

On the art of percussion : as applied to the diagnosis of thoracic and abdominal diseases / by John Hughes Bennett.

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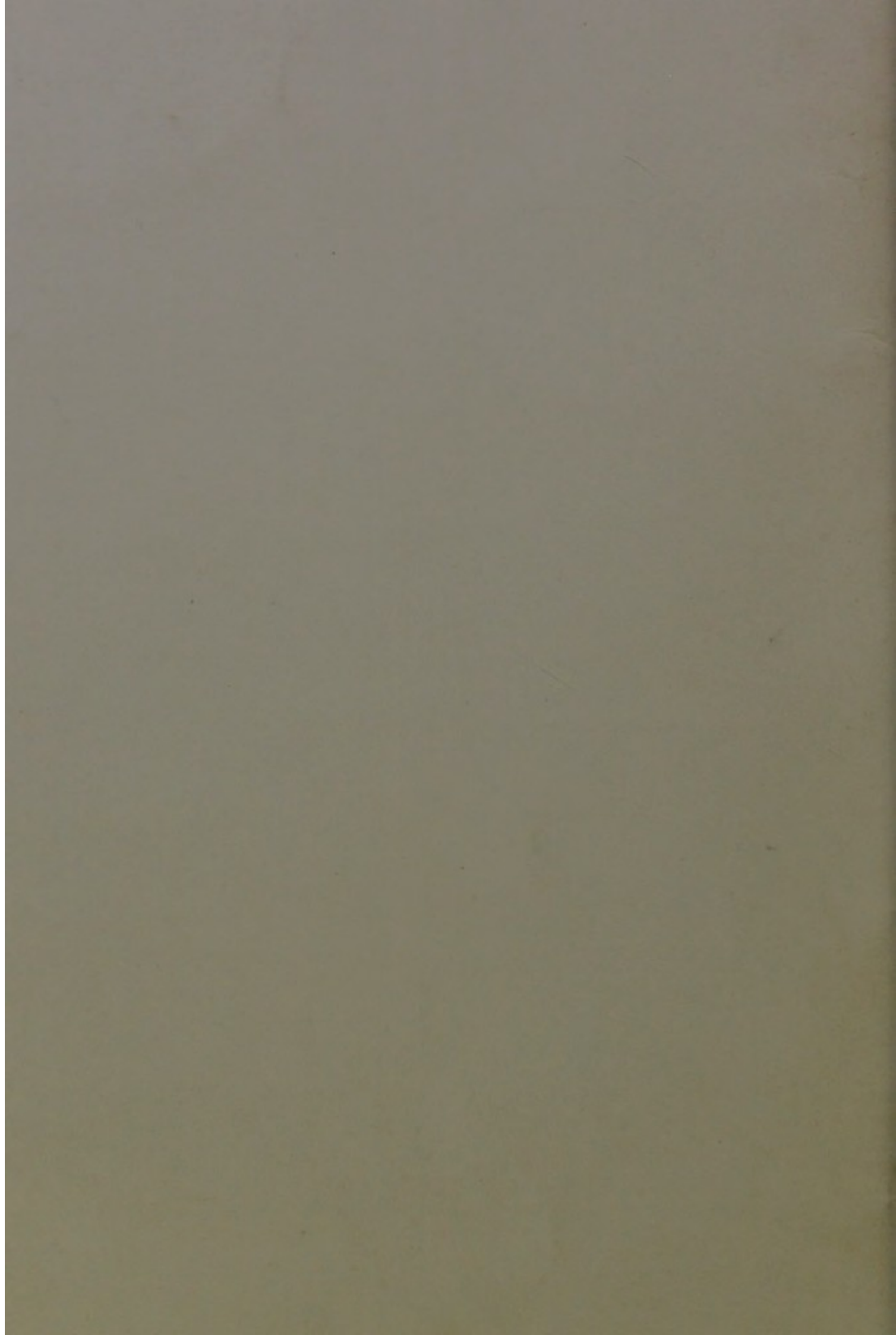
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ON THE
ART OF PERCUSSION,

AS APPLIED TO THE DIAGNOSIS OF THORACIC AND
ABDOMINAL DISEASES.

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(Extracted from the Lond. and Edin. Med. Jour. for February 1842.)

There can be little doubt, that mediate percussion is capable of furnishing much more valuable and exact information than is generally supposed. Every one who has attended the wards of M. Piorry must have been struck with the precision and exactitude with which he indicates the size and form of the thoracic and abdominal organs. I have often seen him thus map out, as it were, on the surface of the skin, with ink, the size and form of the heart, arch of the aorta, liver, spleen, kidney, &c., and indicate, to the eighth of an inch, the exact height of pleuritic effusion, or the margin of circumscribed pneumonic dulness. At first, indeed, this exactitude seems to partake so much of the marvellous, that the looker-on feels somewhat sceptical regarding its truth, and numerous individuals who visit his wards *en passant*, together with many experienced practitioners and teachers in Paris, (themselves, of course, unable to limit a single organ,) openly ridicule the procedure, as partaking more of charlatanism than of medical skill. He, however, who follows out the cases, witnesses the accuracy of his diagnosis, as revealed by post-mortem examinations, and endeavours to learn the art of percussion, soon convinces himself that there is neither imposture nor magic in the procedure, and that, however skilful M. Piorry or his *internes* may be in mapping out the different organs of the chest and abdomen, he also may do the same by means of attention and some practice. This is the plan I have myself followed; and, although far from possessing the great dexterity of the modern master of percussion, I have satisfied myself of the great practical value of his mode of proceeding. Convinced, also, that the difficulties experienced by the learner may be much dimi-

nished, I shall in this communication endeavour to give such short practical rules as may facilitate the progress of those who desire to perfect themselves in this most useful art.¹

In percussing, M. Piorry uses a circular ivory pleximeter, which he generally strikes with the tips of the first, second, and third fingers of the right hand, brought into a line, and pressed together by means of the thumb. The reiterated blows which it is necessary to give the pleximeter, during a careful examination of all the thoracic and abdominal organs, demand considerable physical exertion. This duty can scarcely be performed even by an expert percussor in less than half an hour; and if three or four patients are to be examined, it becomes very arduous. I have often seen M. Piorry himself much exhausted from the exertions he has undergone in this way, from visiting a single ward. But the learner undergoes still greater fatigue, from the numerous repetitions he is under the necessity of making before he is satisfied. The continual blows, also, on the tips of the fingers, (the nails being of course cut very short,) induce, at first, great pain and tenderness in them; and in my case, the skin surrounding the root of the nails became so greatly swollen and inflamed, that I was, for a time, obliged to suspend all practical examination. Indeed, those who amuse themselves occasionally by merely tap-

¹ None of the works on auscultation in the English language attach sufficient importance to percussion, and the authors appear practically unacquainted with the precision which it is possible to arrive at by means of the pleximeter. Dr Forbes, for instance, when describing percussion, says,—“By one well versed in *direct* percussion, an instrument will not often be needed in the exploration of the chest, as his experience will enable him to evade most of the inconveniences attending the former.”—*Cyclop. of Prac. Med.*, vol. i., p. 220. This passage could only have been written by an individual little practised in the art of percussion. In the same article a considerable space is wasted in endeavouring to show the superior advantage of using the fingers of the left hand as a pleximeter, “the *back* of the fingers being uppermost.” Now, those who choose to use the fingers in this way will often find it more advantageous to keep the back of the finger in contact with the skin, as is practised by M. Louis. Dr Forbes also states, that with the finger we can produce sounds as definite as by employing an ivory pleximeter. I have certainly heard MM. Louis, Bouillaud, Barth, and others, elicit very clear sounds by percussing on the index finger of the left hand, but deny that they could ever produce the clear sounds which may be done through the medium of an ivory pleximeter. Moreover, I have never seen any one accurately limit the size of an organ by the mere use of the fingers, and am perfectly convinced, from the vagueness and looseness which characterise the whole of Dr Forbes’s article on this subject, that he himself has never succeeded in doing it. Even Dr Williams, a much greater authority, prefers the fingers. He says, “Little need be said about pleximeters, for they are not generally necessary; M. Piorry much exaggerates the advantages to be derived from them.”—*Library of Medicine*, vol. iii., p. 10. Such also appears to be the general opinion of the profession, and I have frequently heard it stated by practitioners, that they can do with their fingers all that M. Piorry or others can do with pleximeters. To such statements there is only one reply. Whenever a similar assertion is made to me, I invite the gentleman to make his appearance at the bed-side of the patient in some public hospital or elsewhere, and limit the dullness of the heart or some other organ. But, singular to say, none of the numerous invitations thus made have ever been accepted.

ping or flipping the chest and abdomen, can form no idea of the pains and attention required to learn what may be termed the *real* art of percussion.

Without knowing how to strike, and to produce clear tones, we can never educate the ear, or the sense of resistance. This preliminary part in the art of percussion, requires a certain dexterity, which some find it very difficult to obtain. The difficulty seems to depend, in some cases, on a deficiency in the proportions usually existing between the length of the fingers. Thus, I have seen more than one person who had the index finger nearly an inch shorter than the middle one, and who, consequently, found it impossible to strike the pleximeter fairly with the tips of two fingers at once. By far the most common cause of failure, however, is want of patience and perseverance to overcome the first mechanical difficulties; and there is every reason to believe, that could this be surmounted, accurate percussion would become more universal and better appreciated.

Numerous inventions have been made for this purpose. I have been informed, although I do not know how far correctly, that M. Piorry has himself endeavoured to perfect a plexor, but has never succeeded satisfactorily. Balls of caoutchouc, attached to handles of whalebone,—rods covered at their extremity with leather, or some soft material,—rims of Indian rubber attached to the stethoscope,—and other contrivances have been thus employed. Dr Burne has lately invented, and given a description of a new plexor. (*Medical Gazette*, 1840-41, vol. ii. p. 468.) It is not my purpose here to enter upon a criticism of these different inventions, for never having employed any of them, I am of course utterly incapable of giving any opinion regarding their respective merits.

The plexor which I have for some time employed myself, I first saw used by Professor Barez of Berlin. It appeared to me in every way well qualified to meet the wants of the practitioner and of the student. I have used it continually for the last ten months, and am enabled to perform all the manipulations with it, map out the thoracic and abdominal organs, &c., as well as if I struck the pleximeter with my fingers, and this without the smallest fatigue to myself. It is the invention of Dr Winterich of Wurzburg, who thus describes the advantages of percussing with this instrument. (*Berliner Medicin. Central. Zeit. Januar*. 1841.)

1. The tone produced, in its clearness, penetrativeness, and quality, far surpasses that which the most practised percussor is able to occasion by other means.

2. It is especially useful in clinical instruction, as the most distant student is enabled to distinguish the varieties of tone with the greatest ease.

3. The application is much less painful for the examiner and the patient than any other mode of percussion. A very slight force will suffice to produce tones necessary for an exact diagnosis.

4. It at once enables those to percuss, who, from peculiar formation of the fingers, want of opportunity, time, practice, &c., are deficient in the necessary dexterity.

5. It enables the examiner to draw conclusions, under circumstances, and from percussing certain portions of the surface, where, by other modes of percussion, no result can be drawn from difference in tone.

Dr Winterich, however, remarks that the feeling of resistance is distinguished less clearly with the hammer; but he considers this in every way secondary to the production of a clear tone. When M. Piorry saw the instrument which I brought with me to Paris in the spring of 1841, he made the same objection to it. I can however state, that after using the hammer some time, the feeling of resistance is very little affected by it, and that we become as conscious of the different densities of the organs by means of this hammer, as by means of the fingers.

With respect to the tone, every one who has used it can fully concur in Dr Winterich's commendations. I showed it to M. Louis of Paris, and Professor Williams of London, who both detected at once the superior tone that could be produced with it. In Edinburgh it is now commonly used by several practitioners, and Drs Henderson and Spittal employ it continually in the wards placed under their charge in the Royal Infirmary of that city.

The pleximeter recommended by Dr Winterich is circular like Piorry's, but somewhat smaller. I have found an oval one most convenient. These are sold in most of the instrument-makers' shops in Paris. I have caused the size to be reduced in such a manner that the length is two inches and breadth one inch. This pleximeter may be applied with great precision to every part of the chest, even in emaciated subjects. It may be made of ivory, wood, or metal. An inch-and-a-half scale drawn upon the surface, will be found useful in measuring the exact extent of the dullness, and determining the differences which may occur in it from day to day.

By means of the instruments now described, every student acquainted with the relative situations of the different thoracic and abdominal organs, is himself enabled, without other preliminary education, to detect the different degrees of sonoriety they possess in a state of health and disease. I may say that by means of these instruments, after one hour's practice on a dead body, he is placed on a par (as regards the art of percussion) with the generality of experienced practitioners in this country; and several of my pupils, after one month's employ-

ment of them, are enabled to mark out accurately on the surface of the body, the size and form of the heart, liver, spleen, &c. I make this statement merely to convince the profession that the difficulty experienced by every one at first in employing the fingers, is completely removed by using the pleximeter and hammer now recommended.

Of the different Sounds produced by Percussion.—The sounds produced by percussion arise from the vibrations occasioned in the solid textures of the organ percussed. The different density and elasticity of these textures will, of course, more or less modify the number and continuance of the vibrations, and give rise to different sounds.

M. Piorry considers that nine elementary sounds are thus formed, which he has designated, from the organ or part which originates them, "*femoral, jecoral, cardial, pulmonal, intestinal, stomacal, osteal, humorique, and hydatique.*" I consider that all these sounds may be reduced to three elementary ones; that, in point of fact, there are only three tones occasioned by percussion, and that all the others are intermediary. These three tones are respectively dependent, 1st, On the organ containing air; 2d, On its containing fluid; and, 3d, On its being formed of a dense uniform parenchymatous tissue throughout. These tones, therefore, may be termed the *tympanitic*, the *humoral*, and the *parenchymatous*. Percussion over the stomach gives the best example of the first kind of sound; over the distended bladder, of the second; and over the liver, of the third. The terms jecoral, cardial, pulmonal, intestinal, and stomacal, however, may be used to express those modifications of sound produced in percussing respectively the liver, heart, lungs, intestines, and stomach.

No description will suffice to convey proper ideas of the various modifications of tone occasioned by percussing over the different thoracic and abdominal viscera. To become acquainted with these, it is absolutely necessary to apply the pleximeter to the body, and then half an hour's practice with this instrument and the hammer will be sufficient to render any one conversant with those which may be heard in a normal state.

It must be remembered, however, that the tones even then may vary according to circumstances. Thus, immediately after a deep inspiration, the pulmonal sound will be rendered more tympanitic, and, after expiration, more parenchymatous. In the same manner, the stomach and intestines may give out different sounds according as they are more or less full of contents. In the left or right iliac fossa a clear tympanitic sound will be heard when the intestine below is empty, and a dull parenchymatous sound when it is full of feces.

A study of the different modifications of sound, which various organs thus produce in a state of health, readily leads to the

comprehension of the sounds which may be elicited in a morbid state. Thus, the lungs may occasion a dull or parenchymatous sound, from solidification, the result of pneumonia or tubercular deposition, or on the other hand, become more tympanitic, from the presence of emphysema. The abdomen may give out a parenchymatous sound, from enlargement of the uterus, or an ovarian tumour; or a humoral sound, from the effusion of fluid in the cavity of the peritoneum.

Of the Sense of Resistance produced by Percussion.—By the sense of resistance, is understood the peculiar sensation resulting from those impressions which are communicated to the fingers on striking hard, soft, or elastic bodies. It is of the greatest service in determining the physical condition of the organ percussed. The sense of resistance bears relation to the density of the object struck,—hence firm and solid textures offer more resistance than those which are soft or elastic. Of all the thoracic and abdominal organs, the liver presents the greatest degree of resistance, and the stomach the least. The presence of fluid in the hollow viscera, offers a medium of resistance between the parenchymatous organs on the one hand, and those containing air on the other. But air much condensed, or fluid contained within the rigid walls of the thorax, may offer a considerable degree of resistance.

The sense of resistance should be as much educated by the physician as the sense of hearing, and it would be difficult for an individual, practised in the art of percussion, to say which of these two points is most valuable to him. Both are only to be learnt by practice, and considering it perfectly useless to describe that in words which may be learnt in half an hour, by the use of the pleximeter and hammer on a dead body, or the living subject, I shall now proceed to describe the

General rules to be followed in the practice of Mediate Percussion.—

1. The pleximeter should be held by the projecting handles between the thumb and index finger of the left hand, and pressed firmly down upon the organ to be percussed. Much depends upon this rule being followed, as the sound and sense of resistance are considerably modified according to the pressure made by the pleximeter. A very easy experiment will prove this. If, for instance, the pleximeter be struck while it rests lightly on the abdomen over the umbilicus, and again, when it is pressed firmly down amongst the viscera, the change in tone will be at once perceived. In the first case a dull sound is produced, from the muscles and integuments being alone influenced by the force of the blow; in the second case, a clear tympanitic sound is occasioned from the vibration of the walls of the intestine. In every instance, therefore, the pleximeter should be so held and pressed down, as to render it, so to speak, a part of the organ we wish to percuss.

2. Great care must be taken that no inequality exist between the inferior surface of the pleximeter and the skin. Firmly pressing it down will always obviate this when the abdomen is examined. As regards the thorax, however, the groove over the anterior mediastinum, the prominence of the clavicles of the ribs, in emaciated subjects, may allow a hollow to exist under the instrument, by which a deceptive tympanitic sound is occasioned. By a little management, however, with the small and oval pleximeter I have recommended, this may readily be avoided.

3. The hammer should be held, as advised by Dr Winterich, between the thumb and the first and third fingers, the extremities of which are to be placed in the hollows prepared for them in the handle of the instrument. By some these are considered useless, but in all cases where slight differences in tone are to be appreciated, I have found this the best mode of employing it. Ordinarily, however, it will be sufficient to hold it by the extremity of the handle, merely in such a manner as will enable the practitioner to strike the pleximeter lightly, or with force, as occasion may require.

4. Care must be taken to strike the pleximeter fairly and perpendicularly. Unless this be done, vibrations are communicated to textures in the neighbourhood of the organ to be percussed, and fallacious results are the consequence. If, in percussing the lungs, for example, the blow be made obliquely, we obtain the dull sound produced by the rib, and I have seen considerable error in the diagnosis thus occasioned.

5. A strong or gentle stroke with the hammer will modify the tone and sense of resistance, inasmuch as the impulse may be communicated by one or the other to a deep-seated or a superficial organ. Thus a gentle stroke will elicit a pulmonic tympanitic sound just below the fourth rib, where a thin layer of lung covers the liver, but a strong one will cause a jecoral parenchymatous sound. At the inferior margin of the liver, on the other hand, where a thin layer of the organ covers the intestines, the reverse of this takes place, a gentle stroke occasioning a dull, and a strong one a clear sound.

6. By withdrawing the hammer immediately after the blow, we are better able to judge of the sound; by allowing it to remain a moment, we can judge better of the sense of resistance.

7. The integuments should not be stretched over the part percussed, as when the stethoscope is employed, for an unnatural degree of resistance is thus communicated to the hand of the operator from the muscular tension. In every case, especially where the abdomen is examined, the integuments and superficial muscles should be rendered as flaccid as possible.

8. It is always best to percuss on the naked skin. It is not absolutely essential, however, and in cases where, from motives of

delicacy, it is desirable that the chest or abdomen be not exposed, it only becomes necessary that the covering of linen or flannel be of equal thickness throughout, and not thrown into folds.

9. The position in which the individual examined should be placed, will vary according to the organ explored. In percussing the thoracic organs and the liver, a sitting position is most convenient. The stomach, intestines, uterus, bladder, and abdominal tumours or effusions, are best examined when the patient is lying on the back, with the knees flexed so as to relax the abdominal walls, and, if necessary, the head and neck bent forward, and supported by pillows. In percussing the spleen, the individual should lie on the right side, and when the kidneys are examined, he should lie on the breast and abdomen. In cases of effusion into the serous cavities, a change of position furnishes most valuable indications.

10. In percussing any particular organ, the pleximeter should be first applied over its centre, where the sound and sense of resistance it may furnish, are most characteristic. Two blows with the hammer are generally sufficient to determine this. From the centre, the pleximeter should be moved gradually towards the periphery, or margin of the organ, and struck as it proceeds with the hammer, now forcibly, now lightly, until the characteristic sound of the next organ be elicited. The pleximeter is then gradually to be returned towards the organ under examination, until the difference of tone and sense of resistance become manifest. In this manner having first heard the two distinct sounds well characterized, we shall be better enabled to determine with accuracy, the limit between the one and the other. This may be done exactly after having determined, whereabouts the line of separation is, by placing the long diameter of the pleximeter transversely across it, and striking, first one end of the instrument, and then the other, till the precise spot is determined. This spot should now be marked, by placing with a pen a dot of ink on the skin. The opposite and then other portions of the margin of the organ should be limited in the same manner, and these in turn should be marked with dots of ink, until the whole organ be completely examined. Then by uniting all these dots with a line of ink, we have the exact form of the organ drawn upon the skin. When it is thought necessary to render the first mark permanent, in order to see if any subsequent change take place in the size of the organ, or extent of the dullness, it may be rendered so, by carrying lightly a stick of argent. nit. over the ink line, while it is still moist.

Special rules to be followed in percussing particular organs.—The short rules and practical remarks about to be given, are derived partly from the precepts of M. Piorry, as I have heard him de-

liver them in the wards of La Pitié, and partly from my own experience.

Lungs. Percussion of the lungs generally bears reference to a change in density, which is only to be detected by comparing the healthy with the morbid portions. The great practical rule here to be followed, is to apply the pleximeter to both sides of the chest in succession, with the same firmness, exactly in the same situation, and let the blow with the hammer be given with the same force. Care must be taken that the position of both arms be alike, as the contraction of the pectoral muscles on one side more than on the other may induce error. In short, every circumstance must be the same before it is possible to determine in delicate cases, either from the tone or sense of resistance, whether change of density exist in the lungs. When circumscribed alterations are discovered in the pulmonary tissue, their limits may be marked out on the surface of the skin, in the manner previously indicated. In this way, I have frequently succeeded in determining with accuracy the size and form of circumscribed indurations, arising from partial pneumonia and pulmonary apoplexy. Under the clavicles, the pleximeter must be applied with great firmness. Inferiorly, a thin layer of lung lies over the superior surface of the liver; and to determine the exact place where its inferior border terminates, the blows with the hammer should be very slight. Posteriorly, also, the pleximeter must be firmly applied, and the force of the blows considerable: but they should decrease in force inferiorly, where a thin layer of lung descends over the liver much deeper than anteriorly.

In a healthy state, a distinct difference may be observed in the sonoriety of the lungs immediately after a full expiration and a full inspiration. This does not take place when the tissue becomes indurated from any cause; and thus we are furnished with a valuable diagnostic sign. Congestion of the lung, and pneumonia in its first stage, causes only slight dullness and increased resistance, which, however, are readily detected by the practised percussor. In the second and third stage of pneumonia, and in apoplexy of the lung, this dullness and resistance are well marked, and even an impression of hardness and solidity communicated to the hand. When, however, the lung is studded with tubercles, the induration is most intense, and the greatest degree of resistance communicated.

Partial indurations from pneumonia, apoplexy, or tubercular deposition, may be detected by percussion, even when deep-seated and covered by healthy portions of the lungs. In this case, by pressing with the pleximeter, and striking lightly, a tympanitic sound only is heard; but by pressing the pleximeter down firmly, and striking with force, the dull sound may be elicited and circumscribed. When induration, however, exists inferiorly

in those portions of the lungs which overlap the liver, it requires great practice to detect them with certainty. Caverns in the lungs, when large and filled with air, induce a tympanitic sound; but they are generally more or less full of viscous and fluid matters, and give rise to dullness.

Two or three ounces of fluid may be detected in the pleural cavity, by causing the patient to sit up. It is readily distinguished posteriorly, from the dullness of the liver on the right side; on the left, however, the limit between it and the spleen is not so well marked. The height or level of the fluid is readily determined, and should be marked daily by a line made with nitrate of silver. If the effusion be only on one side, the peculiar humoral dullness is more easily detected. It disappears on placing the patient in such a position as will cause the fluid to accumulate in another part of the pleural cavity, when the space, which was previously dull, becomes clear. When the effusion entirely fills the pleural cavity, no limit of course can be detected; but, even then, the dullness is distinguished from that of the liver by the diminished feeling of resistance.

When air is effused into the pleura, the sound is like that of a drum, and readily detected.

Heart. To mark out the precise limits of the heart, constitutes the first difficult lesson in the art of percussion. M. Piorry commences by determining the clear sound at the upper end of the sternum, and bringing the pleximeter gradually downwards till the dull sound of the heart be heard. I have found it best to place the instrument first under the left nipple, where the cardial dullness is most intense; then to draw it upwards, striking it continually with the hammer, until the clear sound of the heart be elicited, then, by bringing it down again towards the heart, we shall readily distinguish the line where cardial dullness commences, and thus limit the superior margin of the organ. The same method is to be followed in determining the situation of the lateral margins, only drawing the pleximeter outwards or inwards, striking more and more forcibly with the hammer, until the clear tympanitic sound of the lung only be heard. I have found it difficult to determine the situation of the apex of the heart, for as this rests on the diaphragm, and this again upon the left lobe of the liver, it cannot readily be distinguished from them. M. Piorry recommends, that the superior margin of the liver be followed with the pleximeter, until a more obscure sound and less resistance be met with. I have no doubt that, with great practice, the apex might be limited in this manner, but hitherto I have not succeeded in accomplishing it. The size of the heart, however, may be pretty accurately estimated by limiting its superior and lateral margins.

The normal size of the heart differs in different persons. As

a general rule, however, it may be considered that, if the transverse diameter of the dullness measure more than two inches, it is abnormally enlarged. It has been known to measure seven inches. (Piorry). In hydropericardium the dullness has been remarked to exist rather at the superior part of the sternum, than on one side or the other. (Piorry, Reynaud.) In hypertrophy, by dilatation of the right ventricle, the increased extent of the dullness stretches towards the median line, and sometimes passes over it. In similar hypertrophy of the left ventricle, the dullness extends on the left side, more or less according to the increased size of the heart. In concentric hypertrophy, there is no or little enlargement, but the density is greatly increased, which is readily detected by the feeling of resistance.

The cardiac dullness may be augmented, from the heart being simply distended with blood, as in cases of plethora. Under these circumstances, it rapidly diminishes after blood-letting, a fact established by M. Piorry, and one which is of great service in diagnosing this condition of the heart from hypertrophy. In the latter disease, as the increased volume depends upon enlargement or thickening of the muscular parietes of the heart, it is little affected by blood-letting.

The presence of tubercles in the lungs surrounding the heart; aneurisms or other tumours, pressing upon, or in the neighbourhood of, the organ; hypertrophied liver, extensive empyema, &c. &c., may render its mensuration difficult or impossible.

Liver. Limitation of the size of the liver should be commenced by placing the pleximeter over the organ on the right side, where the dullness and resistance are greatest. It should then be carried upwards until the clear sound of the lung be distinguished, when it ought again to be brought down, and the limit marked. This limit, however, may indicate either the inferior margin of the lung, or superior convex surface of the liver. Now, as a thin layer of lung descends in front of the liver, it will be necessary to determine where the tympanitic sound ceases inferiorly, by striking gently with the hammer, and where the parenchymatous sound ceases superiorly, by striking forcibly, so that vibrations may be communicated to the organ through the layer of lung. The space between these two lines thus marked on the surface, is wider in some individuals than in others, and deeper and more extensive posteriorly than anteriorly. By carrying the pleximeter from the right side anteriorly, and then posteriorly towards the left of the patient, the whole superior margin may be thus detected, and marked with ink upon the surface, except where the liver comes in contact, through the medium of the diaphragm, with the apex of the heart. The inferior margin is for the most part readily detected. It must be remembered, however, that in the same manner as a thin layer of lung covers the

upper margin, so a thin layer of liver descends on the right side over the intestine. It is therefore necessary to be cautious in determining the inferior margins, for a tolerably strong blow with the hammer will give rise to a tympanitic sound from the intestine, heard through the liver. The lower margin, therefore, must be percussed in an inverse manner to the superior, and as we approach, the force of the blow should be diminished. The inferior margin of the liver is in general readily detected, from the contrast which its dullness and density produced on percussion present, contrasted with the tympanitic and elastic feel of the intestines and stomach.

The superior limit of this organ is generally found about two inches below the right nipple, and its inferior border under the lower margin of the ribs. The extent of the jecoral dullness in the healthy state is in general two inches on the left side, three inches in the hepatic region anteriorly, and four inches in the hepatic region laterally. (Piorry.)

Variations in the size of the liver, from congestion, inflammation, abscesses, hydatids, tumours, atrophy, &c. &c., may often be exactly determined by means of percussion. In icterus, the increase and diminution of this organ, as evinced by lines marked on the skin, will generally be found to bear a proportion to the intensity of the disease. When tumours are present, the inferior border often presents an irregular form. If the inferior lobes of the lung be indurated by tubercles or hepatization, it becomes difficult or impossible to draw the limit between them and the liver. When fluid effusion exists in the pleura, the increased density of the liver still serves to distinguish it, through the humoral sound of the fluid; and by changing the position of the patient, its upper edge in the majority of cases may be limited. In ascites, the patient should be made to lie on the left side, in order to measure the right lobe, on the right side to measure the left lobe, and on the abdomen to percuss it posteriorly. Sometimes the right lobe of the liver is so enormously hypertrophied, that its inferior margin extends nearly to the right iliac fossa. (Piorry.)

When the gall-bladder is much distended with bile, or contains gall-stones to any amount, it may readily be detected by percussion, and the dullness it occasions immediately under the inferior margin of the liver, anteriorly and somewhat laterally, be marked off. M. Piorry is enabled to do this in almost every case, but I must confess that I have often failed in detecting it.

Spleen. In percussing the spleen, it is necessary that the patient lie on the right side, and it is advantageous that the examination be made before rather than after meals. Anteriorly the sonoriety of the stomach and intestines causes the margin readily to be distinguished. Posteriorly, however, where the

organ comes in contact with the kidneys, this is impossible. Its superior and inferior margins may be made out by striking the instrument with some force, and following the rule, No. 10, previously given.

The general size of the spleen is about four inches long and three inches wide. (Piorry.) In diseased states it may be atrophied or enlarged. I have seen it measure ten inches long and six wide. A pleuritic effusion, ascites, pneumonia, or tubercular deposition in the inferior lobe of the left lung, may render a limitation of this organ difficult or impossible.

I am inclined to think, that if the size of the spleen were determined more often than it is in fevers, some curious results would be obtained. In several cases of so-called typhus fever admitted into M. Piorry's ward, percussion determined that the spleen was considerably enlarged, and a more accurate interrogation of the patients proved that the fever was intermittent. In the autumn of 1839, a man, previously healthy, entered La Pitié, who had been knocked down by the shaft of a cabriolet coming in contact with the left side. Considerable pain and swelling followed in the region of the spleen, and this organ was determined by percussion to be enlarged. The general fever which accompanied this local lesion, was of a distinctly intermittent type. As the spleen diminished in size, the fever disappeared. M. Piorry has published a somewhat similar case, where the intermittent fever arose after a fall on the left side, causing engorgement of the spleen. Bleeding and leeches only caused diminution of the local pain, but quinine cured the fever, and caused diminution of the splenic engorgement.¹ In undoubted cases of intermittent fever, where the spleen has been enlarged, I have frequently seen a dose of 50 grains of quinine diminish the size of the organ an eighth of an inch, and sometimes more, round its whole anterior margin, in twenty-four hours, which would indicate at least a diminution of a quarter of an inch in its longitudinal and transverse diameter. I am far, however, from thinking it fully established, that the real cause of intermittent fever resides in enlargement of the spleen, or that quinine acts especially on that organ, although many well-observed facts tend to this conclusion. Those who maintain, that enlarged spleen is the result, rather than the cause of the disease, may be asked, has the organ been accurately percussed in every stage of the disorder?

Stomach and Intestines. The sounds elicited by percussion of the stomach and intestines, are of the greatest service to the practitioner: 1st, As furnishing him with the means of determining the form of other organs, as the liver, spleen, or bladder; 2dly, As enabling him to distinguish the presence or absence of fecal or ali-

¹ Mémoire sur l'état de la Rate dans les Fièvres Intermittentes.

mentary matter; and, *3dly*, As the means of diagnosing abdominal tumours. Hence it is incumbent on every physician to be able at once to recognise the difference between the tones furnished by the stomach, small and large intestines under various circumstances. To arrive at this knowledge, it is necessary to be acquainted with the relative positions of the different abdominal viscera, and the regions of the abdomen to which they correspond.

In exploring the abdomen by means of percussion, the pleximeter should first be placed immediately below the xiphoid cartilage, pressed firmly down, and carried along the median line towards the pubis, striking it all the way, now hard, now gently, with the hammer. The different tones which the stomach, colon, and small intestines furnish, will thus be distinctly heard. The pleximeter should then be carried laterally, alternately to the one side, and then to the other, till the whole surface be percussed. In this manner, the different tones produced by the cœcum and ascending colon on the right side, and descending colon on the left, will be respectively distinguished from that furnished by the small intestines. The sounds and sense of resistance will be modified according as the different viscera are full or empty, as any one can determine by means of the pleximeter and hammer on his own body. When the intestines are full of fluid or solid contents, such portions may be circumscribed and marked out on the surface of the skin. I have thus often succeeded in determining the internal margin of the colon, in its ascending, transverse, or descending portions. Sometimes a portion of intestine is found lying between the abdominal walls and the stomach. The latter however may be readily determined, by pressing down the pleximeter, causing the patient to eat or drink, or by examining after dinner. The small intestines are almost never deprived of the tympanitic sound—a circumstance by which they may readily be distinguished from the stomach and large intestines. The distance of any particular knuckle of intestine from the abdominal walls, may be pretty accurately calculated, by the force necessary to be employed in pressing down the pleximeter, and striking with the hammer, in order to elicit a tympanitic or dull sound.

It is unnecessary to point out the numerous circumstances, and morbid conditions, in which percussion of the abdomen may prove useful in practice. Displacements of the stomach or intestines, femoral and scrotal hernia, mesenteric, ovarian, and other tumours, peritoneal adhesions and effusions, may all frequently be diagnosed, and their limits determined by a careful examination with the pleximeter and hammer. By means of percussion, even the nature of the tumour may often be arrived at, as for instance, whether it be fungus hematodes, scirrhus, encysted, osseous, &c., by the different degrees of resistance they

possess. Care however must be taken, not to confound with tumours an enlarged spleen or liver, a distended uterus or bladder, stomach full of alimentary matter, &c.

In a practical point of view, it is often useful to determine, by means of percussion, whether an enema or a purgative by the mouth is likely to open the bowels most rapidly. If, for instance, there be dullness in the left iliac fossa, in the track of the descending colon, that part of the intestine must be full of feces, and an enema is indicated. If, on the other hand, the left iliac fossa sound tympanitic, and the right sound dull, an enema is of little service, as it will not extend to the cœcum, and purgatives by the mouth are indicated.

Effusion of fluid into the peritoneum may be determined with great exactitude by means of percussion, and the height of the fluid marked, as in the case of pleuritic effusion. In the same manner, a change of position furnishes similar results.

Bladder. This viscus is only to be detected by percussion, when it is more or less distended, and rises above the pubis. It may then be distinguished, and its circular margin limited, by observing the tympanitic sound of the intestines, on the one hand, and the dull humoral sound furnished by the bladder, with increased resistance, on the other. When covered by intestines, it will be necessary to press down the pleximeter with tolerable firmness, but not in such a manner as to give the patient pain. In the infant, the situation of the bladder is not so deep in the pelvis, and a small quantity of fluid renders it cognizable by means of percussion.

A ready approximation of the state of the bladder will be found of great service in cases of apoplexy, delirium, imbecility, paraplegia, &c. &c. In several cases it has been found dangerously distended, on percussing the abdomen to determine the state of the intestines.

I have here only noticed those points and circumstances in the art of percussion which I myself have been enabled to accomplish, and which every one may acquire in a few months by care and attention. The nice and more delicate points I must confess I have myself not yet arrived at satisfactorily, but hope to be enabled to do so by continued practice. To these belong percussion of the kidneys, accurately limiting the left from the right ventricle, determining and marking out the ascending and transverse portions of the arch of the aorta, &c. For directions concerning these points, as well as for numerous details, experiments, cases, and practical remarks, having reference to what has been already noticed, I must refer to the admirable works of M. Piorry.¹ I

¹ De la Percussion Médiante, &c., Paris, 1828. Du Procédé Opératoire, Paris, 1831. De l'Examen Plessimétrique de l'Aorte Ascendante, et de la Crosse Aortique, &c. Archives Gén. de Méd., vol. ix., 1840, p. 431.

shall esteem myself fortunate, however, if the remarks and rules now laid down in any way facilitate the important and difficult art of percussion, as applied to the diagnosis of thoracic and abdominal diseases.

EXPLANATION OF THE PLATE.

••• All the Figures are of the full size.

Fig. 1. The hammer. *a*, the head made of steel, brass, or iron; *b*, the capsule screwed on; *c*, the projecting disc of caoutchouc; *d*, the handle made of wood; *e*, depression for the thumb; *f*, *g*, depressions for the index and ring fingers.

[It will be observed that the head is not placed exactly at right angles with the handle, but that it has a slight obliquity upwards. This is necessary, because in employing it, the handle is almost certain to be somewhat elevated, and this slight obliquity even then allows the practitioner to strike the pleximeter perpendicularly.]

Fig. 2. The head of the hammer without the capsule, shewing the manner in which the caoutchouc is attached.

Fig. 3. The capsule separated, shewing the size of the opening through which the caoutchouc passes.

Fig. 4. The extremity of the head, showing the form of the nozzle to which the caoutchouc is attached.

Fig. 5. The front and edge of the caoutchouc, showing the manner in which it ought to be cut or prepared.

[Dr Winterich attaches much importance to the mode of preparing the caoutchouc. - I have found that cutting a square piece of it, about a quarter of an inch thick, in such a way that two convex surfaces are presented, answers every purpose. One of these rests upon the concave surface of the nozzle, figured in the plate (fig. 4); the other projects through the capsule, (fig. 1, *c*.) The thin part is stretched over the lip, and tied, (fig. 2.)]

Fig. 6. The pleximeter drawn in perspective, shewing its thickness, the size of the handles, and their roughened external surface.

Fig. 7. The pleximeter seen from above, shewing the exact size of the instrument, and the inch and a half scale drawn upon its surface.

