

on the left side of the abdomen, with some lympho-looking secretion taken from an indurated sore of two months standing, situated upon the prepuce of a dispensary patient.

There is a small movable indurated gland in the right axilla.

August 12th.—No 28 having succeeded, Mr. Richardson made an inoculation (29) with matter taken from it, on the left side of abdomen.

August 19th.—Mr. Richardson made three inoculations (30, 31, and 32) on left side of chest, with matter taken from No. 28, both of these having been successful.

Sent to convalescent home for a few days.

August 27th.—Nos. 30, 31, and 32 have succeeded. [When he returned to hospital they were nearly healed. He had no relapse of eruption on the front of the body, and there was scarcely a trace of it on the back. He was so much improved in general health that he resumed business. I have not seen him since.—B. W. R.]

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ART. VIII.—*Researches on the Sounds of the Heart.* By GEORGE PATON, M.D., Toronto, Canada.

IN every class of animals in which we have examined the action of the heart, we have found that the ventricle contracts towards the orifice of the aorta or vessel that conveys the blood from the ventricle into the system, the mode of contraction being evidently designed to facilitate the passage of the blood from the respective ventricle into the aorta or pulmonary artery.

In contracting, the ventricle does not continue its action till the whole of the blood is expelled. It only contracts to an extent proportionate with the impetus received from the auricles, expelling a certain amount of blood, termed the blood-wave.

June 29th.—Took a large turtle, and removed a portion of the sternum or bone that covers the thorax, leaving the thoracic parietes uninjured; and observed the action and listened to the sounds of the heart.

When the ventricle contracts and propels the blood into the aorta, it raises up slightly the parietes of the thorax, and we can distinctly follow the course of the blood from the ventricle into the arch of the aorta, by the heaving up or elevation of the muscular parietes. There appears to be two impulses or movements, first, that of the contraction of the ventricle; second, that of the distension and reaction of the aorta, which take place simultaneously, and are synchronous with the first sound of the heart.

The heart having been fully denuded, the animal continued strong and vigorous, moving about with great energy, and survived several days. Pulsations, 32 per minute.

We applied the stethoscope, and listened to the sounds of the heart. Both sounds are distinctly heard: the first—a dull and prolonged sound terminating by a sort of knock, or as if a piece of cloth or leather were fully stretched out, or extended to its ultimatum—is heard most distinctly over the semilunar valves, at the origin of the aorta, or a little above it, and synchronous with the contraction of the ventricle, and pulsation of the aorta. The second sound immediately follows the first; is a short, sharp sound, like that produced by the tongue striking the roof of the mouth, and occurs during the contraction of the auricles, as they pour their blood with force into the ventricles during the diastole of the latter.

When the ventricle contracts, the blood passes rapidly into the aorta, which becomes more curved and tense, the contraction proceeding from the apex to the base, and as it reaches the muscular fibres around the origin of the aorta, they contract with energy, passing below the semilunar valves, constricting the part, sending the last portion of the blood-wave into the aorta with force; the aorta starts up, and the rapid reaction of the distended parietes causes the blood to recoil against the semilunar valves and shut them, as it imparts an impulse to the wave. The fibres of the ventricle being contracted behind the aorta, as if supporting the valves, whilst the blood recoils against them—synchronous with which the first sound of the heart attains intensity and terminates.

The sound commences as the blood passes with force through the aortic foramen, and terminates in the aorta, as the blood is thrown back against the valves and shuts them, whilst the aorta pulsates. Sometimes a little roughness or bruit attends this sound, which disappears as the ventricle contracts with greater vigour. The sound is distinctly heard through the medium of the stethoscope, or by the naked ear applied over the heart, and as many as 30 pulsations can be counted at a time without interruption.

Immediately after the contraction of the ventricle and impulse of the aorta terminate, the auricles contract; and as they propel their blood into the ventricle, the second sound of the heart is heard. It is a short, sharp sound, distinctly recognized through the medium of the stethoscope. It appears to be deeper seated, and not so near the ear as the first sound, and is heard at the side of the aorta

in the position of the auricles pouring their blood into the ventricle. The whole of the auricles now contract, and not a part of them, and as they pour their blood with force into the ventricle, the second sound of the heart is produced.

We performed similar experiments on several other turtles, during the highest temperature of the season, and with precisely the same results. In some cases, the action of the heart amounted to 36 pulsations per minute; in others to 40, and even 50, per minute. But in general 36 to 40 pulsations per minute were the highest attained.

The ventricle in contracting propelled its wave of blood with force into the aorta, distending its walls, and the aorta reacting with a power superior to that by which it was distended,\* caused the blood to recoil against the semilunar valves, and shut them, as it imparted its impetus to the wave—the ventricle being contracted behind the valves, when the impulse of the aorta is exerted, synchronous with which the first sound of the heart is distinctly recognized over the semilunar valves, or a little above that. The impulse of the aorta preceding the pulse at the extremity of the arteries by a very short interval.

The fibres of the ventricle relax as the auricles contract, and the parietes of the aorta at the same time become straighter, and attain an interval of rest, till the ventricle contracts and again distends the aorta, there being the closest connexion between the condition of the ventricle and that of the aorta.

Dr. Hope, as the result of his experiments on the sounds of the heart, concluded that the first sound depends on three causes. First, a degree of valvular sound, produced by the blood recoiling against the auriculo-ventricular valves; second, a sudden jerking extension of the muscular walls of the ventricle, as a sound is produced by the extension of the leather of a pair of bellows, which he termed the sound of extension; third, a prolongation or increase of this sound by the sonorous vibrations peculiar to muscular fibre. Dr. Williams maintains that the first sound of the heart is produced chiefly by the muscular contraction itself, and that, as a general law, a sound accompanies every rapid muscular contraction. The Dublin Committee, as the result of their experiments on the sounds of the heart, concluded that the first sound is produced either by the rapid passage of the blood along the internal surface of the ventricles on its way to the mouths of the arteries, or by the

\* Poisseuille.

bruit musculaire itself, or probably by both those causes combined; whilst the London Committee attributed the first sound to muscular contraction, but considered that the impulse of the heart against the thorax may occasionally act as an auxiliary cause, in increasing the intensity of the sound. M. Cruveilhier, as the result of his observations, states that the first sound is heard most distinctly at the origin of the large arteries, and diminishes as we approach the apex of the heart. And Carpenter concludes that the principal cause of the first sound exists at the entrances to the arterial trunks. And it does not seem, he states, that any other reason can be assigned for it than the prolonged rush of blood through their orifices, and the throwing back of the semilunar valves, which, in suddenly flapping down again, produce the second sound.<sup>a</sup>

From these statements, it appears that physiologists have, in general, confined the first sound of the heart to the action of the ventricle; but that M. Cruveilhier and Carpenter believe that it is connected with the entrance of the blood into the aorta and pulmonary artery—a view which we consider the nearest approach to the real cause of the first sound of the heart.

We must further observe, it is considered an established fact in physiology, that the first sound of the heart is synchronous with the contraction of the ventricle, and also with the pulsation of the aorta, as it is termed, with the pulse of the arteries near the heart. Carpenter says that “the first sound is evidently synchronous with the impulse of the heart against the parietes of the chest, and also with the pulse as felt near the heart.” Dr. Wood<sup>b</sup> states the “first sound is heard during the contraction or systole of the ventricle, and is synchronous with the beating of the ventricle, and with the pulsation in the large arteries near the centre of circulation, but anticipates by a very minute, but still appreciable interval, the pulse of the wrist.” Müller observes,<sup>c</sup> “the pulsation of the arteries near the heart is synchronous with the systole of the ventricle;” and Dr. Hope maintains<sup>d</sup> that, synchronous with the systole of the ventricle are, the first sound, the impulse of the apex against the ribs, and in vessels near the heart, the pulse; but in vessels at some distance, as the radial, the pulse follows at a barely appreciable interval. From this united testimony of physiologists,

<sup>a</sup> Carpenter's Physiology, p. 419.

<sup>b</sup> Wood's Medicine, Philadelphia.

<sup>c</sup> Müller's Physiology, p. 699.

<sup>d</sup> Hope on the Heart, p. 56.

it must be admitted that the first sound of the heart is synchronous with the contraction of the ventricle and pulsation of the aorta.

But the aorta cannot pulsate without the blood recoiling against the semilunar valves, and shutting them, as it is impelled onwards. If the blood had been sent along the aorta in a constant stream, there would have been no shutting of the valves in its onward course. But the blood is propelled by the ventricle *par saccades*, in successive waves, and as each wave is sent with force into the aorta, it distends its walls, and the aorta instantly reacts, shutting the valves by the rebounding of the wave as it is impelled onwards. And the ventricle is fully contracted at the origin of the aorta, as if supporting the valves, whilst this impulsive movement takes place. The distending force of the ventricle ceases as the last portion of the wave enters the aorta; but it is now within the valves, and the parietes return on their contents with an energy superior to that by which they were distended, throwing the blood against the valves and shutting them, as it exerts an impulse on the wave; the impulse of the aorta being succeeded by the pulse at the wrist by only an appreciable interval of about one-thirtieth of a second.\* Hence it is during the onward course of the blood that it recoils against the aortic valves, just as the fluid in the forcing pump reacts against the valves, during the lateral pressure that propels it forward.

We have seen, in the course of our experiments, that the first sound of the heart is heard most distinctly over the semilunar valves, at the origin of the aorta, and occurs as the aorta pulsates, and the valves shut. During the ventricular systole the blood is sent rapidly into the aorta, rendering it more curved and tense; and as the contraction reaches the muscular fibre at the origin of the aorta, they contract with energy, passing behind the semilunar valves, constricting the part, whilst the aorta becomes fully distended and reacts, throwing the blood against the valves and shutting them by the impetus given to the wave. Immediately after this, the ventricle commences to dilate as the auricles contract, and the parietes of the aorta grow straighter, and recover their former situation, till the ventricle again contracts, and the movements are repeated.

These facts seem to establish the proposition that the blood recoils against the aortic valves when the ventricle is contracting—not when it is dilating; and that the sound which is then produced

\* Müller's Physiology, p. 176.

is the first sound of the heart. It commences as the blood is propelled with force through the aortic foramen, and attains its intensity in the aorta as it reacts on the advancing wave. It is a dull and prolonged sound, synchronous with the contraction of the ventricle and impulse of the aorta, and precedes the pulse at the extremity of the arteries by only an appreciable instant.

And we can perceive the necessity of the semilunar valves being shut, and sustained by the ventricle contracted behind them, as the full impetus of the distended aorta is imparted to the blood-wave—the impulse recoiling against the valves and passing along the tube with such rapidity that the amount of blood which enters the aorta, almost simultaneously displaces a similar amount at the extremities of the arteries—communicated to the veins.

In contraction, the force which the ventricle exerts is spent on the impetus or momentum given to the wave, and the distension of the aortic parietes; but as an artery always reacts with increased vigour, the latter force is more than regained, and exerted during the arterial systole.

No portion of the first sound could be connected, during these experiments, with the auriculo-ventricular valves, because a membranous expansion, very small, of the internal parietes or living membrane of the ventricle is extended over the orifices, and covers the part completely during the contraction and expansion of the walls of the ventricle; and it is so small, and so situated, that no sound can be produced at the part during the ventricular contraction.

The facial artery, says Müller, which is known to depend on the contraction of the ventricle, is nearly synchronous with the heart's impulse, being only one-thirtieth of a second later than it, while the second sound is not heard until one-fifth of a second after the impulse; consequently, the second sound can in no respect be connected with the influence of the aorta. "The second sound," according to Dr. Hope, "results from the sudden expansion of the semilunar valves, occasioned by the reflux on them of the columns of blood in the aorta and pulmonary artery during the ventricular diastole." And Dr. Williams says:—"The second sound being caused solely by the sudden reaction of the arterial columns of blood on the semilunar valves, its loudness will depend on the mobile and perfect state of these valves, and the extent and abruptness by which they are stretched by the recoil of the blood at the moment of the ventricular diastole. It will therefore be most perfect when the heart acts regularly and slowly, giving time for the

full gush of blood to carry the valves loose into their slight recesses in the walls of the artery, and for the as perfect reaction of the contents of the distended artery on their concave surfaces.”<sup>a</sup> But if the second sound be produced by the columns of blood reacting against the semilunar valves when the artery is distended, that must occur during the ventricular systole, for there are no columns of blood in the aorta and pulmonary artery during the ventricular diastole. The blood has already been propelled forward by the pulse in the aorta and pulmonary artery during the contraction of the ventricle; it is then only the blood that remains in the contracted arteries—that is, in the arteries after the systole has taken place—that can fall back and recoil against the valves during the diastole. Dr. John Reid, whose statements are more explicit on this subject, says:—“Synchronous with the first sound of the heart we have the impulse of the heart against the chest, and the propulsion of the blood along the large arteries.” And during the second sound, which is synchronous with the diastole of the ventricle, we have the regurgitation of part of the blood in the large arteries upon the semilunar valves, throwing them inwards to the axes of the vessels. And as the second sound appears to be produced by the shock of the blood upon the semilunar valves, its intensity must in a great measure depend upon the diastole of the ventricle drawing part of the blood back upon them; but perhaps more particularly upon the elasticity of the large arteries returning suddenly on their contents during the diastole of the ventricle, when the distending force of the ventricle has been withdrawn.”<sup>b</sup> This observation shows that Dr. Reid, who performed numerous experiments on the action of the heart, considered that the reason usually assigned by physiologists for the cause of the second sound was insufficient to account for it, and therefore, he says, perhaps more particularly upon the elasticity of the large arteries returning suddenly on their contents. But we must observe, the ventricle, during its diastole, cannot, by a sort of suction power, draw the blood back upon the semilunar valves with a force sufficient to produce an acute and sharp sound like the second sound of the heart. Besides, the dilation of the ventricle always commences at the auriculo-ventricular foramen, and when the action of the heart is vigorous, the contraction of the auricles is synchronous with the diastole of the ventricle, and nothing like a suction power then

<sup>a</sup> Williams on the Heart, p. 213.

<sup>b</sup> Cyclopaedia of Anatomy and Physiology, London, Art. Heart, by Dr. John Reid.

exists in the ventricle to produce a reflux of the blood in the aorta against the semilunar valves. And as regards the elasticity of the arteries returning suddenly on their contents, that occurs during the systole of the ventricle, when the blood is impelled forwards. During the ventricular diastole the arteries straighten themselves, and the aorta feels soft and compressible, and is in a state of rest, till its parietes are distended by the next ventricular contraction. And, in the course of our experiments, no sound was produced in the aorta during the ventricular diastole.

Physiologists seem to think that the contraction of the ventricle propels the blood along the arterial tube to its extremity, independently of the action of the semilunar valves; and that the blood in the distended arteries recoils against the valves during the diastole of the ventricle, and produces the second sound of the heart. But this is not the manner in which the heart acts,\* and it is evident that if there were columns of blood in the aorta that recoiled against the semilunar valves during the ventricular diastole, it would act as an obstacle to the blood entering the aorta, and require an additional force to be exerted by the ventricle during its contraction to overcome it; and it would allow no period of rest to the parietes of the aorta, as they would be kept distended, both during the ventricular systole and diastole, which would speedily destroy their action.

The second sound of the heart has no connexion with the aorta, but depends on the contraction of the auricles, and the force with

\* The ventricle does not act like a syringe, forcing the blood along the arterial tube to its extremity, and immediately relaxing, whilst the blood in the distended arteries recoils against the semilunar valves, as that would be reversing the movement which had just been completed. But in transmitting the blood from the heart through the arterial system, the ventricle acts in concert with the aorta and its valves; and for the sake of illustration, we may be permitted to allude to the action of the single forcing pump, which it somewhat resembles. The piston, which is contained in the working barrel at the base, has a range of two feet or upwards, and, on being raised, immediately descends to that extent, the valve opening, and the fluid passing readily into the upper compartment of the tube. But the instant the upward stroke is given, the valve shuts by the fluid recoiling against it, and a distinct sound is produced. And as the piston is elevated to the limit of its range (viz., two feet), it exerts a force upon the whole of the fluid contained in the tube, expelling at the upper extremity an amount of fluid equal to what had entered at the base; and when the ventricle contracts, it sends with an impulse the wave of blood into the aorta, distending its walls, and the aorta, reacting on the blood that has entered it, forces it against the valves, shutting them, and produces the first sound of the heart as the impetus is exerted on the wave, the impulse of the aorta being synchronous with the contraction of the ventricle, and preceding, at a very short interval, the pulse at the extremity of the arteries.



which they pour their blood into the ventricles; and occurs immediately after the first sound terminates.

We have seen that closely following the first sound of the heart, a second sound is heard, of a short, sharp, and acute character, like the second sound of the heart in man, and occurs during the contraction of the auricles and diastole of the ventricle; as was clearly ascertained by counting 1, 2, 3, 4, 5, 6, &c., whilst we listened to the second sound through the medium of the stethoscope; and several gentlemen carefully observed the contraction of the auricles, and each contraction of the auricles exactly coincided with the second sound as heard by us. Pressure on the aorta above the semilunar valves, at the moment of the occurrence of the second sound, did not in the least diminish its loudness and intensity, but it was affected by whatever impaired the action of the auricles; when they became weak, the second sound was scarcely audible, but when they contracted with energy, the second sound was clearly and distinctly recognized. It appeared to be produced at the auriculo-ventricular foramen, by the force with which the blood is propelled from the auricles into the ventricles. Sometimes it partook of a slight bruit, as if the blood passed over something rough on entering the ventricle. But when the auricles contracted with vigour, the sound was sharp and acute, like the sound produced by the tongue striking the roof of the mouth. It appeared deeper seated, and at a greater distance than the first sound, because the auricles are here deeper seated than the arch of the aorta, and it did not follow the course and direction of the first sound. The first sound ascended along the aorta, but the second descended by the side of the base of the aorta, in the situation of the blood passing from the auricles into the ventricle. We tested this question with the greatest possible care, and distinctly ascertained that the second sound of the heart is produced by contraction of the auricles, as they pour their blood with force into the ventricles. After its occurrence, a momentary silence ensued, and then the first sound recommenced.

Dr. Hope concluded, as the result of his experiments on the sounds of the heart, that no sound is produced by contraction of the auricles. But this depended on the manner in which the action of the heart was maintained. We are informed that during these experiments, in which artificial respiration was employed, the auricles contracted only partially, or chiefly in their appendices. But to produce a distinct sound, the auricles require not merely to

contract, but to contract with energy, in expelling the blood from the cavity. We have found, in the course of our experiments, that when the action of the heart was slow and weak, a sound was scarcely heard, during the contraction of the auricles. At other times it was not constant and continuous, but when the action was vigorous a sharp sound was produced, distinctly recognized through the medium of the stethoscope, closely following the first sound. The principle which chiefly contributes to the production of sound in the contraction of the auricles is what obtains as a general law in the passage of fluids through narrow or contracted orifices. If the force by which the blood is propelled be weak, little or no sound is heard; but if the blood be propelled with energy, a clear and distinct sound is produced.

And Dr. Williams informs us, "that in some recent experiments with Mr. Clendinning, he found the auricles of an ass produce a very distinct sound when they contracted vigorously, and independently of the ventricles: this was afterwards heard by all who were present. The same phenomenon has also been observed in some experiments recently performed in America." <sup>a</sup> Drs. Linnock and Moore heard a sound produced by contraction of the auricles.<sup>b</sup> And we have had ample evidence of this fact in the course of our experiments, during these two last summers, on the action and sounds of the heart in the American turtle.

Much has been said by physiologists respecting the second sound not being produced by contraction of the auricles, from the time at which the auricles contract. Harvey, Lancisi, Senac, and Haller, considered that the auricles contract immediately before the contraction of the ventricles, and not immediately after the termination of the preceding contraction. Dr. Hope and Dr. Williams also maintained this doctrine as the result of their experiments; and Professor Turner, arguing on these data, showed that as the second sound closely follows the first, it could not depend on contraction of the auricles, as their contraction immediately precedes that of the ventricles. Now, it is a fact that, when the action of the heart is slow and weak, as in cold-blooded animals, when it beats at the rate of 20 and 22 pulsations per minute, the ventricle, after contraction, immediately dilates, and blood enters it from the distended auricles, filling it out to a certain extent; and then the auricles contract and produce contraction of the ventricle, the one movement immediately preceding the other. The same thing occurs in

<sup>a</sup> Williams on the Chest.

<sup>b</sup> Wood's Medicine, Philadelphia.

warm-blooded animals after the thorax has been opened, when the action of the heart becomes slow and irregular, or its movements are interfered with, as by preventing the action of any of its valves. In these cases we have observed that, after contraction, the ventricle immediately dilates to a certain extent, and blood passes into it from the distended auricles, and then the auricles contract, and produce contraction of the ventricle. But we are by no means, from this data, to conclude that this is the manner in which the action of the heart is maintained when it is quiet and regular, beating as in warm-blooded animals, at 60, 70, and 80 pulsations per minute; and in the turtle at 32, 36, 40, and 50 pulsations per minute. We have already shown\* that as the action of the heart increases, the auricles contract sooner in point of time and of rhythm; then their contraction becomes synchronous with the diastole of the ventricle; so that they commence to contract immediately after the termination of the preceding ventricular contraction. And let a physiologist examine the action of the heart when it has been quickly denuded in a warm-blooded animal, and he will see that the auricles contract immediately after the termination of the preceding ventricular contraction is finished, and that the action is maintained with surprising power, the one movement following the other in quick and regular succession. And this is exactly what we have seen in the course of our experiments on turtles during the highest temperature of the season.

In observing the action in a denuded heart, we distinctly perceive that the contraction of the auricles commence the cycle or beat, and the contraction of the ventricle and impulse of the aorta terminate the beat; the one beat succeeding the other in such quick and rapid succession that, when the action is vigorous, the contraction of the auricles is synchronous with the diastole of the ventricle. But in listening to the sounds of the heart through the medium of the stethoscope, or by the naked ear applied to the chest, we associate the dull and prolonged sound with the short and acute sound, considering the former the first sound of the heart, and the latter the second sound, and that they belong to the same cycle or beat of the heart. But the reverse is the case. The short and acute sound is in reality the first sound of the heart, being produced by contraction of the auricles, which commence the cycle or beat; and the dull and prolonged sound is in reality the second sound of the heart, being produced by contraction of the ventricle and impulse

\* *British Medical Journal*, February, 1868.

of the aorta, which terminate the beat; so that the short and acute sound does not belong to the same beat of the heart as the dull and prolonged sound which precedes it, but is the commencement of a new beat, and must be associated with the ventricular contraction and impulse of the aorta that immediately succeed it; which enables us to see that the short and acute sound may appear to succeed the dull and prolonged sound, but is in reality the first sound of the heart.

We wish it to be distinctly understood that the statements we make respecting the sounds and rhythm of the heart, refer exclusively to the action of the heart when it is quick and regular, and the contraction of the auricle immediately succeeds the contraction of the ventricle.

The first period of silence occurs between what is termed the first and the second sounds of the heart, and depends on the time at which the auricles commence to contract after the contraction of the ventricle and impulse of the aorta terminate. According to Muller it is one-fifth of a second; but Laennec thinks that the second sound begins immediately after the first ends. From careful and repeated observations, we are of opinion that an appreciable interval occurs between the first and second sound—that is, between the termination of the contraction of the ventricle and impulse of the aorta, and the commencement of the contraction of the auricles. But this interval is reduced to a minimum when the action becomes very rapid, the heart beating 100 and 120 times per minute.

The second period of silence occurs between what is termed the second and the first sound of the heart, that is, between the termination of the contraction of the auricles and contractions of the ventricles. It is longer than the first interval, because it extends through the period of the ventricular action, till the blood is sent with force into the aortic-foramen, and the semilunar valves shut.

From what has been stated, we arrive at the following conclusions, respecting the sounds of the heart:—

The first sound is produced by contraction of the ventricle and impulse of the aorta. It commences as the blood is propelled with force through the aortic foramen and attains its intensity in the aorta, as the blood is thrown back against the aortic valves and shuts them on the impulse being imparted to the wave.

This sound is heard most distinctly in the denuded heart over the semilunar valves—at the origin of the aorta or a little above it.

The second sound depends on the contraction of the auricles, and is produced as they propel their blood with force through the auriculo-ventricular foramen into the ventricle during its dilatation.

It appears to follow the first sound as an immediate sequence, as it takes place so quickly after its completion, but it is the commencement of a new beat, and synchronous with the dilatation of the ventricle, and, of course, precedes the ventricular systole.

And as the same principle obtains in warm-blooded animals, the first sound of the heart is produced during the ventricular systole, as the blood is propelled with force into the aorta and pulmonary artery, and attains its intensity as the blood has entered their orifices and is thrown back against the semilunar valves and shuts them, by the re-action of the distended parietes imparting an impulse to the wave, the impulse of the aorta preceding the pulse at the wrist, by an appreciable instant.

The second sound of the heart is produced by the force with which the blood is propelled by contraction of the auricle, through each auriculo-ventricular foramen, into the ventricles during their diastole.

From what has been stated, it will be seen that a bruit sometimes attends one or both sounds, when the action of the heart is weak, and disappears when the action is strong—so that one cause of inorganic murmurs is the want of energy in the contraction of the auricles or ventricles, and whatever restores this removes the murmur.

From the manner in which the first sound is produced, we can perceive how a murmur connected with the contraction of the left or right ventricle is propagated along the aorta or pulmonary artery; a circumstance on which Dr. Hope laid great stress in determining to which side of the heart the murmur belonged

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ART. IX.—*Cases illustrating the Use of the Laminaria Digitata Tents.\** By JOHN A. BYRNE, M.B., Univ., Dublin; Professor of Midwifery to the Catholic University of Ireland; &c., &c

I.—CASE OF INTRA UTERINE POLYPUS—SEVERE HEMORRHAGE—REMOVAL—RECOVERY.

II.—CASE OF RETENTION OF PIECE OF OVUM AFTER ABORTION—SEVERE HEMORRHAGE—REMOVAL—RECOVERY.

ALTHOUGH it is an easy matter to diagnose extra-uterine polypi by the touch and sight, yet when the polypus is internal great

\* Read at Meeting of Dublin Obstetrical Society, June 11, 1870.