escaping. The catheter was then introduced as far as possible without discomfort, and the solution injected from the catheter by pressing on the bulb of the pipette. After waiting a short time the catheter passed into the bladder, to the great relief of the sufferer.

CASE 2.—Three years later I made a social call on an old medical friend whom I found in great distress. He had not been able to evacuate the bladder for three days, and it was distended to the umbilicus. The attending physician had made repeated efforts to use the catheter, but the pain it occasioned and the failure of results had made the old doctor rebel against further effort. After explaining my previous experience to him, he consented to allow me to try.

The procedure as related above was carried out, with the identical result. The patient passed a large quantity of urine, and was able to use an ordinary soft catheter thereafter himself. However, he never recovered, but died within a month. I am convinced that his last days were made comfortable by my accidental call.

CASE 3.—In September, 1905, I operated on an old man, and at 11:30 p. m. he began to complain of his bladder. The assistant surgeon was called and used hot applications and catheter, but failed to start the urine. The distress increased, and at 4 a. m. I was called by telephone, and suggested that adrephrin and cocain be used. At 5 a. m. I was called again as the attempt to relieve the patient had failed. On arriving at the hospital I found that an effort had been made to introduce the fluid after the catheter was introduced. A long column of air prevented the admission of the astringent to the parts. I prepared a fresh solution, and within ten minutes the patient was relieved and was resting comfortably. He had no more trouble, and made a good recovery.

WRIGHT'S "THROTTLED CAPILLARY" ADAPTED TO THE CONTROL OF BLOOD-COUNTING PIPETTES.*

THOMAS R. BOGGS, M.D.

Associate in Medicine, Johns Hopkins University; Assistant Resident Physician, Johns Hopkins Hospital.
BALTIMORE.

Having repeatedly observed the difficulty many students and physicians experience in acquiring an accurate technic with the coarse capillary pipettes such as are in constant use for leucocyte counting and hemoglobin estimation, it occurred to me that Wright's "throttled capillary" might be adapted to the control of these instruments.

After some experiments, the device illustrated in the accompanying drawing was found to give very satisfactory results.

Description.—It consists of a capillary tube "throttled" in the manner described by Wright, that is, heated in a very small flame and then quickly drawn out into a fine thread.

* From the Clinical Laboratory of Johns Hopkins Hospital and University.

The caliber of this tip must be so fine that when gentle suction is made the air comes through very slowly.

The outer protecting tube is from 5 to 7 mm. in diameter and drawn out to an hour-glass shape. The large part of the capillary (a) is marked with a file so that it may be conveniently broken off after cementing in the holder. This latter is easily accomplished by molding a little sealing wax near the throttled end, passing the larger free end of the capillary first through the holder, and, after warming gently at the constricted part, drawing the waxed end down into the narrow waist of the tube. The wax softens and fills the constriction (c), and on cooling leaves the capillary firmly cemented in place. The ends should be about 5 mm. short of the open ends of the container. It is easy to break off this larger end of the capillary at the point marked, by using a fine forceps passed into the larger tube.

With a little patience any one can make the apparatus. A few trials may be necessary in order to determine the fineness of the "throttle." This should be so arranged that, with gentle suction, the filling of the pipette is slow, while with stronger pressure one may rapidly draw in the mixing fluid.

The device should be connected to the pipette with the fine point (b) toward the mouth end as indicated in the drawing.

In the subsequent washing of the pipette with water, alcohol and ether it is advisable to remove the controlling device, as a drop of fluid drawn into the "throttled" end will occlude it and render it useless.

With this controller it is easy to draw the column of blood steadily and slowly to the point desired, and it also keeps the blood from falling from the pipette in transferring the tip to the bottle of diluting fluid.

The controller is found to give very satisfactory results in the hands of beginners using leucocyte counters and hemoglobinometer pipettes. It may also be used with a large rubber teat instead of the mouth piece and suction tube. In this event, the teat must have a small round hole punched in its upper end so that the negative pressure may be instantly relieved by the admission of air. The teat, however, does not give, in my hands, as satisfactory results as the ordinary suction tube.

DIGITALIS HEART BLOCK.

ALBION WALTER HEWLETT, M.D.

Assistant Professor of Medicine, Cooper Medical College.
SAN FRANCISCO.

The digitalis arrhythmias have been so thoroughly described by Mackenzie¹ that it would seem hardly possible to add to his description. Yet the subject is one of considerable interest, and, since the case here reported presented some peculiarities, I shall briefly relate the patient's history and the observations made on him.

Patient.—J. E., laborer, aged 44, was admitted to the wards of Dr. J. O. Hirschfelder at the City and County Hospital, San Francisco, on April 17, complaining of pain in the left side, the back, and the legs. Family history was negative.

History.—The man has had typhoid fever, pneumonia and malaria; he has used alcohol to excess and tobacco moderately. He has never had acute articular rheumatism, and denies venereal disease. For some time he has been short of breath on the least exertion and has had slight cough and expectoration. One year ago his chest was tapped for a pleuritic effusion. Appetite and digestion are poor. He has frequent vomiting spells, especially in the morning, and often has pain in the region of the stomach. He has vomited small amounts of blood at times and has had tarry stools.

Examination.—Physical examination showed a well-nourished and fairly well-developed man with signs of pleuritic adhesions at the base of the left lung, and a few râles at the

1. Mackenzie, J.: "New Methods of Studying the Heart," Brit. Med. Jour., 1905, pp. 519, 587, 702, 759, 812; Deut. med. Wochschr., 1904, p. 875.

right apex. The point of maximum cardiac impulse was visible in the fifth intercostal space in the mammary line, 10 cm. from the median line. The area of cardiac dullness extended from the lower border of the third rib above, to 11 cm. to the left and 3 cm. to the right of the median line. A systolic murmur was faintly heard at the apex, but was much louder over the aortic area. The second pulmonic sound was accentuated. Heart rate was 96 a minute and regular. The radial arteries were moderately thickened. Liver was palpable 2 cm. below the costal margin. The spleen was large, hard and smooth and palpable 5 cm. below costal margin.

Urine: Acid, sp. gr. 1.019, no albumin, no sugar, few granular casts.

Clinical Diagnosis.—Left-sided pleuritic adhesions, chronic alcoholism, cirrhosis of the liver, arteriosclerosis.

History in Hospital.—While in bed the pulse rate varied be-

Fig. 1.—V, elevations produced by contractions of ventricles; a, smaller elevations produced by contractions of auricles. Lower tracing is from veins of neck.

tween 82 and 90 a minute. On account of his dyspnea, he began on May 8 to take normal solution of digitalis (P., D. & Co.) (15 drops three times a day). His pulse rate was not affected by this until May 18, when it fell rather suddenly to from 46 to 60 a minute, at the same time becoming irregular. The digitalis was stopped on this date and four days later the pulse became normal again. This same experience was repeated on two subsequent occasions; i. e., the use of digitalis was followed by a slow and irregular pulse. This irregularity consisted in a dropping of beats. Auscultation showed that this dropping was not due to the occurrence of extrasystoles but that during the period of intermission there was either

Fig. 2.—Tracings from jugular vein and from apex.

absolute silence over the heart or at most only a faint and indefinite soft sound over the base (auricular contraction?). The patient complained of precordial distress during the irregular heart action.

CHARACTER OF PULSE.

Simultaneous tracings taken from the veins of the neck and from the apical region showed that the irregularity present could be divided into two forms. The first of these was due to a blocking of the cardiac contraction wave on its passage from the auricles to the ventricles. The upper tracing on Figure 1 shows a series of larger elevations, V, produced by the contrac-

tions of the ventricles and a series of smaller elevations, a, produced by the contractions of the auricles. The lower tracing, from the veins of the neck, shows three principal elevations: c the transmitted carotid pulse, a wave due to the contraction of the auricle, and v a wave that depends in some manner on the contraction of the ventricle. The distance from the beginning of a to to the beginning of c has been termed the a-c interval. Assuming that the carotid and jugular pulses take approximately equal periods of time in traveling from the heart to the neck, then the a-c interval represents the time taken by (1) the auricular systole, (2) the passage of the contraction wave from the auricles to the ventricles, and (3) that portion of the ventricular contraction which occurs before the opening of the semi-lunar valves (period of tension). Of these factors the second seems to be the most variable and consequently the duration of the a-c period has been used to estimate the time taken in the passage of the cardiac impulse from the auricles to the ventricles. According to Mackenzie, this period normally does not exceed 0.2 seconds. In this patient, when not under the influence of digitalis, the duration varied from 0.20 to 0.25 seconds, i. e., there was in him a very slight retardation in the passage of the cardiac impulse from the auricles to the ventricles. When he took digitalis, the conductivity of the auriculo-ventricular fibers was still further diminished, the a-c period varying from 0.25 to 0.40 seconds. This injury to the conductivity then became such that certain waves failed entirely to cross the auriculoventricular junction; a' is such a wave (Figs. 1 and 2). We see from the jugular tracings that it is followed by no carotid pulse and from the apex tracings that this is due to an absence of the ventricular systole. The auricles contract

.95	.93	.84	.99	.95	.95	.96	
.35	.33	.26	.35	.39	.37	.46	
.93	1.10	1.08	.99	.93	.99		

Fig. 3.—Diagrammatic representation of Fig. 2. The lower verticals represent the ventricular systoles, the upper the auricular systoles, and the oblique lines the duration of the a-c periods. Notice that these latter cause the ventricular intermission to be relatively shortened and the first subsequent ventricular period to be relatively lengthened.

as usual, but the contraction wave does not reach the ventricles. It is blocked at the auriculoventricular junction. The conducting fibers are not even called into activity apparently, for the next auricular wave that reaches them regularly crosses with unwonted rapidity. Thus, in Figure 2, the a-c period before the intermission is 0.33 to 0.37 seconds and immediately after the intermission it is 0.26 seconds. This shortening of the a-c period after the intermission produces a characteristic change in the rhythm of the ventricles, causing the intermission there to be less than twice the interval of a normal beat and the first normal beats succeeding to be correspondingly lengthened. These relations are made clear by referring to Figure 3, which has been constructed according to the plan devised by Wenckebach and Mackenzie. The vertical lines above represent the auricular contractions; those below, the ventricular contractions, and the connecting oblique lines, the transmission of impulses across the auriculoventricular junction. The duration of this transmission (a-c) is represented by the obliquity of the line. A glance at this diagram makes clear the relative shortening of the ventricular intermission and the relative lengthening of the subsequent beat or beats.

Similar observations on the block action of digitalis have been made by Mackenzie,¹ by Riehl² and by Joachim.³ Mackenzie states that digitalis will produce this block between auricles and ventricles only when the conduction of impulses across the auriculoventricular fibers is already impaired. If the *a-c* period is 0.2 seconds or less, then digitalis had no blocking effect. If the *a-c* period exceeds 0.2 seconds, then digitalis should be used carefully, for a block at the auriculoventricular junction is liable to occur. If this view proves to be correct, it is a matter of considerable practical importance, for we shall be able to segregate a certain class of cardiac patients who may be presupposed to take digitalis badly. The digitalis block frequently, as in the case here reported, causes distressing cardiac symptoms and impairs the capabilities of the heart.

This peculiar block effect of digitalis is believed by

Fig. 4.—The intermissions in this tracing show an absence of auricular contractions. The location of the apices of such contractions if they had been present is indicated by arrows.

Hering⁴ to be due to a stimulation of the vagus nerve. Since atropin paralyzes the vagus terminations in the heart, I have tested the effects of this drug on the *a-c* interval in three patients. A fiftieth of a grain of atropin was twice given hypodermically to the patient whose history has just been reported—once when he was under the influence of digitalis and once when he was not. In both cases, the effect was practically identical. The pulse rate was slightly accelerated. One would suppose that this acceleration, by lessening the period of rest for the already impaired auriculoventricular fibers would lead to a lengthening of the *a-c* period. Such was not the case, however, as the accompanying chart shows.

In these observations, the time was marked off by a tuning fork that was vibrating hundredths of a second.

Atropin was also given to two other patients who showed well-marked auricular pulses. In one of these, a neurasthenic with subacid gastritis, the effect was similar to that just described, the average length of the total systole being shortened from 0.79 to 0.60 seconds and the average length of the *a-c* period being shortened from 0.17 to 0.14 seconds. In the third patient, a convalescent typhoid, a contrary effect was produced, the duration of the total beat being decidedly shortened (from 0.87 to 0.65), whereas the duration of the *a-c*

interval was slightly lengthened (from 0.20 to 0.25). The question of the effect of atropin on the transmission of impulses across the auriculoventricular bundle may prove of some practical importance, for by its use we may be able to correct the slighter irregularities that arise from a vagus block at the auriculoventricular junction. I regret that I was unable to test the combination of atropin and digitalis on my patient.

Earlier in the paper it was stated that at least two forms of arrhythmia were produced by the use of digitalis on my patient. The second form bore a superficial resemblance to the first, for here also a beat was apparently dropped out, leaving a long intermission. This form differed from the first, however, in the important fact that no auricular pulsation occurred during the

Fig. 5.—Diagrammatic representation of Fig. 4. The lower verticals represent the ventricular systoles, the middle verticals the auricular systoles, and the uppermost verticals the rate of stimulation at the venous sinus. The lower oblique lines represent the time taken in the passage of the contraction waves from the auricles to the ventricles. The upper oblique lines represent the time taken in passage from the great veins to the auricles. This latter is purely hypothetical.

It will be seen from the chart that the *a-c* interval was reduced from an average of 0.23 seconds to an average of 0.17 seconds, and that this reduction was proportionately greater than the reduction in the length of the total wave. This shortening must be due to the atropin, and, since atropin paralyzes the vagus terminations in the heart, it supports the view that the vagus nerve influences the transmission of impulses from the auricles to the ventricles.

pause in the ventricular rhythm. Figure 4 shows three such long beats interposed in an otherwise regular rhythm. Similar beats occurred throughout the tracings taken at this time; sometimes singly, sometimes in series, so that two distinct rhythms appeared to be present. In Figure 4 the auricular waves *a* are well marked on the jugular tracing and are indicated on the apex tracing; yet, during the intermission, they are entirely absent on both. The duration of the intermission between auricular beats is nearly equal to twice the duration of the normal beats; while the duration of the auricular periods next succeeding the intermissions exceeds slightly that of the subsequent periods (Fig. 5).

2. "Analyse von fünf Fällen von Ueberleitungsstörungen," *Ztschr., f. exp. Path. u. Therapie*, vol. II, p. 74.

3. "Vier Fälle von Störungen der Reizleitung im Herzmuskel," *Deuts. Arch. f. klin. Med.*, vol. lxxxv, p. 373.

4. Hering: *Cong. f. in. Med.*, 1906.

How are we to account for these intermissions? From the fact that the long waves are approximately twice the length of the short waves it seems most probable that the rate of stimulation has remained approximately constant, but that the auricles have failed for some reason to respond to certain of the stimuli. Such a failure to respond might be due to (1) weakness of the muscle, (2) an inadequate stimulus (weakness of the stimulus or refractory condition of the auricle), or (3) a block of the impulse before it reached the auricles. Against the first supposition we have the facts that the auricular contractions as shown on the tracings are well marked and that there is no sign of an alternation in the size of these contractions (a sign of weakness). Against the second and in favor of the third supposition is the fact that the intervals between the auricular beats immediately following the intermission are somewhat greater than the intervals between subsequent beats. This, as we have seen, is characteristic of the ventricular beats when the block occurs above the ventricles, e. g., at the auriculoventricular junction. As has been explained it is then due to the more rapid transmission of stimuli across this junction after a period of rest (Fig. 3). Similarly we may assume in the present instance that a block has occurred above the auricles, between these and the mouths of the great veins whence the contraction waves originate. Such a block can be produced experimentally in the turtle's heart by vagus stimulation, and venous tracings that were believed to indicate such a block in man have been published by Joachim⁵ and by Wenckebach.⁶ Joachim's tracings, however, are poor and unconvincing as to the absence of the auricular wave. Wenckebach's, on the other hand, are quite typical and hardly to be interpreted in any other way.

I have said that the duration of the intermissions in these cases was approximately twice that of the smaller beats. This relation is approximate only, however, for throughout my tracings the long beats, as in Figure 5, are always less than twice the length of the short beats. In some instances this may be explained entirely on the assumption of a block above the auricle. In other instances, however, this discrepancy is very marked; so that the average length of a series of long beats is but slightly in excess of half again the length of the short beats. I would explain these discrepancies by assuming that the rate of stimulation is quickened during the intermissions. When one remembers that the supposed block must be located near the point of origin of the stimuli, such a secondary involvement of the rate of stimulation is neither surprising nor improbable. This assumption is furthermore supported by the fact that a few portions of my tracings show an arrhythmia that can only be interpreted by assuming a variable rate of stimulation above the auricles.

A UNIQUE CASE OF EYESTRAIN.

PERCY R. WOOD, M.D.
MARSHALLTOWN, IOWA.

The eye may be designated as an end organ of the brain through which the latter discharges its visual function, thus explaining the disturbance of cerebral reflex centers by slight errors of refraction and consequent interference with various functional activities.

Twenty-five per cent. of all civilized people suffer

from conditions dependent on ocular malfunction and clinically described as eyestrain. A large proportion of these cases is not reached because few physicians correctly diagnose the condition, the profession, as a whole, being poorly informed on this subject. If insomnia, nervousness, headache, indigestion and constipation may result from ocular defects, the physician should know this and so be able to prescribe the proper remedy.

Whenever our text-books emphasize more clearly, and our medical schools teach more explicitly, the pathogenesis of eyestrain, we may have recognized colleges for postgraduate work along these lines and laws confining the practice of ophthalmology and refraction therapy to those especially qualified and licensed. This would protect the public from embyro specialists and opticians who do harm. If headaches and systemic disturbances of a digestional or psychic character, which are unrelieved by drugs, were referred to the ophthalmic surgeon, more satisfactory results would obtain.

Conditions predisposing to eyestrain often date from birth and attract attention only after serious consequences have accrued. A law requiring the examination of children's eyes and the correction of refractive errors before they are permitted to enter school would mean much in health and happiness.

As demonstrating that eyestrain leads to ignorance, invalidism, pauperism and crime, we find in statistics taken of the school children of Berlin that over 40 per cent have refractive errors. The number of children thus affected shows a decreased ratio from the lower to the higher grades, indicating that ocular defects are factors in reducing school attendance. Eighty per cent. of the patients at the National Hospital for Epileptics in London have serious ocular lesions.

The same deficiency appears to play a rôle in nervous diseases. The bulletin of Iowa institutions for 1903, by Dr. Applegate, indicates that nearly 50 per cent. of inebriates have ocular defects. Statistics also show that nearly 50 per cent. of the young criminals at the Elmira Reformatory have defective vision, which has been held responsible, in part at least, for their downfall.

The case given below is unusual. It demonstrates the depth and range of ocular reflexes, as well as the necessity of never overlooking the eye in making a diagnosis.

CASE 1.—Miss M. of Marshalltown, aged 10, first seen last June, was suffering from a group of symptoms easily recognized as being of ocular origin, viz., nervousness bordering on hysteria, melancholia, indigestion, headache, etc., but standing out from this striking clinical picture was one symptom, unknown in my experience, enuresis, occurring mostly at night. She had suffered from this distressing symptom for two years and had consulted many physicians and obtained no permanent relief. She had taken treatment for neurasthenia, indigestion, liver and kidney troubles.

Under a cycloplegic I found the following errors:

R. Sph. plus 1.50, Cyl. plus 0.87, axis 180.
L. Sph. plus 2.50, Cyl. plus 1.00, axis 175.

Notice the astigmatism against the rule. I prescribed:

R. Sph. plus 1.00, Cyl. plus 0.50, axis 180.
L. Sph. plus 2.00, Cyl. plus 0.87, axis 175.

The more aggravated symptoms gradually lessened in severity and now six months later she has entirely recovered.

The result in this instance goes to show that no obscure case of a functional, organic or psychic nature has received proper consideration until the eyes have been skilfully examined under a mydriatic and every phase of the case gone thoroughly into from an ophthalmologic standpoint.

5. Beiträge zur Kenntnis der menschlichen Herztätigkeit," Arch. f. Anat. u. Physiol., Abteil, 1906, p. 297.