drug should not be pushed farther, but just enough given to maintain the advantage by keeping pace with the elimination of the drug.

7. The heart tracings show that a pure digitalis effect is obtained on perfusing digalen, the therapeutic effect being marked, and the tonus at the end very considerable.

8. The tracings also demonstrate the much higher Coefficient of Distribution of the drug in saline solution than in the blood so resembling the chloroform action. Even at the lowest concentration tested no therapeutic equilibrium is established, but the heart goes on taking up the drug from the saline till the death point is reached. This does not occur with a much heavier dosage in the intact animal where the drug is dissolved in the blood.

9. Soluble digitoxin shows none of that haemolytic action in destroying red blood corpuscles which is possessed by those sapo-glucosides which act on the heart, as, for example, the digitonin present in ordinary tincture of digitalis.

REFERENCES.

¹ *Journal of Physiology*, vol. xxxviii: Proc. Physiol. Soc., p. x.
² *Muench. med. Woch.*, 1904, No. 33. ³ *BRITISH MEDICAL JOURNAL*, July 22nd, 1904.

A CASE OF CARDIAC FAILURE TREATED BY CANE SUGAR.

By HARRY DINGLE, M.R.C.S., L.R.C.P. LOND.,
BARMOUTH.

THE following notes of a case of cardiac failure treated by cane sugar show how remarkably an apparently hopeless case was benefited by its use.

The patient, a plumber, aged 28, first consulted me on December 4th, 1910, complaining of great shortness of breath and swelling of his abdomen, which had commenced in July, 1910, and gradually grew worse; he had, however, continued his occupation. He had previously always been healthy and temperate. In March he was helping to pull a heavily-laden hand-cart up a stiff hill, when he suddenly felt giddy and faint, great difficulty in getting his breath, and had to sit down for a time. After a short rest he was able to continue his work, and thought no more about this incident.

State on Examination.

The patient looked ill, dusky complexion, anxious expression, marked dyspnoea, had to gasp between his sentences whilst talking to me. *Heart*: Faint apex beat, little to left of left nipple line, diffused. No definite bruit heard at apex, but a galloping, tumbling kind of rhythm, very irregular and intermittent. *Aorta*: No bruit heard, but second sound accentuated. *Pulse* 100, feeble, small, irregular and intermittent. *Lungs* normal. *Respirations* 35. *Abdomen* much enlarged and definite signs of dropsy. Slight oedema of skin over lower part. Girth measurement at level of umbilicus 35½ in. *Liver* not enlarged to any extent. *Appetite* only fairly good. *Tongue* fairly clean. *Urine*: No albumen, high-coloured urates.

Diagnosis.

I considered his condition of failing heart most serious, and that the cause was probably due to damage of mitral valve at the time he was helping to pull a hand-cart the previous March. I ordered him to bed, to lie absolutely quiet, put him on light nourishing diet and tinct. digitalis $\mathfrak{m}$ v, tinct. nucis vom. $\mathfrak{m}$ v, every four hours; large doses of mag. sulph. mornings.

Progress.

December 7th, 1910. Condition much the same; head and shoulders well propped up with pillows. Taking nourishment fairly well. Passed three pints of urine in twenty-four hours. Increased tinct. digitalis to $\mathfrak{m}$ x doses every three hours.

December 12th, 1910. Feeling better, breathing more comfortably, and sleeping better. Better colour. Pulse a little steadier, 88. Heart sounds much the same. Appetite improving. Increased tinct. digitalis to $\mathfrak{m}$ xij every four hours; added liq. strychninae $\mathfrak{m}$ iij. Girth measurement of abdomen less 32 in.

December 17th, 1910. Substituted strophanthus for digitalis. Condition much the same.

December 22nd, 1910. Much the same. Returned to digitalis and strychnine. Calomel gr. v at night occasionally.

December 26th, 1910. Rather worse. Increased amount of fluid in abdomen. Pulse 88, respirations 40. Slight oedema at bases of both lungs. Passing less urine. Heart sounds much the same.

December 31st, 1910. Same galloping sounds heard at apex, with a faint systolic bruit as well. Continuing digitalis and strychnine, also mag. sulph. mornings and calomel at night. Had a consultation with Dr. Wood, who gave a very bad prognosis.

January 2nd, 1911. Discontinued digitalis for a while and gave pot. iod. instead.

January 4th, 1911. Slightly better; breathing more comfortable. Passing more urine, 2 quarts. Amount of dropsy much the same.

February 1st, 1911. Considerably worse; more fluid in abdomen; signs of fluid in left pleura; also some pleuritic frictions in left axilla causing pain. No rise of temperature. Heart sounds the same; bruit still heard at apex.

March 3rd, 1911. More comfortable, and is now lifted out on couch and wheeled out of doors when fine. Appetite better; sleeping better. Certainly improved by being in open air. Still taking cardiac drugs.

April 30th, 1911. Condition of heart much the same. More comfortable on the whole. Amount of fluid in abdomen much the same, though fluid in left pleura less marked. Taking nourishment fairly well.

May 5th, 1911. Not so well; not well enough to go out of doors last few days. Abdomen increasing in size; oedema of skin of abdomen more marked. Breathing more distressed. Respirations 40; pulse feebler, 100. Heart sounds at apex very irregular and bruit distinct. Appetite bad. Colour dusky.

May 7th, 1911. Very ill, condition appears hopeless. Taking very little nourishment and vomiting at times. Fluid in both pleurae at bases; tapped abdomen, and drew off 22 pints.

May 8th, 1911. Much relieved by tapping, better colour, and able to take more nourishment. Pulse 80. Respirations 30. Heart sounds much the same.

May 10th, 1911. Able to be wheeled out of doors again, and seems to be improving slightly. Still taking digitalis, which seems to do more good than any other drugs.

June 2nd, 1911. Breathing becoming difficult again, unable to lie down, not well enough to go out of doors for some days. Fluid reaccumulating in abdomen. Pulse 94, weaker. Heart's action weaker, sounds of same character.

June 11th, 1911. Much worse. Abdomen filled up again. Breathing very bad. Pulse very feeble, 100. Oedema of bases of both lungs, and fluid in left pleura. Abdomen tapped, and 16 pints drawn off.

June 12th, 1911. More comfortable since fluid of abdomen removed. Condition of heart much the same. Commenced sugar treatment. Taking 5 oz. Glebe's granulated cane sugar a day. Continuing small doses of digitalis as well.

June 16th, 1911. Discontinued all medicines with the exception of occasional doses of mag. sulph. and calomel. Persevering with the sugar, taking the full 5 oz. most days. Occasional feeling of nausea. Able to be wheeled out in bath chair.

June 20th, 1911. Says he feels decidedly better, much more comfortable, and able to lie down at night now. Better colour. Breathing much better. Pulse a little stronger, but still very irregular and intermittent. Heart sounds much the same. Some fluid in abdomen, but no marked increase. Fluid left side of chest less. Oedema at bases of lungs less. Taking the 5 oz. of sugar regularly. Appetite good.

July 2nd, 1911. Decided improvement in general condition, able to go out in bath chair and remain out all day. Much better colour. Appetite good. Taking the full 5 oz. of sugar without any inconvenience. No increase of fluid in abdomen. No signs of fluid in left pleura. Diminished breath sounds at left base behind, due to thickened pleura. No oedema of lungs.

August 30th, 1911. Still improving, every day in bath chair, and able to sit upright in chair. Taking the 5 oz. of sugar regularly. Appetite good. Sleeps well. Seems much better in every way. Scarcely any fluid can be detected in abdomen and none in chest. Heart sounds more regular. Pulse stronger. Passing normal quantity of urine.

September 12th, 1911. Wonderfully better; still out of doors every day in chair. Says he would like to walk, but I advised him not. No appreciable quantity of fluid in abdomen. No oedema of skin. Good colour. Heart sounds less irregular. Bruit not always heard. Pulse stronger.

He continued to improve up to October 9th, 1911, when he had a severe shock on being told that a friend and neighbour of his had been run over by a train and had lost a leg. He experienced difficulty in breathing again, not eating or sleeping well. Pulse weaker. I ordered him to bed for about a week, and gave him digitalis for a few days. He soon improved with the rest, and was able to go out in his bath chair again on October 16th.

October 20th, 1911. Condition much improved, and is now as well as he was before October 9th.

November 29th, 1911. Has been going out every day in chair, in which he sits up quite comfortably. Says he feels quite well. Appetite good, sleeps well, able always to lie down at night; passing good quantity of urine; no shortness of breath. Has not walked yet, but is very anxious to; is able to stand by himself. Still taking the 5 oz. of sugar. Heart: Apex beat in normal position; no bruit heard; still the continuing irregular rhythm at apex; heart's action considerably stronger. Pulse 80, small, irregular, and intermittent, but much stronger. Lungs normal, with exception of diminished breath sounds at left base. No oedema or fluid in abdomen.

REMARKS.

This is evidently a case of failing heart which dates from March 1910, and due to his damaging his mitral valve by overexertion.

From the time he first came under my care he was treated with all the various cardiac drugs, in variable doses, with absolute rest and suitable diet. He at times showed signs of improvement, but it was never lasting, and

he went from bad to worse. I had to tap him on May 7th, 1911, drawing off twenty-two pints from his abdomen. This, one thought, was the beginning of the end. He in a few weeks again had to be tapped; this time sixteen pints were removed.

Since June 12th, 1911, he has taken 5 oz. of sugar a day, hardly missing a single day and almost always taking the full quantity. Only twice since he commenced the sugar has he taken any cardiac drugs, and then only for a few days. Further, he has never again required tapping.

I attribute his remarkably improved condition (his condition at one time appeared absolutely hopeless) solely to the cane sugar. His urine was examined on various occasions and only contained an excess of urates. Whether in time he will sufficiently improve to allow of light work remains to be seen, but I certainly think it well worth while continuing the sugar treatment. Dr. Wood, who saw the patient twice with me before I commenced the sugar treatment, agreed with me that there was little to be done, as it seemed quite a hopeless case. I may add that the patient experienced no inconvenience in taking such a large quantity of sugar, except at the very first, when he occasionally had a feeling of nausea. Before commencing the sugar he had to be almost constantly taking aperients, now he hardly ever takes any.

I am indebted to Dr. Goulston, of Exeter, for the idea of the cane sugar treatment.

A CASE OF OBSCURE FEVER WITH PRONOUNCED NERVOUS SYMPTOMS,

APPARENTLY DUE TO INFECTION BY A
LEPTOTHRIX BACILLUS.

BY

J. MICHELL CLARKE, M.A., M.D.CANTAB., F.R.C.P.,
JOINT PROFESSOR OF MEDICINE, UNIVERSITY OF BRISTOL; PHYSICIAN
TO BRISTOL GENERAL HOSPITAL;

AND

G. SCOTT-WILLIAMSON, L.R.C.P. AND S. EDIN.,
DEMONSTRATOR IN PATHOLOGY AND BACTERIOLOGY, UNIVERSITY
OF BRISTOL; PATHOLOGIST TO BRISTOL GENERAL HOSPITAL.

This was a case of continued fever of obscure origin, running a course of a little over three weeks, with marked symptoms of disturbance of the nervous and also of the urinary systems. It appears to have been due to a leptothrix bacillus not previously described as a pathogenic organism except in a case recorded by Professor J. Ritchie and Dr. Stuart McDonald,¹ and in five other cases met with by the latter during an epidemic of cerebro-spinal meningitis. These cases were all fatal.

The leptothrix described by Professor Ritchie and Dr. Stuart McDonald occurred in a case of pyaemia and meningitis, and had the same characteristics, except as regards motility. The patient was a child, aged 1½ years. The symptoms were:

1. Diffuse inflammation of the left leg, with a small abscess outside the knee-joint.
2. An abscess in each elbow-joint and suppuration in the right middle ear.
3. Signs of meningitis and hypostatic pneumonia; death.

A leptothrix was recovered from the blood, cerebro-spinal fluid, and from the suppurating joints; its characters and cultural characteristics will be given below. In this case there was also a terminal pneumococcal infection. *Post mortem* there was a purulent subdural meningitis over the left cerebral hemisphere, pia-arachnoiditis in patches over the brain, and spinal meningitis. They found the organism to be pathogenic to monkeys and mice, very slightly to guinea-pigs, and not at all to rabbits. By intra-spinal injection in monkeys it produced acute meningitis. It appeared to break down the resistance of the body to other pathogenic organisms.

Dr. Stuart McDonald² had previously described 5 cases of meningitis during prevalence of epidemic cerebro-spinal meningitis, in which micro-organisms with the same microscopic characters as this leptothrix bacillus were found in the cerebro-spinal fluid. In none of these

cases was the typical meningococcus isolated. In two cases there was a mixed infection with the *Diplococcus crassus*. In one case in which there was a *post-mortem* examination—the patient dying after eight days' illness with typical clinical symptoms of cerebro-spinal meningitis—a fibrino-purulent lepto-meningitis was found on the sides and vertex of the brain. In this case there was a growth on blood-agar after three days like a pneumococcus, with next day a leptothrix formation.

Our patient, Rowland W., aged 23, was a shop assistant. When very young he had a severe attack of chorea, and early in 1911 he had rheumatism, which laid him up for three weeks. These were the only previous illnesses, and he had never had gonorrhoea or any previous difficulty in micturition.

Five weeks previous to admission he was given double work to do, owing to the illness of his manager, and this work involved the keeping of accounts, with which he was unfamiliar. He began to suffer from severe headaches, chiefly frontal, and felt weak and overdone. There was no complaint of sore throat. The headache grew much worse on September 11th, and he gave up work on September 15th. He saw Dr. Stevens on September 19th, who found he had fever, and sent him to bed. The fever continued, with headache, dullness and drowsiness, and slight abdominal swelling. There was no delirium, no diarrhoea, no cough, no pains in or swelling of the joints, and no abdominal pain except a little over the pubes; he had some difficulty in passing water; there was no discharge from the urethra and no history of gonorrhoea.

He was admitted on October 3rd. He had a heavy expression, was dull and listless, and complained of headache; his aspect strongly suggested enteric fever. He was quite clear in all statements, but had little memory of his illness.

Condition on Admission.

Cheeks flushed; pulse regular, not dicrotic, varying in rate from 96 to 110 per minute; respirations 28 to 30; bowels constipated; appetite fair; tongue dry, furred in centre. On examination, chest well formed, lungs normal.

Heart.—Apex beat and area of dullness normal; the sounds showed evidence of affection of heart muscle (toxaemia), in that there was a triple sound at the apex, and the pulmonary second was accentuated.

Abdomen.—Not distended, resonant everywhere; no abdominal pain or tenderness; no ascites. The lower edge of the liver was felt just below the ribs; it was not tender. The splenic dullness was increased, beginning above the seventh rib, and extending forwards to the anterior margin of the ribs, its tip being just felt. There were three or four doubtful pink spots on the abdomen.

The urine contained a trace of albumen, a few pus cells, and a deposit of urates. It had a very peculiar mouse-like odour.

Nervous System.—Pupils small, equal, acted well to light and accommodation. Optic discs normal. Knee-jerks exaggerated; superficial reflexes all normal. There was a marked fine muscular tremor with slight twitchings of the muscles. Widal's test, taken once before and once after admission, was negative. During the next few days he lay in a very drowsy state with low muttering delirium, especially at night. Slight retraction of head and stiffness of limbs. He answered questions slowly and complained chiefly of headache and of pains over the bladder. He had great difficulty in micturition. The urine contained a trace of albumen and was somewhat turbid. On October 6th Widal's test was again negative.

Within a few days after his admission to hospital cultures were made from the blood on two occasions from three different veins. Each sample yielded a pure growth of the leptothrix. The same organism had been first recovered in pure culture from the cerebro-spinal fluid. The latter was clear and contained a very large number of lymphocytes; few polymorphs; a differential count gave small lymphocytes 60 per cent., large lymphocytes 33 per cent., polymorphonuclears and endothelial cells 7 per cent.

A specimen of urine removed by catheter with antiseptic precautions gave a similar growth to that found in the blood and cerebro-spinal fluid.

From October 8th to 14th the patient was at his worst; he lay in a drowsy, stuporous condition, with low muttering delirium, with an occasional loud cry, like a patient with meningitis. During the nights the delirium became more violent, and he shouted out and tried to get out of bed. At this time he could not be sufficiently roused to answer questions, and appeared to be somewhat deaf; he lay down in the bed on his back; restlessness was not a marked feature of the illness. The tremor increased, and there was marked subcutaneous tendinum. At the same time there was some retraction of the