Sheffield, with which I am connected as Honorary Physician.

The weekly Board of the hospital having sanctioned the proceeding, I started in the autumn of 1893 by putting up a notice in the out-patient waiting room to the effect that patients suffering from mental disorder would be seen at 1.30 P.M. every Tuesday, and that it was advisable that patients of this class should be accompanied by a near relation. The response to my notice was immediate and continuous, and for the last four years and a half cases of mental disease have never failed to present themselves on the day set apart by me for their treatment. During this period every form of insanity has passed under my notice at the hospital, and with very gratifying results.

The great object aimed at in the establishment of this department has been to get at the insane of the lower classes in the early stages of their malady, which are so much more amenable to treatment than the more advanced ones. To this end I spoke in my notice of mental disorder and not of insanity, as the latter term is singularly abhorrent to these people.

The first thing to determine, on a case presenting itself, is whether or no it is a suitable one for out-patient treatment, or whether it would be more properly dealt with inside an asylum, thus providing the poor with expert advice gratuitously on a most important point.

Where I have thought it advisable to recommend asylum care, I have always found the relatives ready to fall in with my suggestion, though previously, perhaps, averse to taking action in the matter. However, the great proportion of patients presenting themselves have proved suitable for out-patient treatment and home management.

In the absence of such a department as I am describing, these patients would too frequently be put through a routine narcotic treatment, which might or might not be suited to the case; or, on the other hand, would receive no treatment whatever. Such as these are the cases which would be specially benefited by the advice and treatment of an expert mental physician attached to the staff of a general hospital; and I am anxious to support Dr. Rayner's contention that such a physician should, wherever practicable, be attached to at least one hospital in each large town.

My own experience is that patients of this order readily avail themselves of the facilities afforded, and are brought at an early stage of their disease to the hospital consulting room, with, in many cases, eminently favourable results. Dr. Rayner, in a letter to me on this subject, says: "What strikes me with wonder is the ease with which arrest can be effected in these early stages." I can quite bear out this statement.

Another function of this department is to render aid in the supervision and after-care of patients discharged as convalescent from county asylums with their mental equilibrium still somewhat unstable.

A CONTRIBUTION TO THE PHARMACOLOGY OF THE MAMMALIAN HEART.

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THE effects of drugs on the mammalian heart have hitherto been experimentally studied chiefly by an indirect method, the graphic registration of the arterial blood pressure by means of the manometer, the results thus obtained being interpreted by the aid of the changes observed in the frog's heart. Although the value of this procedure is undoubted, it seems high time that some of the direct methods which have given such valuable results in the hands of the physiologist should be introduced into the pharmacological laboratory. The numerous factors on which the tension of the arteries depends render deductions as to the condition of the heart very insecure, while the reaction of the frog's heart to poisons is often very different from that of the mammalian. A systematic examination of the effects of some of the more important drugs has therefore been carried on by direct methods in the pharmacological laboratory of this University during the last three years.

METHODS.

The rabbit's heart was observed directly by dividing the sternum and opening the pericardium, while the cardiometer of Roy and Adami was employed to register the movements of the cat's heart, and a somewhat modified form of their myocardiograph¹ was used in experiments on dogs. The rabbits were anaesthetised with urethane, the cats and dogs with morphine and chloroform acetone.

1. DIGITALIS SERIES.²

A number of drugs of this series (digitalin, digitoxin, strophanthin, antiarin, erythrophlocein, convallamarin, oleandrin, etc.) were examined, and all gave very similar results. After therapeutic doses, the rhythm of the heart was slowed, the relaxation of the ventricles was considerably increased, and their contraction rendered more complete. The auricular systole was generally weaker, while its relaxation appeared unaltered, although the last could not be measured accurately. The contraction volume, or amount of blood rejected at each ventricular contraction, was increased, the total output per minute augmented to a less extent.

When the vagi were paralysed by the injection of atropine previously, digitalis produced a very different result. The rhythm was then unchanged, while the ventricular systole became much more perfect than before, and its dilatation during diastole was either unchanged or was less than that before the injection. The changes in the auricle were identical with those in the ventricle. The contraction volume and the output per unit of time were augmented in equal proportion, and often to a much greater extent than when the vagi were intact.

The changes seen in hearts in which the inhibitory mechanism is uninjured are, therefore, due to two distinct and separate factors—the stimulation of the regulating apparatus (chiefly in the medulla oblongata) and the direct action on the cardiac muscle, which is observed in the heart after the former has been paralysed by atropine. The slow rhythm and increased dilatation of the ventricle are due to the inhibitory stimulation, which would also lead to a less perfect systole were this effect not opposed by the direct muscular action. In the auricle the inhibitory action overbalances the muscular, so that the latter at first appears to be wanting, but is shown to be present by the atropine experiments and also by more careful examination of the other tracings. The vagus effect would also lead to a lessened contraction volume and output were it not for the compensatory increase in the ventricular systole. It is to be remarked that the muscular action does not prolong the systole in the mammalian as it does in the frog's heart. The blood pressure rises in this stage, partly from the increased output of the heart and partly from contraction of the vessels.

Poisonous quantities of these drugs may cause two entirely different results, according to which of these two factors is thrown into the greater prominence. If the inhibitory stimulation is the more pronounced, the rhythm becomes extremely slow and somewhat irregular, the ventricular relaxation is more marked than after therapeutic doses, and the systole is often reduced in strength. The auricle generally ceases in diastole, and the output falls to a very low point. These symptoms are often accompanied by cyanosis and dyspnoeic and convulsive movements. The heart then gives a few rapid contractions and the ventricle passes into delirium. On the other hand, if the muscular action is the more highly developed, the ventricle assumes an independent rhythm, which undergoes rapid acceleration. If the auricle continues to beat at a different rate, there results a periodic variation in the extent of contraction and relaxation both in the auricle and ventricle, which gives a characteristic appearance to this part of the tracing. With advancing intoxication these periods become shorter and less regular, and, after a stage of extreme irregularity, the ventricle ceases its contractions and goes into delirium cordis, while the blood pressure, which has been slowly falling as the heart becomes more irregular, descends to zero.

2. ACONITINE³ AND VERATRINE.

In therapeutic doses these produce slowing of the rhythm, increased relaxation and less complete contraction of the

ventricles and auricles, owing to their stimulating the inhibitory centres in the medulla oblongata. They have no direct action on the heart except in very large quantities, when they produce an independent ventricular or auricular rhythm and consequent irregularities, which sometimes resemble those following poisonous doses of digitalis. Aconitine is more apt to cause these than veratrine, which, on the other hand, we found to stimulate the inhibitory centre more strongly.

3. CAFFEINE.

Intravenous injections of small quantities of caffeine (0.03 to 0.05 g.) had often little effect on the dog's heart, although distinct acceleration occurred in some experiments after 0.05 g. Larger doses were followed by marked acceleration, for example, from 90 to 117 beats per minute after 0.2 g. This acceleration was not accompanied by any distinct alteration in the strength of contraction or in the extent of relaxation, and only lasted from 10 to 20 minutes. In very large quantities caffeine sometimes elicits an independent ventricular rhythm, which again leads to the rhythmical variations mentioned under digitalis.

4. STRYCHNINE,

even in large quantities, has no direct action on the heart, but often causes some slowing from inhibitory stimulation, which, however, is not nearly so marked as that observed after aconitine and veratrine. The blood pressure is increased by doses which are too small to increase the reflex irritability to any very marked extent.

5. NITROGLYCERINE

does not increase in any way the contraction or efficiency of the heart. In fact it has no effect on that organ save in large doses, which weaken the systole, especially that of the auricle. This effect seems to be due to a direct action on the heart muscle, perhaps aided by the changes in the blood.

6. ALCOHOL

injected intravenously does not in any way increase the efficiency of the heart. The smallest quantity from which any result was observed was equivalent to $\frac{1}{2}$ c.cm. of absolute alcohol, and produced a transient weakness of the auricular systoles. Very much larger quantities (equivalent to $7\frac{1}{2}$ c.cm. absolute alcohol) were required to produce any permanent injury, and even these did not materially affect the rhythm, but only the strength of the contractions. Even 20 c.cm. of 50 per cent. alcohol injected into the vein of a small dog only produced a slight and transient weakness of the ventricle, which recovered itself entirely within three minutes. The strength of the auricular contraction was at first profoundly affected by this quantity, but this rapidly passed off, although no such complete recovery followed as in the ventricle.

Of all the drugs examined, then, the digitalis series and caffeine alone were found to increase the efficiency of the heart, and would be entitled to rank as cardiac stimulants. Caffeine differs from digitalis, however, in its increasing the number and not the strength of the contractions, and would therefore seem to stimulate the rhythm-giving mechanism rather than the auricle and ventricle proper. Digitalis, on the other hand, acts primarily on the strength of the contractions, and only produces noticeable acceleration when administered in poisonous doses. It would therefore seem to act chiefly on those parts of the heart which are endowed more largely with contractile power than with automatic. Caffeine can in no sense be considered a substitute for digitalis, but may have a special sphere of usefulness in cases in which acceleration alone is desired. To induce any increase in the rhythm considerable quantities of the drug would seem to be necessary from our experiments. The essential feature of the digitalis action in therapeutics does not seem to be the inhibitory stimulation and the slowing of the heart, for if this were the case veratrine and aconitine would give equally good results. Its beneficial effects are rather due to the changes which it produces in the heart muscle, and it is to be desired that some drug possessed of this property and devoid of its action on the inhibitory centre were available. The different members of the series vary somewhat in this respect, digitoxin and erythrophloin acting more strongly on the vagus centre and relatively less on the heart muscle than strophanthin.

From our experiments with the digitalis series, the further deduction may be made that the therapeutic effects of these drugs cannot be estimated by the slowness of the pulse. The muscular action may be induced without any marked alteration of the rate of the heart, if from any cause the inhibitory apparatus is weakened, or if one of the series which has but little action on that apparatus has been administered. Much less weight should therefore be laid on the rate of the pulse than on its other characters and on the general symptoms in digitalis treatment. In cases where slowing of the pulse is desired without further alteration, aconite and veratrine would seem to be indicated rather than digitalis. Strychnine and nitroglycerine owe their use in disorders of the circulation not to any changes produced by them directly in the heart, but to their vascular effects. Strychnine increases the resistance to the contraction of the heart by narrowing the calibre of the arterioles through the vasoconstrictor centre; while nitroglycerine dilates the vessels through acting on their coats, and therefore lessens the resistance against which the heart has to work. Both of these may therefore be of value in certain conditions of the circulation; and nitroglycerine would seem to be indicated where the contraction of the vessels induced by digitalis has to be avoided.⁴

Any beneficial effects produced in the heart by alcohol or ether must be attributed to their local irritating properties which may increase the activity of the medullary centres reflexly, or to their general action on the central nervous system and the tissues.

REFERENCES.

¹ *Journ. of Phys.*, xxi, No. 3. ² For details see *Journ. of Exp. Med.*, ii, pp. 233-299. ³ See Matthews, *Journ. of Exp. Med.*, ii, p. 594. ⁴ Cf. Marshall, *Journ. of Phys.*, xxii, No. 1.

ACETYLENE, THE NEW ILLUMINANT, AND THE DANGERS ARISING FROM ITS INHALATION.

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IN the BRITISH MEDICAL JOURNAL of March 12th, p. 713, attention was drawn to this new illuminant. As the subject is at present attracting public attention owing to the ease with which the gas can be generated and the likelihood of its being used pretty widely throughout the country, it may be well to point out to your readers certain facts connected with the medical side of the question. In the article referred to allusion is made to the greater explosibility of acetylene compared to ordinary coal gas. A mixture of air and acetylene commences to be explosive when it contains 5 per cent. of acetylene, whereas it requires the presence of 8 per cent. of coal gas to make a similar mixture explosible. This, therefore, is one of the dangers attending the use of the new illuminant, and its excessively pungent and disagreeable odour, though a warning to the individual of its presence, is one of its disadvantages. Experimenting with calcium carbide from which the gas is obtained on the addition of water, my colleague, Dr. R. A. Bolam, and myself had ample evidence in the Physiological Laboratory of the unpleasant and penetrating odour of acetylene, the rapidity with which the gas is evolved immediately, and of the great heat which is generated. This latter circumstance would point to the absolute necessity of having acetylene, if being made for private mansions, generated in the open air or in a covered shed open at the sides.

Our experiments were directed rather towards an investigation of the poisonous properties of the illuminant when inhaled compared with coal gas. In the case of coal and water gas, death supervenes by asphyxia owing to the carbon monoxide, so largely present in these gases, entering into extremely stable combinations with the hæmoglobin of the blood, from which it is with difficulty dissociated. It is the absence of odour in water gas that renders it so dangerous; its influence is so subtle because of its presence being unperceived. Under ordinary circumstances a short period is sufficient to asphyxiate an animal by coal gas. With the assistance of Dr. Bolam I have tested the effects of acetylene. If a rabbit, for example, is placed in a bell jar into which ordinary air and acetylene are pumped, the animal seems for a very