none of these properties of *muscæ*. The particles are not floating freely, but move only in definite lines. Gravity has no effect on them. Movement of the eyes in any direction carries all of the particles seen in the same direction, with the same angular velocity that the eye has. Suddenly stopping the motion of the eye does not allow the particles to fall in any way. It is an impossibility to make these particles rebound. They never move backward and forward in the same path. It is absolutely impossible to bring one of them to the center of the field of vision. The particles that produce *muscæ volitantes* are frequently globular in appearance, or sometimes ring-like, and these rings sometimes have a darker center. These rings or globes may be of sufficient size to subtend one or more minutes of the arc. In all of these respects *muscæ* differ from the spots seen with the blue glass. The latter are so small that it is impossible to perceive any structure whatever. Sometimes a number of globular or ring-like *muscæ* may be seen to be connected together by a band, forming an appearance resembling a string of beads. These strings may sometimes be straight and of some length. The particles seen with blue glass are never connected together by any visible band, neither are they ever arranged in a straight line of an appreciable length.

Having pointed out the dissimilarity between *muscæ* and the particles seen with the blue glass, we will consider these particles more particularly. They are very small and without visible structure. Their motion is a peculiar jerky one, each particle moving forward rapidly for a moment and then for a moment having a slower motion. During the rapid part of the motion the particles seem to be slightly elongated; without doubt this apparent elongation is due to the "persistence of vision." The motion of these particles exactly corresponds to that seen in the capillaries in the web of a frog's foot when it is examined under the microscope. The motion is never forward and back along a single path, but always in one direction. The jerks of this motion are synchronous with the pulse-beat. The number of jerks may be increased by anything that will increase the number of heart-beats, for example, physical exercise.

None of these particles can be seen in the field at the point of fixation corresponding on the retina to the macula lutea, but they are seen all around this point and their paths bear the same relation to the point of fixation that the retinal capillaries do to the macula lutea. Any movement of the eye gives the particles together in their paths the same movement both in speed and in distance as the angular movement of the eye. This fact would prove that the particles must be very near the percipient layer of the retina, as if they were situated any appreciable distance in front of the retina, their angular motion would be different from that of the eye.

The foregoing evidence seems to show that there is no similarity between these particles and *muscæ volitantes*, with the slightest exception that they are both entoptic appearances. There is everything to prove and nothing to disprove that the appearance is due to the image or shadow of the blood-corpuscles in the capillaries of the retina falling on its percipient layer. That these corpuscles have been seen and described by others there is no doubt. The only claim to originality that I make is that I have discovered an easy method of seeing them when the eyes are in health.

This subject has a practical bearing. This appearance is sometimes seen without the aid of blue glass. When this occurs frequently or constantly in the case of persons who are not trying to see it, it is valuable

evidence of ocular overwork. And when the appearance is continuous I have seen some evidence tending to show that it is a premonitory symptom of neurasthenia, but I have been unable to give this subject the attention which it doubtless deserves, as this class of patients seldom come to an oculist.

DISCUSSION.

DR. GEORGE M. GOULD.—I do not know that I can add anything of value to this discussion until I can make the experiments with the blue glass, and I can have no opinion on the matter at present further than that derived from a general consideration of the subject. I cannot see how there can be sufficient magnifying power added to the eye to make it possible to see the red blood-corpuscles. It takes a very high magnification to enable us to see them by the microscope. I have considered the phenomena spoken of as a matter of accommodation. Last year I spent some time in the mountains, and while there I noticed a great prevalence of *muscæ volitantes*, which were present all the time I remained there. I found that if I examined them without accommodation they were say a quarter of an inch in diameter, when looking at distant clouds, but with the use of the accommodation, and especially with the aid of ground glass, they narrowed down to the size of pin points. I have been supposing that these were the phenomena that the Doctor alluded to. I shall be very much interested in going through the experiments spoken of, and yet I cannot readily see theoretically how the retina can see its own red blood-corpuscles. This subject is indirectly related to a little instrument I meant to have shown at the meeting last year in Denver, but which was unfortunately broken in transit. It consisted in revolving a pinhole-perforated disc, 1/16 of an inch around the center of the pupil, so that it would throw shadows on either side of the capillaries.

DR. A. B. HALE.—If Dr. Norton will refer to Zeng's article in the *Monatsblätter* of April, 1897, he will find corroboration of his studies in perhaps more detail. It was enough to convince me that one could see his own blood-corpuscles and Zeng even thinks he can detect the red from the white corpuscles. The work was very thoroughly done and with enough detail to make one abandon the idea of *muscæ volitantes*.

DR. EDWARD JACKSON.—There can be no doubt as to what it is, for any one who has seen it will at once be struck by the resemblance to the capillary structure of the frog's foot. We must remember that the corpuscle is there in close relation to the retinal percipient elements so that the image is as large as the object. If you will take some object at a known distance and compare it with the size of these moving bodies, you can satisfy yourself that they are approximately the size of the blood-corpuscles; I think they are a little larger than the blood-corpuscles, probably from diffusion. I can see them even against this gray sky without any blue glass, and I can always see them against a blue sky. I think the blue brings them out because it approaches nearly to the complementary color of the corpuscle. There can be no question but that they correspond in size to the projected image of a blood-corpuscle situated in the retina and their motion is very characteristic.

DR. C. E. NORTON.—In my experiments with the colored glass I have found that the glasses having the colors that came near the violet end of the spectrum showed the corpuscles much more distinctly than those approaching the red, and I have not been able to see them very distinctly with any other glass, but I do not know that this has any special significance.

CHRONIC INTERSTITIAL NEPHRITIS.

TREATMENT OF THE HEART THEREIN.

BY ARTHUR R. ELLIOTT, M.D.

CHICAGO.

The sequence of events occurring in the cardiovascular apparatus during the progress of chronic interstitial nephritis is recognized as constituting an integral part of the pathologic incidence of this form of Bright's disease. The changes taking place may be briefly summed up as sclerosis of the arterial system and hypertrophy of the heart, conditions which in the fullness of their development invariably result in heart failure. The constancy of these circulatory accompaniments has been recognized since the days of Bright, who placed the per-

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centage of occurrence at 65. More recent estimates make a much higher showing, Goodhart's post-mortem average being 89.6 per cent., Ewald's 84 per cent., Kantschack and Holmes' 90 per cent., while Dickinson, Tiard, Balfour and others regard it as certain that thickening of the arteries and hypertrophy of the left ventricle are invariably associated with cirrhotic kidneys. It is not too much to say that hypertrophy of the heart and arterial fibrosis accompany, in some degree, every interstitial nephritis of any standing, and are dominant factors in the clinical history. In brief detail the cardiovascular sequence is as follows: As a result of the renal lesion and the consequent imperfect depuration of the blood or because of conditions which coexist, although not necessarily the outcome of the renal changes, an abnormally high vascular tension becomes established and may persist for years and progressively increase. This sooner or later brings about certain alterations in the walls of the arterioles, resulting in thickening, loss of elasticity and increasing resistance to the onward passage of the blood. This imposes an increased burden upon the left ventricle, which undergoes hypertrophy to cope successfully with the high peripheral resistance. Thus compensation is established. Up to a certain point this hypertrophy of the heart may be said to be a "compensatory" or at least an "accommodation" enlargement, and it is to that extent fortuitous and desirable, and so long as it compensates the renal lesion, its purposes are good. The evils of excessive hypertrophy may as a rule be successfully combated, but deficient or faulty compensation is fraught with serious consequences to the patient.

Samuel West¹, in the last Lettsomian lectures, remarks, "A persistently high tension under ordinary conditions is of itself mischievous, but not so with granular kidney, paradoxical as it may seem. The patient is best without granular kidney, but if the kidneys be granular, it is better that the tension be high than low; in other words, the patient is worse with low tension."

The changes in the arteries are progressive, and the increased blood-pressure permanent. The hypertrophied muscular tissue is prone to degenerative changes, and shows a greater tendency to subsequent exhaustion and weakness than the normal heart tissues, so that it is but a question of time until increasing impairment of the nutrition of the myocardium with constantly growing peripheral resistance results in failure of compensation and dilation of the hypertrophied ventricles. This nice adjustment to conditions that Nature brings about in the circulatory organs suffices by its compensation of the renal lesion to obviate the main danger of the nephritis, the retention of the uremic toxins. The debt which the kidneys owe the heart in this way is amply demonstrated when the cardiac compensation fails. Then the greatly diminished urine, increasing albuminuria, and rapidly developing uremia leave us in no doubt as to what organ has conserved the life of the patient. Moreover, because of the friendly offices of the heart we can obtain but little true idea of what the organic capacity of the kidneys really is, for what they are able to accomplish with the co-operation of a sustained blood-pressure and what they are capable of when deprived of such assistance are two widely different things. Kidneys which can well maintain their function under increased blood-pressure prove miserably inadequate when such support is removed. In a general way it may in consequence be stated that the condition of the heart is the best gauge of the disease. The clinical history of the vast majority of cases at their termination is that the excretion of urine was sufficiently good for the maintenance of life

and that the direct cause of death came elsewhere than from the kidneys—usually the heart.

Furbringer² is at some pains to point out that the heart does not simply compensate but overcompensates the kidney lesion. This may be a necessity imposed by the peculiar character of the renal changes but, however that may be, the cardiac condition is one of tense adjustment which becomes progressively more susceptible to influence, more sensitive, more resentful to any increase in the circulatory load. During the early stages of the disease the cardiac hypertrophy is not extreme enough to give rise to symptoms sufficiently pronounced to awaken even the notice of the patient. With the progress of the malady, evidences of embarrassment on the part of the heart become manifest, and giddiness, dyspnea on exertion, cardiac discomfort, headache and palpitation give to the clinical picture the "cardiac" aspect it seldom loses during subsequent progress. These symptoms are at first transitory, occurring at night time or following unusual exertion. With the onward march of the disease, these signs of impaired circulation become more permanent and distinct, and during the last few weeks the dyspnea is constant and dropsy and uremic symptoms supervene. At the same time the pulse loses somewhat in tension and the heart sounds become less distinct and accentuated. The pulse, save in rare instances, may be said never to lose the element of tension, although this may become modified through failure of the muscular power of the heart.

In the treatment of chronic interstitial nephritis, if we are to draw any inference from the clinical history, we have decidedly to deal with more than one set of organs—the kidneys. The damage wrought by degenerative process in the kidneys is irremediable, and in our endeavors to favorably influence the progress of the disease, we may with profit teach our art to follow Nature's lead and assist her in her heroic efforts at a conservative systemic compensation. Unaided the preservative adjustment in the circulatory organs—which is Nature's compromise with the erring kidneys—is sufficient of itself to extend the course of the disease over many years, and with such perfect accommodation that it may be only through some untoward circumstance that the real condition of affairs is discovered. By contrast, the futility of our own endeavors when the compensation has failed is apparent. The problem before us in the management of the disease will always include our utmost to conserve the damaged kidneys, and, if possible, stay the progress of the degenerative changes there, but it is no less incumbent upon us and important to maintain the *status quo* in the circulatory system. No greater mistake could be made than to approach the question of treatment solely from the standpoint of the kidneys and leave the overburdened heart and arteries to shift for themselves under the exigencies of an impaired organic life. With the greatest care we must avoid all conditions which threaten the hypertrophied and sensitive heart fibers. We must employ all means to support the tone of the cardiac muscle and promote the equilibrium of its nervous mechanism, and when compensation fails, we must strive to restore, if possible, the damaged heart wall and re-establish previously existing conditions.

In my remarks upon treatment, I shall make no direct reference to the measures one should address toward the control of the renal condition, but will confine myself to the treatment of the heart and arteries. The conditions which confront us here are, as we have seen, thickened and inelastic arteries which are constantly

subjected to the strain of a heightened tension, and a hypertrophied and sensitive heart muscle. Thus the patient is exposed to the risk of rupture of the degenerated vessels on one hand, and to failure of the hypertrophied heart on the other. As has been pointed out, both the increased tension and cardiac enlargement are compensatory and preservative, and on this account any effort to qualify either, unless taken with full understanding of conditions, may prove meddlesome and mischievous. The question is: At what point is one's intervention warranted? It is impossible to lay down any rule, but it would seem best to abstain from any active intervention as long as there are no definite subjective symptoms present. As soon as compensation passes in either direction the point of exact adjustment there is not lack of evidence to publish it. An increase of tension in the arterial system beyond the bounds of safety becomes manifest in dizziness, ringing in the ears, headache, disturbed cardiac action, unusual fullness of vessels, occasionally epistaxis, or it may be temporary amblyopia. The first sign of a flagging heart is seen in the pulse, which loses some of its hardness and becomes irregular and frequent. Additional signs are dyspnea, post-sternal weight and discomfort, cough on exertion or recumbency, and some diminution in the volume of urine.

In the early stages of the nephritis, if it be our good fortune to assume charge of the case at that amenable period, we should begin while compensation is still well maintained to take measures to ensure permanence to the existing conditions. If the full co-operation of the patient can be secured, much may be done for his future health. With this end in view it may be well to set the matter plainly before him and definitely state the necessities of his case, for it is often difficult to secure the faithful and permanent co-operation of the patient in so chronic a disease. As an assurance that no important detail of the patient's life escape, it is well to have him set forth minutely and in full a sample day of his life, his hours of work and sleep, his manner of occupation, his diet and habits. In this way a more thorough regulation of the small details of life, which are often important, may be secured. It is well to bear in mind that the directions to the patient are for his permanent adoption. We should, therefore, not risk misunderstanding, by lack of explicitness of direction or by trusting important details to the faulty memory of the patient. It is far more satisfactory to furnish him with full written particulars of the course to be pursued.

The details of life which will need especial care in regulating are the diet, clothing, exercise and baths. Exercise is of more importance to the nephritic than perhaps to any other, because of the great need that exists to secure as good a nutritive condition as may be. Regular exercise in the open air should be recommended. This may consist of walks upon the level, perhaps golf upon a level course, or easy bicycle riding upon a smooth and level road. Strenuous forms of exercise, such as tennis and horseback riding, should be interdicted, and the patient must be counseled never to hurry, run, or climb long flights of stairs, walk in the face of a strong wind, or attempt to mount steep acclivities, lift heavy weights, or strain at stool, and to be careful not to exert upon a full stomach. He should be warned to carefully guard against exhaustion and desist from all activity at the earliest approach of a continuous fatigue.

The clothing is a matter of much importance. These patients very easily take cold, in which case the kidneys and heart bear the brunt of the disturbance, and often to their permanent detriment. Moreover, the con-

tact of a chill air upon the surface causes contraction of the cutaneous capillaries, thus raising arterial tension and increasing the work of the heart. The patient must be cased in woolen garments from head to foot, and sleep with flannel next to the skin. In this manner, as Dickinson facetiously remarks, he may carry the temperature of summer under his waistcoat while breathing the air of winter, and so provide himself without leaving home with one of the advantages of travel.

The diet best suited to the control of the renal lesion is also best adapted for the heart. The cardiovascular changes are Nature's responsive efforts to combat imperfect blood depuration. Consequently, the careful regulation of the diet, according to the principles in vogue must form, especially in the earlier stages of the disease, the corner-stone of our treatment of the heart. The flatulence and autointoxication of indigestion are of all things the most disturbing to both the heart and kidneys. This is a development to which these patients are especially prone. The most scrupulous regularity of habit in regard to meals must be imposed, and the preparation of the food should of preference be by simple method. The patient must be cautioned against heavy meals, and eating to satiety, and be instructed against fast eating and insufficient mastication of the food. The regularity of the bowels should be scrupulously maintained, and an occasional mild mercurial purge administered. Warning must be made against the immoderate use of tobacco, the use of alcoholics, sexual excess, and emotional disturbances, because of their disturbing effect upon the cardiac system.

At the earliest signs of cardiac embarrassment some restriction in activity should be insisted upon and when compensation seems threatened, or has already given way, absolute rest in bed must be enforced. It should be remembered, however, that, beneficial as rest may be to tide over a period of wavering compensation, prolonged bodily inaction is undesirable and may work positive harm by impairing the nutrition, and thus hastening the degenerative changes at work in the cardiac walls. During the period of rest, massage and passive movements may do much to obviate these undesirable results. The greatest importance attaches to sustaining the mental tone of the patient, and regular sleep, which is one of the best of heart tonics, should be secured. To this end paraldehyde, trional and sulphonal may all serve excellent purposes and when a simple reflex irritability seems to be the underlying cause, the bromids may suffice. Chloral is frequently a dangerous cardiac depressant and opium is bad for the kidneys.

The medicinal measures which we can bring to bear upon the heart during the existence of its compensation are limited to the vasodilators. The effect of these remedies is largely mechanical. They act by dilating the capillaries, lowering peripheral resistance and thus diminishing the work of the heart. Moreover, by allowing a freer passage of blood through the vessels, the nutrition of the various tissues is improved. They are useful to overcome excess of tension in the arterial system, and are valuable aids in securing relief to an overburdened heart. To meet alarming symptoms and produce at once a decided effect upon blood-pressure, no measure is so useful as a free catharsis. In selecting a cathartic for this purpose, it is not a matter of indifference which one is chosen. Some preparation of mercury should be employed, for from it more decided benefit can be derived than from larger doses of other purgatives. The beneficial effect upon the tension of such a measure is well demonstrated in sphygmographic pulse-tracings

taken before and after the action of an aperient. This effect may be continued and supplemented by repeated depletion from the bowels or better by means of vasodilators. The vasodilators most useful in controlling arterial tension are the nitrites and the iodids. To meet emergencies amyl nitrite may be employed by inhalation, but its action is too ephemeral to admit of its continued use. For this purpose nitroglycerin is usually the drug of choice. It is well to bear in mind when prescribing the nitrites that those who have supernormal tension manifest a peculiar tolerance toward their action. Given in conventional doses they may prove disappointing. Nitroglycerin is very diffusible and within a few (five) minutes its effects become apparent, while at the end of three hours the arterial tension resumes its usual degree. A longer period than three hours should, therefore, not be allowed to elapse between doses, if a continuous effect is to be secured. The action of the iodids upon the vascular tension has been a subject of much dispute; some observers denying to them all effect and even condemning their use, while others enthusiastically praise them. Vierordt³ expresses himself unqualifiedly in their favor, and reports undoubted good effects in the control of tension. He regards the "modus operandi" of the iodids as entirely hypothetical, and, taking exception to Huchard and others who attribute to them direct action upon the heart and vasomotor nerves, he thinks it probable that the morbid process in the blood-vessels, which otherwise always shows a progressive character, is brought to a standstill, and that consequently the heightened blood-pressure is gradually lowered, which would provide for a decided amelioration of the circulatory function, although no retrogression of the vascular changes may be looked for. Judged from the effects upon the tension when administered for a considerable period, they may certainly be accounted a valuable means of relief to the overloaded circulation, and they may as well tend to restrain the hyperplasia in the kidneys. The most appropriate forms for administration are sodium and potassium iodids, in from five to ten grain doses given well diluted one hour after meals. Mercury protoiodid seems occasionally to render very happy service in cases marked by a bilious habit with coated tongue and sluggish liver. It is undesirable to give a prolonged course of mercury in nephritis, so that the protoiodid is best employed as an alternating substitute with one of the other iodids, and not continued for longer than two weeks at a time. One-sixth of a grain thrice daily is an appropriate quantity.

It is unnecessary to state that heart tonics of the digitalis group should never be used during the stage of cardiac hypertrophy. Digitalis and its congeners are only admissible when there is indication of failing compensation. In employing digitalis, its vasoconstrictor action must be borne in mind and provided against or the peripheral resistance may be dangerously augmented. This is best accomplished by the simultaneous administration of a vasodilator. A good practice is to give the vasodilator about one hour after the digitalis. The latter is slowly absorbed, while the vasodilators are without exception quickly diffusible, and by this arrangement of administration, the maximum effect of each falls together and control of tension is secured. It is a safer rule to follow, to always combine a nitrite or iodid with digitalis in interstitial nephritis, for some element of tension is never lacking. Strophanthus may be advantageously substituted for digitalis when the pulse tension is high. Its efficacy as a heart tonic is established and it lacks the arterial action of digitalis. It must, however, be used

with caution in advanced degeneration of the myocardium. If digitalis and strophanthus fail to elicit response from the failing heart, the outlook is grave indeed, and recourse to other measures holds out small prospect. Caffein and theobromin may prove of value on occasion, and nux vomica and strychnin will always be of the utmost value as adjuvants to any plan of treatment.

In the employment of the measures referred to it may be stated that digitalis and the heart tonics should in all cases be reserved for a failing heart while the vasodilators may be employed throughout, first as conservators of the heart by modifying peripheral resistance, and afterward as guards to the action of the heart tonics.

Time will not permit of more than a cursory reference to the applicability of the Schott gymnastic methods to the failing heart of Bright's disease, nor is my own experience in their use sufficient to enable me to dogmatize. Schott gymnastic exercises comprise certain volitional muscular movements made against graduated resistance applied by the hand of the operator, and having for their object the stimulation of the circulation in the muscles brought into action whereby the heart is reflexly induced to stronger and more abundant contractions with a simultaneous relieving of the venous and acceleration of the arterial and lymphatic circulations. These movements are applied according to a definite plan and with such attention to detail as to secure in an increased degree all the good effects of passive movements with little or no fatigue. To quote the words of R. Douglas Powell⁴: "The effect of the Schott exercises may be said to be a stimulation of the heart's action with some steadying effect and increased completion of systole, an improved circulation through the coronary arteries, and an increased mobility of the blood by its readier passage in greater bulk through the muscles, especially on their venous side. Their effect on the general blood-pressure is that during the exercise itself the pressure first rises above the normal, but begins to fall even during the continuance of the exercise, so that at the end of the treatment it has usually reached the normal. After cessation the pressure continues to fall and may become subnormal for half an hour or longer, when it slowly rises again to its initial height."

These exercises have been found of most excellent service in the failing heart of valvular compensation. By analogy it would seem not unlikely that they might prove to be a valuable contribution toward our means of sustaining the degenerated heart of granular kidney. At the outset, however, we are confronted by the fact that these movements are absolutely contradicted in advanced arteriosclerosis characterized by hypertension and degenerated vessels, and that they offer but slight prospect of success in cases with even moderate arterial change. In arteriosclerosis, the increased energy of the heart's action caused by the muscular contractions is but inadequately offset by the coincident dilation of the arteries and hence a dangerous raising of the blood-pressure and strain upon the heart results. In place of an improvement of the cardiac insufficiency in such cases, the opposite effect is brought about. It is apparent at once that very few of the cases we are considering are eligible for this plan of treatment. Still just as there are certain cases of arteriosclerosis of moderate grade in which the Schott exercises may with certain modifications be employed to advantage, so there may be an occasional nephritic heart capable of deriving benefit from mechanico-gymnastics. In considering the question of the proper selection for mechanical treatment,

no general rule can be laid down. Each must be judged upon its own merits and with the utmost care, for great damage may be inflicted in unsuitable cases. When the sclerosis of the arteries is not general and advanced and the superficial vessels not rigid, an attempt with resistance exercises may be made, beginning in an insinuating way with the gentlest movements and desisting upon the first sign of fatigue. No progression should be made to the more trying movements until a beneficial reaction is apparent from the easier exercises. If these fail to elicit results, it is needless to persist. In cases where the heart is so feeble that the primary rise of blood-pressure caused by even gentle exercises interferes with its action, continuance of the treatment can but result harmfully. It may be laid down as an absolute rule to be followed in these cases, that when there is so advanced a degree of degeneration of the myocardium that digitalis and other heart stimulants are without effect, no attempt with resistance exercises should be made. In patients whose muscular powers are greatly enfeebled the treatment is also forbidden. Dropsy may be taken as a contraindication, as may also persistent dyspnea and engorgement of the rigid heart.

It is unnecessary to state that in using a measure which in these cases is so largely tentative, every precaution should be employed to secure safety and success. Not only should all the rules laid down by Schott and Besly Thorn be scrupulously obeyed, but the patient's condition must in all cases be looked to to furnish the individual indications so necessary to the success of any measure.

Although gymnastic exercises are but rarely permissible in the weak heart of interstitial nephritis, massage and passive movements are much more widely applicable. The experiments of Bruton and Tunnicliffe⁵ go to show that the effect of massage and passive movements is to improve the circulation of lymph within the tissues and to determine to the muscles a larger supply of blood, thus at once stimulating nutrition and affording mechanical relief to an overloaded heart. The employment of these measures is accompanied primarily by a slight and transient rise in blood-pressure, which is soon followed by a fall in tension less extreme and not so long sustained as that following resistance exercises. The effect, therefore, of these measures is the same in quality as the Schott movements, differing only in degree and duration, while the dangerous increase of blood-pressure is eliminated. They furnish valuable means of obviating the circulatory stagnation and malnutrition of prolonged and enforced rest. In fact, it is this last conservative function that is the principal office of all these mechanical measures in the cases under consideration. Too much must not be expected of them. The very nature of the factors which bring about dilation of the hypertrophied heart of Bright's disease precludes the possibility of great or permanent results from any or every means we can bring to bear. Once dilation has taken place the outlook is indeed a dark one.

In concluding my remarks, I cannot do better than to repeat the words of Leonard G. Guthrie,⁶ who gives as a guarding principle in the treatment of chronic nephritis the motto: "Watch the heart and pulse." Herein I am convinced is the surest way to the successful management of this widespread disease. Sooner or later the morbid process must end in death. But this termination can be longest postponed, the patient's interests can best be served, and his condition most securely palliated by placing the heart upon a therapeutic parity with the kidneys.

BIBLIOGRAPHY.

1. Some Clinical Aspects of Granular Kidney. *British Med. Jour.*, Feb., 11 and 18, March 11, 1899.
2. Diseases of the Kidneys and Genito-Urinary Organs. vol. i. London: H. K. Lewis, 1895.
3. *Centralblatt für innere Med.*, June 26, 1897.
4. *British Medical Journal*, vol. 1, 1898.
5. *Journal of Physiology*, vol. xxvii, p. 364.
6. Chronic Interstitial Nephritis in Childhood. *The Lancet*, Feb. 27, 1897.

DISCUSSION.

DR. C. H. MILLS of Illinois.—I have had a great deal of experience in diseases of the heart, largely during my service of fourteen months in charge of the hospital. Under me came a great many cases of organic diseases of the heart. Aconite is a great remedy in Bright's disease of the kidneys and in the irritable heart. Besides there were given tonics—iron, gentian, cinchona, and when a sedative was needed, aconite.

DR. R. H. HENRY of Illinois.—I wish to say a word in regard to the use of mercury and iodid of potassium, for I was much impressed by the remarks made by Dr. Elliott. I believe the use of mercury and iodid of potassium will prolong the life in these cases; also, the use of the other tonics and vasomotor dilators. The long-continued use of iodid of potassium without disturbances of the stomach will prolong life in the most hopeless instances. The mercury has a specific effect in unloading the canal and in increasing the activity of the cells lining the canal, and so unloading a sluggish condition. I usually combine the nitrites with it, and I have had satisfactory results.

DR. NORMAN BRIDGE of Los Angeles, Cal.—I am really satisfied that there is nothing left to be said regarding the management of these cases; the speaker has covered the ground in such a thoughtful, judicious and able manner. Patients, in the light of existing knowledge, who can be managed as Dr. Elliott has suggested, will have the best treatment extant. From what he has stated, however, one would almost come to think that we ought to expect a curative effect from the iodids—a curative effect upon the disease itself. I fear that this is not justified by the experience of the profession. And so the thought that occurs to my mind as the paramount one is the need of further study to discover some means that shall lessen the progress of the disease; i. e., to stop the interstitial nephritis and lessen thereby the coincident thickening of the heart muscle and vessel-walls. It is probably true that the heart must undergo hypertrophy in all cases of interstitial nephritis. It is probably true that hypertrophy is exactly in proportion to the amount of disease in the kidneys, although I doubt if that is always the case. I think these pathologic processes which are conservative do not always go on exactly to this conservatism. Sometimes the hypertrophy is greater or less than necessary; we see that in the fibrosis of pulmonary tuberculosis. There it is a conservative condition; it helps to cure the patient. We know that when there is no hypertrophy the disease runs on rapidly to destruction. This shows the conservative power of Nature. It is, therefore, not true that we always have hypertrophy of the heart coming on with the interstitial nephritis in due proportion. I do not know that we know that patients die of heart failure. So long as the heart remains hypertrophied, and not dilated, we believe that the patients are going to live. We observe a number of cases where there is no giving away of the heart or blood-vessels, but where injury to the nervous centers and brain particularly seems to be the predominating cause of death. The amount of urea did not justify the expectation of fatal issue. The great desideratum in the treatment of this disease is to get the means of lessening the interstitial nephritis.

DR. ALFRED STENGEL of Philadelphia.—The paper of Dr. Elliott's is of unusual interest, which lies in the fact that he has pointed out the general relations of interstitial nephritis, and particularly that the vascular system is the point of attack for medical men. In the early stages, with treatment we can do good. Reduce the blood-pressure, and if possible control the fibrin changes, particularly with the Schott or mechanical method, with which I have had experience. Physiologists have shown that the effect of exercise is to reduce the blood-pressure in the muscles. I believe that the reduction in the blood-pressure is greater than Dr. Elliott is inclined to state in his paper. There is an increase in the blood-pressure in the beginning of the Schott treatment, but this is only temporary; it is soon followed by a fall in the pressure. In treating a case of chronic interstitial nephritis from the beginning, the institution of the systematic mechanical treatment may prevent fibrin changes in the blood-vessels and in the organs. For this disease is a general disease which affects the kidneys, liver, heart muscle, brain and other organs, sometimes one more than another—and it is to be controlled by measures which control the blood in general. We do not know how the nature of the poison developed, but we do have the means by

which we can obviate its effects. The continued use of mercury in small doses, I believe, may influence the elimination of this poison. As for the iodids, I am convinced that those of sodium and potassium are the preferable salts; they are better borne and have a less disturbing influence upon the heart. The mechanical treatment, I am convinced, is the treatment of the future for this disease. It should be given when the disease is forming.

DR. EDWARD F. WELLS of Chicago.—I wish to speak briefly upon a single point, that is, the reduction of blood-pressure. In interstitial nephritis there is an increase in the blood-pressure and a hypertrophy of the heart. This increase in blood-pressure causes a thickening of the arteries, the cardiac hypertrophy increases more and more, and if the patient takes some amount of active labor it is necessary that his nutrition should be kept up. The first thing to do is to stop any excessive amount of exercise he may be taking, and limit the amount of nitrogenous food, and I believe that a careful regime, such as the avoidance of draughts, regulation of his diet, the giving of large amounts of fluids to reduce the amount of poison in his system, will do vastly more good toward reducing the blood-pressure and relieving the patient and prolonging his life than any drugs. I do not wish to be understood as deprecating the use of drugs; I believe that the iodids are the drugs to be used. We should not lose sight of the careful regulation of the diet.

DR. JENKINS of Iowa.—I am very much pleased with Dr. Elliott's paper, and I wish to emphasize one portion of it regarding the use of nitroglycerin in cases of chronic interstitial nephritis. I have frequently had patients come to me with this disease for treatment, coming from other physicians, who had failed to try this remedy. Placing them on the use of strychnin, regulating their diet, and giving nitroglycerin relieved their symptoms and gave them many months of comfortable living. For this reason I am glad Dr. Elliott emphasized that portion of his paper. The disease has not been well treated until recently. Now it is, with careful bathing and dressing, dieting, regulation of bowels, with the administration of such vasomotor dilators as glonoin, one drop every two, three or four hours, and up to five drops, that benefit is to be derived.

DR. ARTHUR R. ELLIOTT, closing the discussion.—I wish to express my pleasure at the amount of discussion my paper called forth. I think cases of interstitial nephritis cannot be classified as all belonging to the cardiac type, any more than they can be said to belong to the purely nephritic type. The fibrosis is a general one affecting different portions of the body in different degrees. I would like to state that in the preparation of my paper I was influenced in setting forth measures of direct treatment against the disease in the later stages, i. e., when cardiac hypertrophy was present or failure threatened. I did not enter into any discussion of the early stages of the disease. If we could get hold of the disease in the earliest stages I think that hygienic, dietetic and other measures would give better results than could be obtained through the use of drugs. The cardiovascular changes of nephritis are Nature's protest against the results of imperfect metabolism in the blood-stream.

SYSTOLIC MITRAL MURMURS.*

THEIR TRANSMISSION, WITH SPECIAL REFERENCE TO THE NATURE OF THE SO-CALLED ANEMIC MURMURS.

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What is familiar to us is not necessarily well understood, and yet in medicine as much as in any branch of learning we are to accept this feeling of familiarity for knowledge. This thought must be my excuse, if one is necessary, for bringing to your attention a subject so familiar as the heart murmurs.

The question whether a systolic murmur is organic or functional is being constantly brought up for our decision, yet although it has been discussed many times there is still lacking that unanimity of opinion among the best authorities which would assure us that it has been definitely settled. The question is one of practical importance, and any addition to our knowledge, however small,

should be welcome in our efforts to find a solution.

A review of the literature shows that the discussion has turned chiefly on the points of maximum intensity of these murmurs. The second left intercostal space has been the battle-field of the champions. Whether the point of maximum intensity was just over the pulmonary artery or a little outside of it has been the burning question. So many theories have been advanced to explain the murmurs in this region that Balfour¹ has well called it the "region of romance" for cardiac murmurs. In all this discussion the area of transmission of these murmurs has received little attention, although it seems to the writer to be of considerable importance. In fact, the method of conduction of the sounds and murmurs of the heart to the surface of the chest, and the area over which they may be heard have only of late received much attention, and we have still much to learn of these important and fundamental matters.

Gibson² in his recent book says: "We are by no means thoroughly acquainted with the physical facts which regulate the extent to which the sounds are conducted." And again: "The direction of propagation and the extent of conduction constitute a subject of much difficulty in the study of murmurs."

When a murmur is heard at a given point on the chest, one fact at least is true, namely, that there exist at this point vibrations of the chest wall capable of transmission to the ear and of such a character and intensity that they produce the sensation of sound. How these vibrations originate, where they start, and how they reach the points at which they are heard, are questions less definitely determined—questions of probability rather than fact, which still come to some extent within the realm of opinion and theory. It is important to thus recognize when we cross the boundary separating fact from theory.

Clinically, we find that these vibrations reach the chest wall at certain areas; experimentally, we find that such vibrations may be caused by certain physical conditions; pathologically, we find these conditions existing at certain points in the heart and blood-vessels. In this way we can demonstrate the cause of certain murmurs. For example, we know that mitral regurgitation may cause vibrations which are heard as a systolic murmur near the apex of the heart. These vibrations are also heard in other areas, as will be considered later. It is worth while noting at this point, however, that the so-called anemic or functional murmurs frequently occur in trivial disturbances of health, are often transitory, and are rarely so associated with fatal disease as to give us the opportunity to definitely determine their cause by pathologic investigation. Our explanation of many of them is, therefore, based on inference, and carries a greater or less degree of probability rather than certainty.

It is generally accepted that mitral murmurs are heard best near the apex of the heart, and we commonly speak of this place as the "mitral area." The term is a good one, provided we do not assume that all murmurs heard in this area are generated at the mitral valve. It is not very uncommon to find a systolic murmur from the aortic valve transmitted to this point, and occasionally a presystolic murmur in this area finds its only explanation in aortic insufficiency. The vital point in all these cases is that the vibrations are carried here through the medium of the wall of the left ventricle and the blood within its cavity. This fact should be kept in mind when we speak of the "mitral area." In the same way it requires very little study of the distribution of murmurs to show that it is not safe to argue that because a murmur is heard at the aortic pulmonic, or tricuspid

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