slight burn on the forearm and back of the hand; the other two patients were women.

Clifton.

THE ANTI-FERMENTATIVE TREATMENT OF INFANTILE DIARRHŒA.¹

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INFANTILE DIARRHŒA may be a symptom of many diseases, such as dietetic, parasitic, tubercular, syphilitic, miasmatic, and local diseases, or it may result from diseases of defective nutrition. I propose in this communication to discuss only the causation and the treatment of that variety of acute infantile diarrhœa that is caused by irritative products resulting from fermentations produced in

milk either previously to or after ingestion. The majority of the cases of this kind occur in infants who are being reared on cow's milk, and, although they occur at all seasons of the year they are far more common during the summer. The infant is restless and irritable; the tongue is generally coated with a white fur; the diarrhœa is severe, and is frequently accompanied with vomiting and signs of abdominal pain; the motions are watery, usually greenish at first, with lumps or flocculi of curd in them; later they may become lighter in colour, or even may resemble the rice-water stools of cholera or of arsenical poisoning. In some of the cases marked nervous prostration is present. The causation of this variety of acute infantile diarrhœa has been attributed by various authors to undigested caseine, to the action of bacteria, to acid fermentation, to alkaline fermentation, to poisonous ptomaines, or to catarrh of the intestinal mucosa set up by the above-mentioned or other irritants. Bednar was one of the earliest writers who put forward the theory that primary abnormal decomposition of food was a cause of diarrhœa in children. Escherich found by the aid of Koch's method of cultivation that the bacterium lactis determined strong lactic acid fermentation in carbohydrates, and especially in milk sugar, but that this bacterium does not split up albumen. On the other hand, according to Baginsky, in a paper read before the Berlin Medical Society in 1888, the bacterium lactis produces only very small quantities of lactic acid, most of the acid formed being acetic acid; moreover, cultivation experiments show that the formation of acetic acid, when it exceeds a certain limit, destroys this bacterium, so that if the bacterium be sufficiently active it dies, so to speak, by its own hands, killed by its own products. Experimentally, it is found that a trace of calomel in the gelatine prevents almost entirely the growth of this bacterium, and this may explain the undoubted usefulness of calomel in sudden diarrhœa in children, due apparently to fermentation of milk sugar in the milk-supply.

Now, although I do not for a moment deny that several irritating substances resulting from the fermentation of milk may be factors in the production of this form of acute infantile diarrhœa, yet my contention in this paper will be that the principal share of the blame rests with the milk or cheese ptomaine, tyrotoxinon, produced during the fermentation of milk under certain conditions. I will therefore here give a brief description of this body. In 1883-84 300 cases of cheese poisoning were reported to the Michigan State Board of Health. The symptoms were vomiting, diarrhœa with watery stools, occasional pain in the region of the stomach, tongue at first white, red and dry later on, pulse feeble and irregular, countenance pale with marked cyanosis; dryness and constriction of the throat were complained of by all, and in a few cases the diarrhœa was followed by marked nervous prostration. In the majority of the cases no fatal termination occurred. From the symptoms many of the cases were at first diagnosed as arsenical poisoning. In all these cases the cheese was apparently in good condition, and there was nothing in the taste or odour of it to excite suspicion. From some of these cheeses Victor Vaughan extracted a crystalline ptomaine which he named "tyrotoxinon," and which he found was capable of producing the symptoms described above as characteristic of poisonous cheese. He later on extracted tyrotoxinon from milk that had stood in stoppered bottles from three to six months. He found that tyrotoxinon administered to a cat produced vomiting and watery stools, with subsequent immediate retching and vomiting whenever it lapped a little milk. This condition continued for three days, when the animal was placed under ether and its abdominal organs examined. The stomach and intestines contained a frothy, serous fluid, such as had formed the vomited matter, and the mucous membrane was very white and soft; there was not the slightest redness anywhere along the alimentary canal. Similar results in several other experiments on lower animals were obtained by the same observer. It may be mentioned here that the chemical constitution of tyrotoxinon is known; it has been shown by Victor Vaughan to be identical with diazobenzol ($C_6H_5N_2$).

Many remedies have been employed in the treatment of infantile diarrhœa with the view of arresting the abnormal intestinal fermentation. Carbolic acid, creasote, resorcin, salicylate of soda, salicylic acid, naphthol, and salol have

² *Maladies du Système Nerveux*, vol. iii., leçons vii. and viii.

¹ A paper read before the Harveian Society, Nov. 7th, 1889.

been given as antiseptic remedies in the hopes of checking the abnormal fermentative changes going on in the bowels. Ringer recommends a weak solution of bichloride of mercury in acute or chronic diarrhoea of children with very slimy stools, and accompanied by pain and straining; the salient indication, according to him, for employing the bichloride of mercury is the slimy character of the motions. In some forms of infantile diarrhoea, characterised by watery, very offensive, muddy looking or green-coloured stools, Ringer recommends small doses of grey powder. Illingworth uses for infantile diarrhoea a mixture containing perchloride of mercury, iodide of potassium, carbolic acid, sal volatile, and paregoric. This is a most useful combination, and it was the employment of it that first directed my attention to the treatment about to be described in this paper. Dr. Angel Money has recently drawn attention to the temporary value of naphthaline as an antiseptic in cases of infantile diarrhoea and of fetid urine. Dr. Edward P. Davis of Philadelphia, in a recent clinical lecture on the treatment of infantile diarrhoea, points out that it is of prime importance that the milk should be sterilised, and also advocated in cases of pronounced gastric irritation the washing out of the stomach with water containing either bicarbonate of soda or salicylate of soda; as an intestinal antiseptic he recommends small doses of calomel, or, as a final resort, intestinal irrigation with water made alkaline with bicarbonate of soda, or with thymol solution (1 in 1000), or with salicylate of soda solution (20 gr. to 20 oz. of water). Dr. Koblasenko, in a Russian medical journal, states that he has found great advantage from the use of zinc oxide in the summer diarrhoea of children; he gave the zinc oxide in a mixture with ether and tincture of rhatany.

The treatment that I have lately employed in these cases consists of (1) drug treatment and (2) diet treatment.

1. If the view that I entertain be the correct one—viz., that the milk ptomaine tyrotoxin is one of the main factors in the causation of the diarrhoea—then the rational treatment will be to destroy or to render insoluble, and therefore inert, this substance, and at the same time to stop the abnormal fermentative changes occurring in the stomach and intestines, and so arrest further production of this and any other irritating chemical bodies. Now, can any one drug combine these two functions? Yes, in the soluble biniodide of mercury we have a drug which renders the milk ptomaine insoluble and inert, and which at the same time is one of the most powerful, if not the most powerful, of antiseptics. But, it may be asked, what advantages in the treatment of acute infantile diarrhoea has the biniodide of mercury over the bichloride of mercury, as recommended by Ringer? It has the following decided advantages: (a) The soluble biniodide of mercury precipitates the milk ptomaine tyrotoxin by forming an insoluble double iodide with it; bichloride of mercury is powerless to precipitate the milk ptomaine. (b) The soluble biniodide of mercury is a much more powerful antiseptic than the bichloride of mercury. (c) The soluble biniodide of mercury is a safer drug than the bichloride of mercury, in that it is more rapidly eliminated from the system than the latter preparation. This is explained by the facts that the bichloride of mercury after it has passed into the circulation becomes converted into insoluble or partially insoluble compounds, both by the albumen and by the carbonate of soda of the blood (an albuminate of mercury and a carbonate of mercury being respectively formed), and that in consequence the mercury becomes deposited in the various tissues, and so, by not being speedily eliminated from the system, may produce toxic effects. This disadvantage is not possessed by the soluble biniodide of mercury, which is not precipitated either by the albumen or by the carbonate of soda of the blood, so that there is consequently no danger of its being deposited in any of the tissues; and, as a matter of fact, after absorption into the circulation, it is rapidly eliminated by the kidneys. This rapid diffusibility through the system and elimination of the soluble biniodide of mercury in the urine I have been able to prove in the following manner. A male adult, who had not previously taken mercury, came under my friend Mr. Hastings Stewart to be treated for secondary syphilis. A subcutaneous injection of three-quarters of a grain of the soluble double iodide of mercury and potassium was administered, and within two hours of the injection I was able, after careful analytical search, to find a small quantity of mercury in the urine. It was on account of its property of precipitating the

milk-ptomaine tyrotoxin, and so rendering it insoluble and inert, and on account also of its powerful germicidal action, that I was first led to employ the soluble biniodide of mercury in the treatment of infantile diarrhoea. I have always prescribed it together with chloral hydrate, the latter being employed as a sedative to the irritated and possibly inflamed mucous membrane of the stomach and intestines, and also on account of its action on the muscular walls of the intestine in diminishing exaggerated peristaltic action. The form in which I prescribe it is as follows: R Liq. hydrarg. perchlor., ℥xii.; potass. iodid., gr. 4; chloral hydrat., gr. j.; aquam ad 5j. This forms the teaspoonful dose, which in the case of infants up to six months of age may be given every four hours, and for infants from six to twelve months of age every three hours; children more than one year old may take two teaspoonful doses. This mixture contains the biniodide of mercury dissolved in the excess of iodide of potassium as a soluble double iodide of mercury and potassium; every teaspoonful of the mixture contains one-fiftieth of a grain of biniodide of mercury. Taking into account the irritant action of most of the persalts of mercury, it might be imagined that the biniodide of mercury itself would possibly act as an intestinal irritant. I have, however, never found this to occur in any one of the cases in which I have employed it, and this I attribute to its extreme solubility and diffusibility, and to its rapid elimination by the kidneys. I have by me the records of eighty cases of acute infantile diarrhoea that I have treated by the biniodide of mercury method. In all the cases the diarrhoea was severe, and in many of them was accompanied by vomiting with signs of abdominal pain, and in a few of the cases by marked nervous prostration; the ages of the infants varied from three weeks to eighteen months. The results, briefly stated, are as follows:—In seventy-two of the eighty cases the diarrhoea ceased within two or three days; in five of the remaining eight cases it ceased within four days; and in no case did it last over seven days.

2. As regards the diet treatment, if milk is to be given I always direct that it should be previously boiled; and here let me remark that boiling the milk not only destroys germs but also rapidly decomposes any of the milk-ptomaine tyrotoxin that may have been formed, the tyrotoxin splitting up on boiling into carbolic acid and nitrogen. In the majority of cases, during the continuance of the diarrhoea I order one part of the boiled cow's milk to be mixed with three parts of barley water, and a few teaspoonfuls of this diluted milk to be given to the infant every hour. In certain cases it may be necessary to withhold milk altogether for a time, allowing the infant only barley water sweetened either with milk sugar or with saccharine. I advise the mothers that the various parts of the feeding bottle when not in use should be kept in a weak solution of permanganate of potash, which is not only a powerful germicide, but since all ptomaines are rapid reducing agents, they become speedily destroyed by the oxidising powers of the permanganate. I also endeavour to get the mothers to use the old-fashioned torpedo-shaped feeding bottle, in which no indiarubber tubing, the favourite lurking place of germs and other abominations, is employed.

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THE BACILLUS COLI AS A CAUSE OF ENTERIC FEVER (RODET).

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IT may be assumed that Rodet's statement of the relationship which he believes to exist between the bacillus coli communis and the bacillus of Eberth will not meet with ready acceptance. It reopens in a startling manner the whole question whether septic bacteria may, under certain conditions, acquire pathogenic properties, and revives Murchison's contention that enteric fever may arise spontaneously from decomposing sewage. While the larger question awaits answer, isolated and fragmentary outbreaks of enteric fever now and again occur which resist every effort to fix their origin in some previous case. Here it is that, in certain cases, Rodet's views lend themselves