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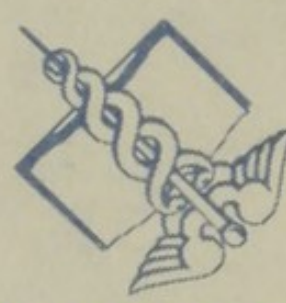


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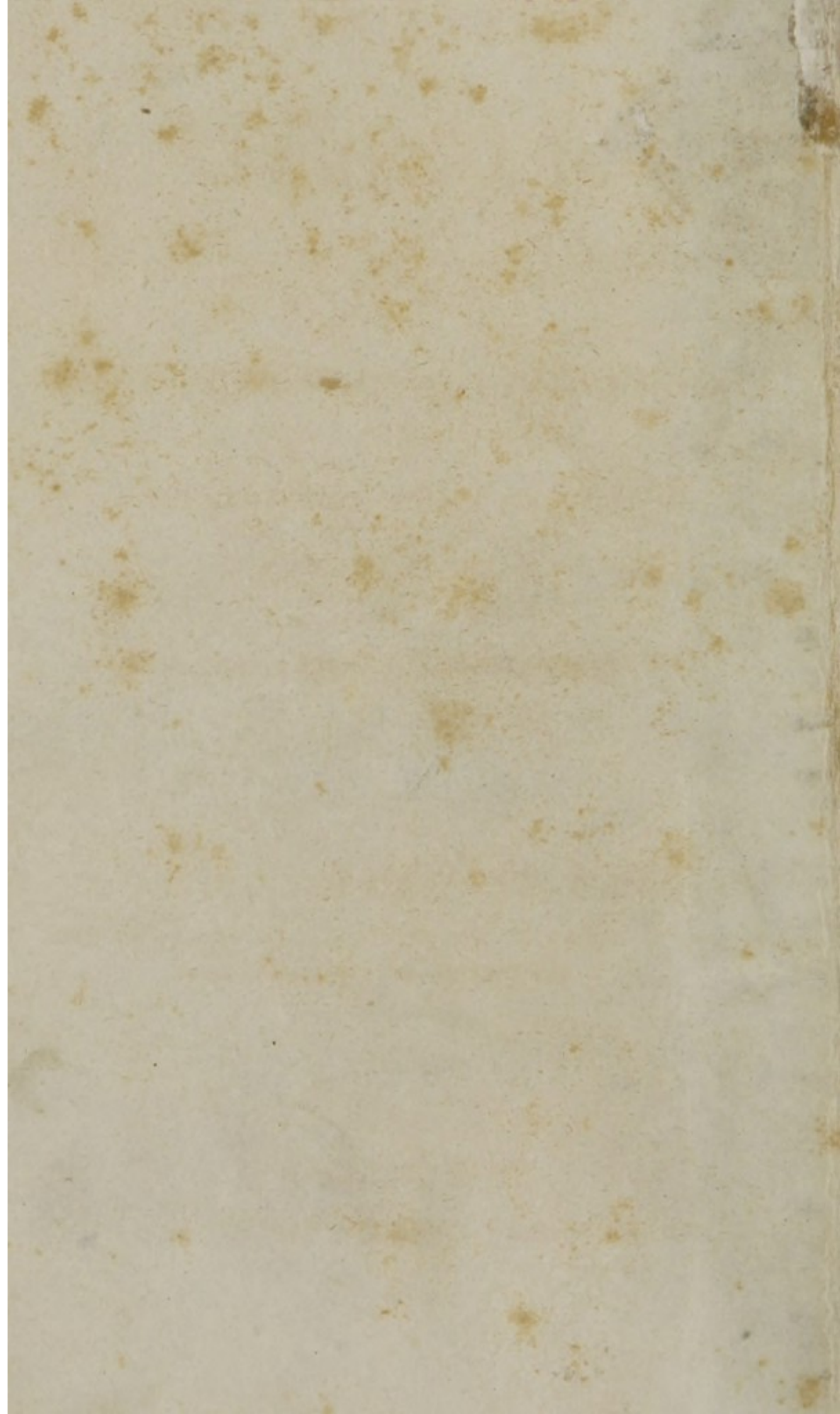
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A
M A N U A L
OF
PERCUSSION AND AUSCULTATION.

COMPOSED FROM THE FRENCH

OF

MERIEDEC LAENNEC.

ANNEX

By JAMES BIRCH SHARPE, M.R.C.S.

AUTHOR OF ELEMENTS OF ANATOMY DESIGNED FOR THE
USE OF STUDENTS IN THE FINE ARTS.



NEW YORK:

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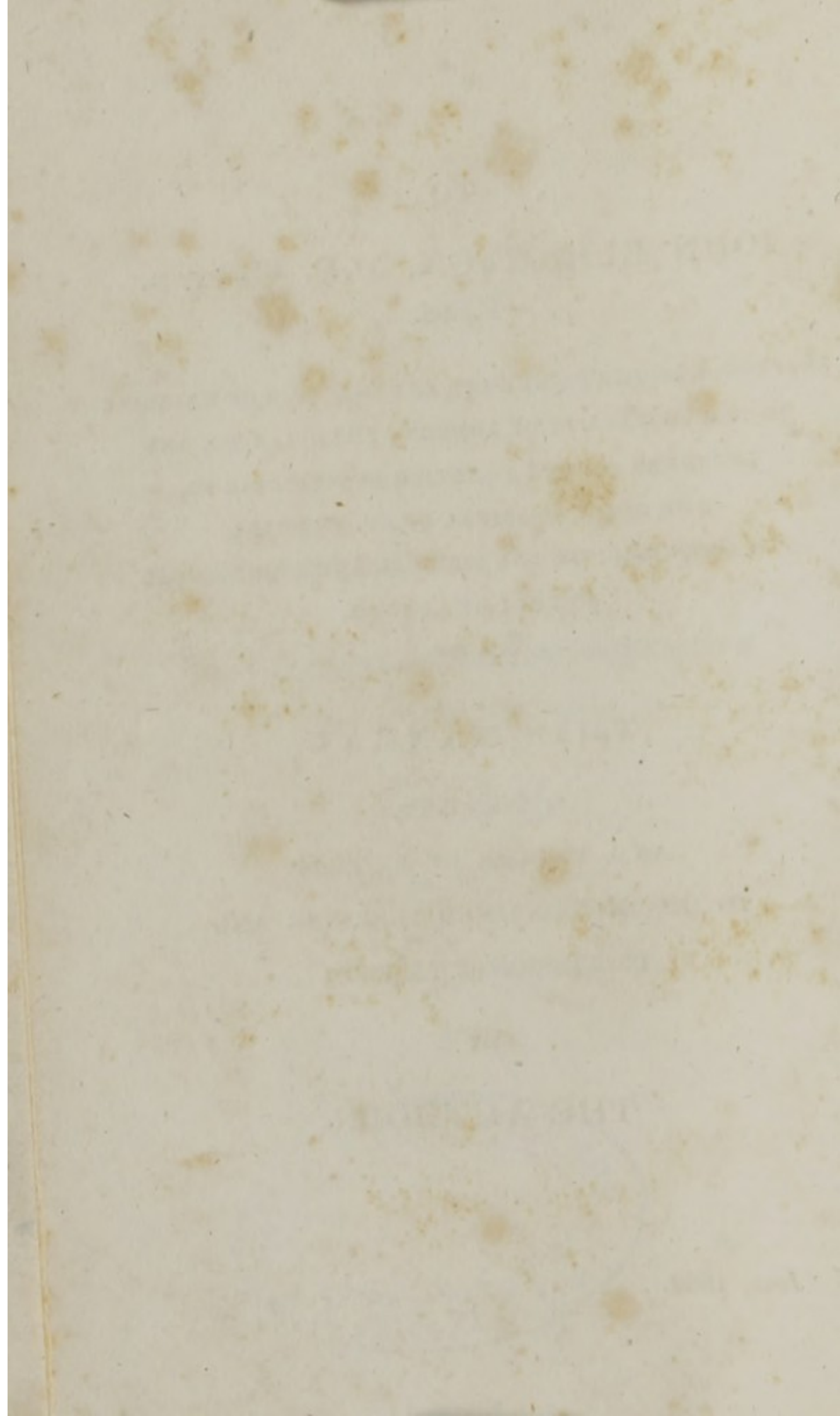
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&c. &c.

THIS MANUAL
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RECOMMENDATIONS.

The work of M. Velpeau on Surgical Anatomy, or the Anatomy of Regions, as it was the first so it is also, I think, the best systematic Treatise of the subject. I know of no work so useful as a book of reference to the operator; none so comprehensive, so minute and so accurate. With respect to the merits of the translation by Doctor Sterling, I can vouch for its correctness, in those portions which I have examined, and these have been numerous.

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Prof. Surgery in the University of New-York.

From Dr. Smith, Prof. Anat. and Physiology in the University of New-York.

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I take great pleasure in recommending your translation of Velpeau's Surgical Anatomy. We have no treatise in the English language on the same plan, and surely nothing can be more important to the surgeon than to have brought under one view all the parts

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J. AUG. SMITH.

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From Dr. Mott, Professor of Surgery in
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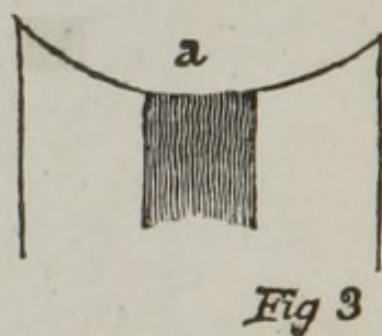
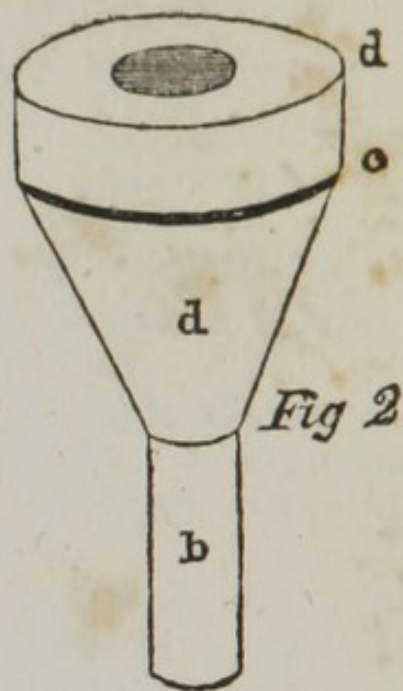
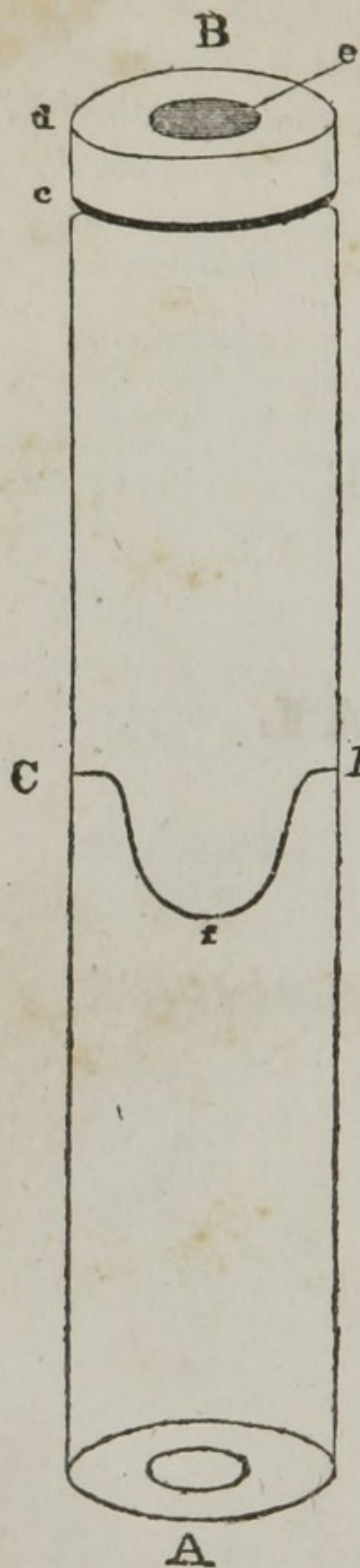
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A
MANUAL
OF
PERCUSSION AND AUSCULTATION.



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* This word *pneumato-thorax* is in Laennec's work written *pneumo-thorax* ; the author, for the sake of using a more correct orthography, has changed its form.

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EXPLANATION OF THE PLATE.

Fig. 1. A diminished drawing of the Stethoscope.

Its proper dimensions vary from 9 to 11 inches in length ; and from one inch and a half to an inch and three quarters in diameter.

- A. The auricular extremity.
- B. The obturator extremity, to be applied upon the chest.
- C. A line in the centre showing a division made in some stethoscopes, either by a screw or by a stopper, and corresponding hollow as shown by the dotted line at f.
- c. d. The length of the outward part of the obturator being about 5 or 6 tenths of an inch long.
- e. The opening of the tube which passes through the Stethoscope.

Fig. 2. The obturator as seen when drawn out from the Stethoscope.

- a. Its conical body.
- b. A brass tube to fit into the bore of the Stethoscope.
- c. d. The length of the outward part of the obturator ; there should be an additional obturator to every Stethoscope with this part produced to double its usual length, say about an inch ; and gradually diminishing in its

diameter, so as not to be wider than half an inch for the purpose of applying the instrument to children, and the mastoid process, &c. &c.

Fig. 3. A section of the auricular extremity of the Stethoscope to show the cupped, or dished form, of both ends: the dip of it may be more or less to suit the ear of the auscultator.

Fig. 4. A section of the extremity of the Stethoscope when the obturator is removed;—to show its rounded border at c. c. This rounded edge should be particularly attended to, as the usual thin edge always gives pain to the patient.

The drawing in this plate gives the simple and original form of the Stethoscope as invented by the great Laennec; but since his time, various forms have been given to this instrument, without, however, the slightest addition to its utility or scientific improvement.

The only object of a division in the centre is portability;—but if made upon the same scale as the one recommended by Dr. Elliotson, there is no necessity for even this contrivance: his instrument is 9 inches in length, and one inch and 11 sixteenths in diameter; and its material is cedar.

PART I.

CHAPTER I.

ON PERCUSSION.

1. *By percussion* is meant that method of examining the internal state of the thorax by the resonance produced on gently striking it in various parts with the points of the fingers ; or some convenient instrument.

2. *Percussion* is best performed upon the patient sitting up ; for when he is recumbent on a bed, the bedding, the pillow, and even the curtains, will materially affect the character of the resonance.

The chest should be clothed only with a light garment, as the night gown, shirt, &c. The intervention of the linen is rather advantageous than otherwise ; for if percussion be performed upon the naked skin the operator's hand should be clothed with a glove, to avoid

the clacking sound produced by the contact of the two skins : but this latter plan is not so proper, as the glove deadens the sound.

4. The clavicle, the sternum, and the ribs are more eligible for percussion than the intercostal spaces.

5. The four fingers (3, 2, and 1 only are necessary with children) should be used in percussion, and so placed that their extremities form one line, and held together with sufficient firmness by the opposition of the thumb to prevent any motion between them on giving the stroke.

6. The stroke should fall perpendicularly upon the part, and be made with the points of the fingers.

7. Both sides of the chest should be struck in succession, exactly under the same angle and with equal force. The omission of these precautions will occasion erroneous results.

8. When percussion is performed upon the soft parts the muscles should be made tense : and when performed upon the back, the arms should be firmly folded across the chest, the body being bent forwards.

9. *Percussion* should be repeated several

times upon alternate sides of the chest, before any opinion be formed upon the case ; for when the sound is doubtful on one side, the repetition of percussion after striking the other side will often give a very different result.

10. Percussion is performed by some through the medium of a thin round plate of wood, or horn, or ivory, or even at times with a piece of money. Others use a round piece of ivory with a border to it like the lid of a circular box ; and some stethoscopes are furnished with this contrivance so as to screw on and off, making when together one instrument. A writer in the Medical Gazette lately used two round pieces of sole leather, placing one upon the part and striking it with the margin of the other.

11. *Percussion*, when performed through the medium of such instruments, is called *Mediate Percussion* : there are other methods, but the former only are used with advantage.

12. The chest of a man in a state of health, lightly struck in the manner directed, upon the lateral and anterior parts, gives out a clear sound by reason of the volume of air that habitually fills the lungs.

The nature of this sound must be learned by experiment, for no verbal description can give a perfect idea of its character.

13. In order to perform percussion systematically, the thorax is divided into distinct regions, and every region has its particular degree of sound.

The Regions of the Thorax.

14. The external parts of the thorax are divided into fifteen regions, of which twelve are double, and three are single ; as follows :

I. The *sub-cloidal* region, is that part of the chest covered by the clavicles. When the clavicle is struck upon the sternal extremity, or towards its middle, it gives a very clear sound ; on the humeral portion the sound is rather dull. The knowledge of the natural and unnatural sound of this part of the chest is most important, inasmuch as it ordinarily furnishes the first signs of tubercles in the lungs. When the clavicles are too far from or too close upon the chest, by reason of their being too arched or too straight, then the resonance is less ; especially in the latter case.

II. The *Anterior Superior Region*.—This region commences immediately below the clavicle, and terminates upon the fourth rib. The resonance is naturally clear but somewhat less so than at the sternal extremity of the clavicle.

III. The *Mammary Region*.—This region commences at the under edge of the fourth rib and terminates at the eighth rib. In females this region will not allow of percussion. In males it rarely gives as much sound as the *anterior superior* region, by reason of the thickness of the inferior edge of the pectoralis major.

IV. The *Submammary Region*.—This region commences at the under edge of the eighth rib, and terminates at the border of the cartilages of the false ribs. The sound on the right side is less clear, owing to the volume of the liver. The left side, on the contrary, is frequently more than naturally clear, and almost tympanitic in sound, owing to the gaseous distention of the stomach. In some rare cases an excessive enlargement of the spleen will produce a dull sound.

V. VI. and VII. The *Superior, Central*

and *Inferior Sternal Regions*.—These regions give out a sound as clear as that at the external extremity of the clavicle. Yet in some subjects, particularly the very fat, the inferior region resounds less than the superior by reason of the quantity of adipose matter that envelopes the heart.

VIII. The *Axillary Regions*.—These regions commence at the summit of the armpit and terminate at the fourth rib : the sound given out is very clear.

IX. The *Lateral Region*.—This region commences beneath the fourth rib and terminates at the eighth. The sound is always clear on the left side. On the right side it is often remarkably less so ; this indicates a more than ordinary elevation of the liver, and that the right lung, by being pressed upwards, becomes more dense and less filled with air. For the liver seldom rises higher in a healthy condition than the sixth, or at most the fifth rib.

X. The *Inferior Lateral Region*.—This region commences at the eighth rib, and terminates at the border of the cartilages of the false ribs. For the reasons already stated,

this region on the right is almost always less sonorous than on the left side ; and sometimes the sound is quite flat. Whilst, on the contrary, the left region gives a clearer sound than is natural to it by reason of the distention of the stomach. For the like cause the same resonance may take place in this region, although the inferior part of the left lung may be engorged, or an effusion may have taken place into the pleura on that side.

XI. *The Acromion Region.*—This region is comprised between the clavicle, the superior edge of the trapezius, the humerus, and the inferior part of the neck. There is no resonance in this region.

XII. *The Supra-spinal Region.*—This region corresponds to the supra-spinal fossa of the scapula ; and by reason of the supra-spinous muscle there is scarcely any resonance. The transverse spine of the scapula sometimes resounds a little, but in a very heavy manner, and then the arms must be powerfully crossed or folded.

XIII. *The Inferior Spinal Region.*—This region corresponds to that part of the scapula

situated below the transverse spine ; and here also there is scarcely any sound owing to the thickness of the muscles.

XIV. The *Inter-scapular Region*.—This region includes the space comprised between the internal edge of the scapula and the vertebræ when the arms are crossed upon the chest. To obtain a sound from this region is difficult, arising from the thickness of the muscles and their various directions, which occupy the space. Yet sometimes it gives out a moderate sound, and tolerably clear, in thin persons, when the muscles are made tense by the crossing of the arms and the bowing down of the head. The dorsal spine itself gives out a tolerably clear sound ; and so does that part of the chest included between the interior superior angle of the scapula and the first spinous process of the dorsal vertebræ.

XV. The *Inferior Dorsal Region*.—This region commences at the inferior angle of the scapula, and terminates at the twelfth dorsal vertebra. To obtain any sound from this region, particularly in fat persons, the angle of the ribs must be struck transversely to their

direction. The sound is tolerably clear at the upper part, but a little lower it is nearly lost, often none at all; and almost always obscure on account of the locality of the liver. On the left side the sound is deceitful, owing to the before-named distention of the stomach.

15. The student will learn from the subsequent pages of this work that percussion is only the handmaid of auscultation; and that when used alone, no certain and satisfactory result can be obtained.

The Method of using the Stethoscope.

16. The stethoscope should be applied perpendicularly to the part on which it is placed, and so that no angle be between its extremity and the skin.

17. Care should be taken not to press the instrument too powerfully,—particularly when the obturator is removed, lest pain be given to the patient.

18. The part need not be naked, linen and even flannel may be interposed without detriment; it is better, however, that nothing but a thin dress be upon the part. Silks, and

woollen stuffs, interrupt the examination, by reason of the rustling noise which they create.

19. The stethoscope should be held firmly, but not with a powerful grasp, and the ear must not press heavily upon the instrument.

20. The patient should be placed in the most convenient position for the application of the stethoscope to that part intended for examination ; the sitting posture is generally the best, and the auscultator should rest upon one knee on the ground, or on a footstool, as occasion may require.

21. When examining the back, the patient should bend forwards ; if one side is to be examined then he should lean over to the other ; and so on of the rest.

22. Care must be taken not to confound the noises heard without, with the sounds within the chest : a little practice will lead to a perfect recognition of both the natural and extraneous sounds.

23. The student should practise the use of the stethoscope upon persons in health in the first instance, and thin persons generally afford the most characteristic sounds. Indeed, not

only upon persons, but upon brutes and inanimate things should he apply the instrument; by which means he will tutor his ear to distinguish every variety of sound *and vibration*, and acquire a delicacy of discrimination that will far surpass the most sanguine expectation.

For a description of the stethoscope, vide the Plate.

Definition of mediate Auscultation.

24. Mediate auscultation is the method of examining, through the instrumentality of the stethoscope, the internal state and condition of the thorax and its viscera, by ascertaining their actions, vibrations, and the sounds which those actions afford.

CHAPTER II.

AUSCULTATION OF RESPIRATION.

25. The penetration of the air into the organs of respiration is accompanied by a slight murmur, which is distinctly perceived by the aid of auscultation, and is called the *respiratory murmur*.

26. This sound of the passage of the air in the pulmonary tissue, the larynx, the trachea, and the great bronchial branches, presents a different character in each locality.

27. *In the first case* the sound is somewhat soft and silky; and the ear recognizes the penetration of the air into a multitude of little cells, which are dilated to receive it: this is the true pulmonic respiratory murmur, which is also called *vesicular respiration*. *In the other cases* the sound is more dry, and is deprived of that crepitation which accompanies

the developement of the air cells ; the passage of air through tubes of various dimensions is thus perceived : this is the bronchial respiratory sound, or more simply, *bronchial respiration*.

28. In health, the *vesicular respiration* is heard almost equally at all points of the chest ; yet is more plainly heard at those parts where the lungs are nearest to the surface ; as at the arm-pits, the space between the clavicle and the trapezius muscle, and between the same bone and the mammæ.

29. The *respiratory murmur* is sonorous in proportion to the rapidity of the respirations : a slow and deep breathing scarcely, but a short breathing, though incomplete, plainly, develops the respiratory murmur.

30. *Vesicular respiration* is more energetic and blustering in children than in adults ; and still more so than in old persons. The younger the infant the more marked is this energy : and it continues until, and a little beyond, the age of puberty.

31. The *intensity of the respiratory murmur* differs in different individuals. With some it is heard with difficulty, unless in a strong

respiration : with some it is heard with facility, even though the breathing be gentle : whilst others retain during their whole life the energetic murmur of infantile vesicular respiration : this breathing is called *puerile respiration*.

32. This last species of breathing sound (*the puerile*) is for the most part heard in females and men of a very nervous constitution ; and with the exception of these two classes, respiration never becomes puerile in the adult, but when a considerable portion of the lungs becomes, from some cause or other, impermeable to the air.

33. When *vesicular respiration* is heard with equal force in all points of the chest, the lungs are in a healthy state ; when, on the contrary, this respiratory murmur is diminished or annihilated at any part whatever of the thoracic surface, we may conclude that the corresponding part of the lungs has become impermeable to the air in a greater or lesser degree.

34. *Bronchial respiration*, in a state of health, is only heard on the anterior and

lateral parts of the neck. But in some very thin persons it may be heard towards the upper extremity of the sternum, and in the interscapular space. In all other parts the respiratory sound in the small bronchial branches is confounded with the vesicular respiration.

35. When, from any cause, the pulmonary tissue becomes hardened or condensed, the *bronchial respiration* replaces the vesicular, and thus it becomes one of the first signs of hepatisation of the lungs, of the accumulation of tubercles in this organ, of an effusion, &c. &c.

36. *Bronchial respiration* becomes a sign of greater importance, in proportion to the distance at which it is heard from the interscapular spaces ; therefore, it is a matter of great importance to practise the ear in distinguishing bronchial from vesicular respiration.

37. When, from any cause, an excavation is formed in the lungs, the penetration of air into such cavity produces a sound similar to bronchial respiration, when heard at the anterior part of the neck ; this is the *cavernous respiration*.

38. *Cavernous* and *bronchial respiration* are sometimes so modified, that in inspiration the air seems as if drawn *from* the ear of the observer, and in expiration as if drawn back into the ear: this is the *blowing respiration*; a decidedly morbid phenomenon, demonstrating the near approach of the excavation, or of the bronchiæ which pass into it, to the surface of the lungs.

39. This *blowing respiration* sometimes resembles the agitation of a moveable veil (or sail) placed between the ear of the observer and the pulmonary excavation. This veiled blowing appears to arise from an unequal density of the sides of the excavation in which it takes place.

40. In examining these respiratory sounds and their modifications, the stethoscope must be used without its obturator.

CHAPTER III.

AUSCULTATION OF THE VOICE.

41. When any one, in a healthy state, speaks or sings, the voice resounds through every part of the respiratory organs : if we seek by auscultation to discover the nature of this resonance, we shall find it to differ in the larynx, trachea, the bronchiæ, and in the pulmonary tissue.

42. The voice resounds so forcibly in the larynx, and the superior portion of the trachea, that when heard through the medium of the stethoscope applied over those parts, the other unassisted ear does not distinguish the sound of the voice proceeding from the lips. This resonance is not so loud at the inferior portion of the trachea ; and it is still less so when the stethoscope is applied to the upper portion of the sternum.

43. This resonance is yet strong, though diffuse, in the great bronchial branches situate at the root of the lungs, and which we explore by applying the stethoscope to the interscapular spaces. The sound of the voice does not pass through the instrument, but resounds at its extremity ; nevertheless, the resonance is so strong as to be heard more plainly than the voice proceeding, at the same time, from the lips.

44. In the pulmonary tissue, and in the expanded bronchial ramifications, this resonance is scarcely heard : and the stethoscope discovers nothing more than a slight trembling, such as may be felt by the hand placed upon the chest of the speaker. But in those who have a powerful and deep voice, this resonance is at all times to be heard, upon whatever point of the thoracic surface the stethoscope be applied, as powerfully as at the interscapular spaces of ordinary persons.

45. If from any cause the lungs become impermeable, the resonance of the voice becomes audible in the small bronchial branches ; and increases greatly in the larger branches, if the

induration is in a part situated near the root of the lungs : such resonance is called *bronchophony*.

46. This effect also takes place when the small bronchial ramifications are dilated ; so much so, that the resonance is heard almost as plainly as at the larynx.

47. *Accidental bronchophony* therefore indicates either an induration of the pulmonary tissue, or a dilatation of the small bronchiæ, or both combined at the same time.

48. *Bronchophony* may be heard at all points of the thoracic surface. But it is more frequently recognized at the interscapular spaces, and the subspinal fossæ of the scapulæ, on account of the proximity of the great bronchial branches, and the frequency of the hepatisation of the inferior lobes of the lungs. It also as often occurs at the arm-pits, and beneath the clavicles, by reason of tuberculous indurations which are so very frequently developed at the summit of the lungs.

49. When there is an excavation of the lungs, communicating with the bronchiæ, the resonance of the voice is heard over the place

similar to that upon the larynx. This is called *pectoriloquy*.

50. *Pectoriloquy* is either *perfect*, *imperfect*, or *doubtful*.

It is *perfect*, when the voice appears to issue directly from the chest, and to pass entirely through the tube of the stethoscope. It is *imperfect*, when the transmission of the voice is not complete, notwithstanding the presence of every other local symptom of excavated lungs. It is *doubtful*, when the resonance is very feeble, and only to be distinguished from bronchophony by signs drawn from the place where it is heard, and from the history of the disease.

51. *Perfect pectoriloquy* is the result of the complete vacuity of the excavation; the greater density of the pulmonary tissue surrounding the excavation; the communication of somewhat voluminous bronchiæ with the cavity; and the proximity of the cavity to the parietes of the chest.

52. *Perfect pectoriloquy* is generally the sign of an excavation of a middling size. It is also very evident in small cavities, provided

they are surrounded by hardened lung, and are near the surface of the lungs : but in very large excavations, wherever their seat, pectoriloquy is almost always very slight.

53. *Pectoriloquy* is suspended occasionally during a greater or lesser time, if the bronchiæ which communicate with the excavation are obstructed by expectoration. It is diminished, or ceases entirely, when the cavity communicates with a vast number of bronchiæ, or opens into the pleura.

54. *Pectoriloquy* may take place at any point of the thoracic surface, since excavations may be formed in any part of the lungs. But as excavation is generally the consequence of a resolution of tubercles, and as these tubercles are principally developed in the upper portions of the lungs, it follows that pectoriloquy is most frequently heard beneath the clavicles and in the hollow of the arm-pits.

55. *Ægophony* is a particular resonance of the voice, which is heard at nearly the same points as bronchophony, and is often coincident with it ; but it is the result of very different anatomical conditions.

56. *Simple ægophony* is characterized by a tremorous jerking voice like that of the goat, having an acute silvery tone, not possessed by the natural voice of the patient: rarely heard as if within the stethoscope, and seldom if ever passing through it.

57. When it is heard with bronchophony, this goat-like voice resembles that of a man speaking with a counter between his teeth and lips; or still more that of *Punch*.

58. The existence of effusion into the pleura is the anatomic condition producing ægophony. But this effusion must not be very abundant, for if so, ægophony is no longer heard; it is again manifest when the effusion diminishes, and finally disappears with the fluid by degrees.

59. *Ægophony*, therefore, co-exists with pleurisy, and continues from the first to the third day; it exists only for a few days in acute pleurisy, but continues many months when this disease is chronic. In both cases it is a favourable symptom, since it proves the effusion to be of small extent.

60. *Ægophony* may not be present in pleu-

risys under three conditions; 1st, When the effusion of fluid is very rapid and very abundant; 2d, When old adhesions obstruct the effusion of fluid into the pleura; 3rd, When there are false membranes without effusion.

Those who have thought that *ægophony* was audible in this last case have mistaken it for *bronchophony*.

61. When the patient stands, or sits, *ægophony* is heard between the spinal column and the scapula, and along a zone of three fingers' breadth drawn from the inferior angle of the scapula to the nipple, following the direction of the ribs. When he lies upon the belly it is heard only in the side.

62. The extent over which *ægophony* is heard will hardly allow it to be confounded with *pectoriloquy*. *Pectoriloquy* is bounded by narrow limits, is rarely discoverable at the same place with *ægophony*, has not the jerking character, and is moreover accompanied by cavernous respiration, and other signs of excavation.

63. *Ægophony* is distinguished from *bronchophony*, with which it often co-exists, in as

much as this latter is constantly accompanied by bronchial respiration, and is always heard at the same place whatever may be the position of the patient; whilst ægophony changes its place with a change of position, and is generally attended by a pure respiratory murmur, although it be but feeble.

64. The distinction of ægophony and of bronchophony, as the one or the other may exist alone or predominate, determines whether the pleurisy is simple or complicated with pneumonia; and which affection be the more serious, or if pneumonia alone exist.

65. To hear distinctly that goat-like voice which forms the principal characteristic of ægophony, the stethoscope should be firmly applied to the chest, and the ear placed lightly upon its auricular extremity.

66. In the auscultation of the voice the obturator of the stethoscope must be retained, and care must be taken to observe all the precautions given in sections 16 to 22.

CHAPTER IV.

AUSCULTATION OF COUGH.

67. The cough examined by itself discloses no particular sound in healthy lungs: the shock of the cough is felt upon the parietes of the thoracic cavity, and respiration is more rapid and perhaps less blustering than usual.

68. When the cough is heard, by means of the stethoscope upon the larynx, and trachea, and in narrow-chested persons at the root of the bronchiæ, it gives besides the shock the sensation of a hollow, or of the passage of air through a tube.

69. When the lungs are inflamed to a degree of hepatisation, these sensations are more manifest than naturally, at the trachea; at the root of the lungs; and sometimes even at those points where the bronchiæ are not larger than

a small goose quill. This is called *tubular cough*. Some prefer the expression *bronchial cough*.

70. The same phenomenon takes place in simple compression of the lungs, produced by pleuritic effusion; but then it exists only at the root of the lungs and does not extend far: whilst in the first case (see 69) it extends to the distant branches of the bronchial tree; at least when the peripneumony is not circumscribed and of small extent, which is very rare. *Bronchial cough* often takes place in dilatation of the bronchial tubes, and it enables us to appreciate their acquired diameter.

71. When a pulmonary excavation communicates with the bronchiæ, the cough resounds nearly as much as in the larynx; but the resonance is not so diffuse, and it gives an accurate idea of the extent of the excavation: the cough also shows the *cavernous rattle* more easily than respiration, especially if the excavation is filled with a somewhat liquid matter. This is the *cavernous cough*; and if the excavation be empty, it is evinced more perfectly than by any other phenomenon.

72. The cough also sometimes gives the metallic tinkling, in cases where it is scarcely made evident by the respiration or the voice.

73. When *pectoriloquy* is suspended by reason of a momentary obstruction of the bronchial tubes by expectoration, the cough expelling this, reproduces the sound, or at least gives the *cavernous rattle* which is an equivalent sign ; it also opens the fistulous communications which might exist between the pleura and the bronchiæ.

74. In those excavations where the softening of the tubercles has only commenced, and in the beginning of pulmonary abscesses, respiration is not always sufficiently energetic to produce the rattle ; yet the cough very strongly evinces the gurgling sound. In fact all the sounds treated of in the following chapter are heard more powerfully by the aid of coughing than by that of breathing.

75. *Precautions* are however necessary in making these examinations. Sometimes a violent cough appears to close rather than to open those fistulous communications and to produce a great commotion in the chest and the

pulmonary tissue, without evincing the gurgling sound. At other times a timorous patient coughs only from the throat, and there is no resonance in the bronchiæ; in this case a powerful respiration should be recommended previously to coughing.

76. One of the cases in which it is most useful to make the patient cough, is that of a dry catarrh, so severe as to render the breathing inaudible. The cough is always preceded or followed by an energetic inspiration which is always much better heard, and enables a judgment to be formed of the permeability of the pulmonary tissue.

77. This means (of exploring by the cough) is most valuable in incipient peripneumony, especially when it supervenes upon dry chronic catarrh. The chest then gives a doubtful or deceitful sound; to listen to the respiration is often useless; the cough alone can render the *crepitous rattle* audible where it exists,—a pathognomonic sign of incipient peripneumony.

78. Yet we should not examine by the cough but where respiration is not sufficient, on account of fatiguing the patient: in other respects

the inconvenience is less than it may appear to be. To the experienced auscultator a single effort of the cough, rather moderate than strong, will suffice to convey a knowledge of all the signs that it can give, whilst many inspirations are required to produce the same results.

CHAPTER V.

AUSCULTATION OF SOUNDS FOREIGN TO THOSE OF RESPIRATION AND THE VOICE.

79. Various sounds foreign to those of respiration and the resonance of the voice may accidentally take place in the chest: these are divided into the different species of *rattles* and *metallic tinkling*.

Of the Rattles.

80. Any sound contrary to nature, which is produced by respiration, whether occasioned by the passage of the air through fluids which are frequently found in the bronchiæ, and in the pulmonary tissue, or by a constriction or narrowing of the air-tubes, is called *rattle* (*rhonchus*).

81. There are five species of rattle: 1st, the

crepitous ; 2d, the mucous ; 3d, the sonorous ; 4th, the hissing or sibilous ; 5th, the crackling.

82. The *crepitous rattle* is a sound like that produced by salt decrepitating in a basin over a gentle fire. This sound is produced by the successive bursting of very small uniform bubbles upon the surface of a fluid of nearly the same tenuity as water.

83. The *crepitous rattle* is evidently the result of the penetration of air into the aërial vesicles filled with blood or some fluid of similar tenuity. It is observed, therefore, in pneumonia of the first degree, in pulmonary œdema, and in hæmoptoic engorgement of the lungs : but in these last two cases it appears to be produced by larger bubbles, and approximates to the *mucous rattle*, and may be called the *subcrepitous rattle*.

84. The *mucous rattle* is similar to that which takes place in the trachea of a dying man ; or to that which is produced by blowing bubbles with a pipe in soap and water more or less viscid.

85. The *mucous rattle* is composed of a

succession of bubbles whose size and number vary ; so that the rattle is sometimes great, sometimes small, at one time scanty, at another abundant. The ear perfectly appreciates the consistence of the fluid upon the surface of which the bubbles burst ; and this consistence is greater than in the crepitous rattle.

86. The *mucous rattle* takes place whenever the bronchiæ are filled with a fluid more or less easily traversed, as blood, mucus, and pus. It is, therefore, met with in pulmonary catarrh, in hæmoptisis, often in pneumonia, and in phthisis.

87. The *mucous rattle* also takes place in an excavation produced by an abscess in the lungs, a gangrenous eschar, or the softening of a tuberculous mass. But then it is more abundant, larger, produced in a circumscribed space where the cavernous respiration, cough and pectoriloquy are generally heard : this is the *gurgling or cavernous rattle*.

88. The *sonorous rattle* is a grave sound, and sometimes resembles snoring, sometimes the sound of a bass string rubbed by the finger, very often similar to the cooing of the

turtle dove. It appears to be produced by the difficulty with which the air penetrates the bronchial branches which have been narrowed by some cause or other.

89. The *hissing rattle* is a very variable sound: sometimes, much prolonged, it resembles a little, grave or sharp, dull or sonorous, whistling. At other times it is of very short duration, and similar to the cry of little birds or the clicking of a small valve. It appears to arise from the difficulty with which the air penetrates the bronchial branches, of small or middling calibre, narrowed by the tumefaction of the mucous membrane. Sometimes also it arises from some very viscid mucus more or less completely obstructing the small bronchial ramifications, and then it forms but a variety of the *mucous rattle*. The hissing or *sibilous rattle*, like the sonorous, is heard in pulmonary catarrh.

90. The *crackling rattle* (or crepitous rattle of great bubbles) is a sound similar to that which is made by the inflation of a dry bladder. It only takes place in inspiration, and appears to arise from the penetration of the air into dry and unequally dilated cells. It

is observed in pulmonary emphysema ; and is found in subcutaneous emphysema, when the stethoscope is applied upon the diseased part, and an interrupted pressure is made with the fingers upon the surrounding parts.

91. Every one of these rattles communicates to the stethoscope a slight vibration, sometimes equally sensible to the hand when placed upon the thorax ; and by the aid of which it is easily discovered whether the rattle be near or distant from the surface of the lungs. This vibration is stronger in the *mucous* and the *sonorous* rattles than the others.

92. *The rattles* in general are not heard at a little distance from the space occupied by the lesions which produce them ; and this is particularly so in the mucous and crepitous rattles. The sonorous and the hissing rattles may be heard at a distance, and on that account are often complicated with other rattles.

93. *The rattles* take place in coughing as well as in breathing, and are then generally more evident.

94. In the auscultation of rattles the stethoscope should be used without its obturator.

Of Metallic Tinkling.

95. By *metallic tinkling* is meant that sound which may be perfectly imitated by gently striking with a pin a piece of metal, glass, or china ; or by letting fall grains of sand or pins into a glass.

96. *Metallic tinkling* is heard when the patient breathes, speaks, or coughs ; but more feebly in the former than in the two latter cases ; sometimes the reverse of this happens, but that is an extreme case.

97. When pectoriloquy exists at the same time, this metallic tinkling and the voice traverse the tube of the stethoscope : but when pectoriloquy is not present, a light acute sound is heard within the chest, analogous to the vibration of a metallic string struck with the finger.

98. *Metallic tinkling* can be heard in two cases only. First, In that of the co-existence of a serous or purulent discharge in the pleura with pneumato-thorax. Second, When a large tuberculous excavation is partly filled with a liquid pus.

99. *Metallic tinkling*, therefore, may be taken as a sign of a triple lesion when pneumato-thorax is joined to empyema, since there must exist at the same time a fistulous communication between the pleura and the bronchiæ, the result of a tuberculous vomica, of an abscess in the lungs, or of a gangrenous eschar.

100. The magnitude of the fistulous opening and the relative proportions of air and fluid poured out may be ascertained by this sound. Since the more clearly the tinkling is heard, the greater is the fistulous opening ; and the greater the extent of the vibrations, the larger is the space filled with air : but the maximum of sound is (perhaps) when the air and fluid occupy equal parts.

101. Thus this space may be estimated with sufficient accuracy by the stethoscope, and by percussion exercised at the same time at different points ;* then a resonance similar to that of an empty cask, mixed with the tinkling, will be heard.

* Percussion in this case is best performed by striking with the back of the finger.

102. Sometimes this sound passes into another similar to such as is produced by blowing into an empty decanter : this is the *bottle-buzzing* or *amphoric sound*. Respiration, the voice, and cough equally display it.

103. There are two circumstances which produce this buzzing resonance more frequently than the tinkling ; although sometimes these sounds succeed one another, or are alternately produced for uncertain periods, or even heard simultaneously : 1st, when two or more fistulous openings exist between the cavity occupied with air and the bronchiæ ; 2nd, when this cavity is extremely vast and contains but a small quantity of fluid.

104. *Metallic tinkling* may be evinced by a fact quite independent of the voice, cough, or respiration. Thus when pneumato-thorax with an effusion of fluid has taken place, and the patient be made to sit up, sometimes a drop of the fluid which was retained above falls down at the moment of examination, producing a sound similar to a drop of water let fall into a decanter three parts empty, and it is accompanied by an evident metallic tinkling.

105. *Metallic tinkling* and the amphoric buzzing are always heard after the operation for empyema, so long as there is a communication between the cavity and the air, either by the external wound, or a fistulous opening as already stated.

106. There is a phenomenon of no value as a sign, but which might be mistaken by the inexperienced for the metallic tinkling :—it is produced by the friction of some hard parts upon one another, where the ribs allow much mobility of parts, and resembles the sounding of fire arms in military exercises.

107. There is a heavy sound similar to that which is produced under the stethoscope by rubbing the finger against a bone ; this is called *the ascending and descending friction sound*, and is the result of interlobular emphysema, and in conjunction with the dry crepitous rattle with great bubbles becomes a sign of that disease.

108. This friction sound takes place, 1st, when the internal surface of the pleura becomes unequal or wrinkled. 2nd, In pleurisy when there is little or no effusion, and when the

pleura is covered only with false membrane more or less thick. 3d, When there is a moderate effusion, and old adhesions do not obstruct the lungs, in certain positions of the body, while rising above the level of the fluid, and rubbing against the sides of the chest, at a point where the ear may be applied.

109. This friction disappears when the effusion is very abundant, and reappears as the fluid diminishes. It is sensible to the hand as well as to the stethoscope, may sometimes be heard by a distant observer, and even perceived by the patient himself.

110. The habitual friction between the two glistening surfaces of the pleura, gives out no appreciable sound, owing to their extreme polish : it takes place only when the healthy surfaces are changed by disease or other causes.

PART II.**STETHOSCOPIC SIGNS IN THE DISEASES
OF THE LUNGS.**

CHAPTER I.**STETHOSCOPIC SIGNS IN PULMONARY
CATARRH.**

111. All pulmonary catarrhs are attended by a rattle, or rhonchus, more or less powerful ; and by a total suspension, or a variable and partial diminution, of the respiratory murmur.

112. This rattle is either the sonorous, the sibilous, or the mucous. Those who think the crepitous rattle may be heard in these cases, mistake for it the mucous rattle of little bubbles.

113. The sonorous, sibilous, and mucous

rattles, are heard simultaneously in almost all catarrhs; but the two former prevail whenever any degree of tumefaction takes place in the mucous membrane of the bronchiæ, without, or almost without, an augmentation of secretion; the mucous rattle on the contrary, prevails whenever the secretion abounds so as to fill the bronchiæ with mucosities (mucous sputa).

114. Whatever kind of rattle may prevail in catarrh, it is confined to the affected part; the extent over which it is heard is therefore the measure of the severity of the disease; for the greater the extent of the inflammation, the more serious is the disease.

115. The suspension of the respiratory murmur seems to arise from the obstruction of the bronchiæ by mucous sputa, and it is, therefore partial and momentary: one fit of coughing generally restores the murmuring.

116. The diminution of the respiratory murmur, in like cases, appears owing to the tumefaction of mucous membrane of the little bronchial branches; and it is almost always equally partial, and is attended by an increased

murmuring in those parts of the lungs where the bronchiæ are intact.

117. This diminution therefore of the respiratory murmur, like the rattle, may be taken as the measure of the extent and severity of the catarrh.

118. *In acute mucous catarrh*, a dull sonorous rattle is at first heard, sometimes conjoined with the sibilous rattle; and at the same time the respiratory murmur is suspended in places; afterwards in exact proportion to the augmentation of the bronchial secretion, the mucous rattle arises and becomes predominant.

119. *In chronic mucous catarrh*, no other than the mucous rattle is generally heard, but it is strong and abundant. Nevertheless, the sibilous and sonorous rattles are not unfrequently heard at the same time. The respiratory murmur is clearly heard notwithstanding these rattles, and sometimes so energetic as to become puerile.

120. *In the pituitous catarrh*, the respiratory murmur is weak, though rarely suspended; the sibilous rattle is heard more or less power-

ful, often mixt with the sonorous and sometimes with the mucous rattle, the bubbles of which appear to burst upon the surface of a fluid of less consistence than in the mucous catarrh. These phenomena are especially apparent during the exacerbations, yet they are also discoverable during the intervals.

121. *Dry catarrh*, is principally marked by the diminution, or complete suspension, of the respiratory murmur, a diminution or suspension that varies at every instant, and ordinarily alternates with an energetic, though not puerile, murmur. Sometimes in addition an obscure sibilous rattle is heard, like the clicking of a little valve.

122. *Hooping cough* is characterized during the fits by a complete suspension of the respiratory murmur, the air not penetrating beyond the trachea. During the interval of the fits, the respiratory murmur is variable, as in dry catarrh, and, moreover, very constantly accompanied by a snoring or hissing rattle, which is heard here and there.

123. *In suffocative catarrh*, the respiratory murmur is suspended or greatly diminished

over the greatest part of both lungs. A blustering mucous rattle is heard throughout the chest, sometimes attended by the sonorous and sibilous rattles : and at the same time the rattles in the larynx and trachea are very audible.

124. In all these cases the thorax remains as sonorous as in a state of health.

CHAPTER II.

STETHOSCOPIC SIGNS IN DILATATION OF THE
BRONCHIÆ ; WITH A NOTICE OF OTHER
AFFECTIONS.

125. In those points where the dilatation of the bronchial extremities is the greatest, a pectoriloquy more or less perfect is heard, accompanied by the mucous rattle of great bubbles, perfectly resembling the cavernous rattle in phthisis.

126. In those same points bronchial respiration is heard, which becomes cavernous when the dilatations are extremely large ; and care must be taken not to confound this sound with puerile respiration.

127. The cough and the mucous rattle equally present the bronchial, or cavernous, character over those dilatations which are very large and near to the surface of the lungs.

128. The voice, respiration, and the cough, frequently give the *veiled blowing* : that is to say, the sound of a small veil, or of a humid membrane, which waves with every vibration, and seems alone to prevent the passage of the column of air into the ear.

129. This last sign proves, in those places at least where it is found, that the pulmonary tissue has not become cartilaginous.

130. Sometimes all these phenomena disappear for a time, particularly at the inferior portion of the lungs, owing to the accumulation of mucous sputa which, by gravitation, collect in the lowest parts ; and they return after an abundant and copious expectoration.

131. When the dilatation is moderate, and nearly of equal degree in a certain number of the bronchiæ, a diffuse bronchophony is heard in place of the pectoriloquy.

132. If this moderate dilatation is extensive, then in all the corresponding parts of the thorax, bronchophony, bronchial respiration, and in some few cases pectoriloquy, will be found.

133. The sound given by percussion is sometimes less than in a natural state of things,

by reason of the compression of the pulmonary tissue

Stethoscopic signs in other affections.

134. *In croup*, properly so called, the stethoscope is of no value ; and when applied to the larynx, or the interscapular spaces, will only render more evident the blowing or breathing already heard by the natural ear.

135. In bronchial hæmorrhage the chest is perfectly sonorous ; crepitous rhonchus is not heard, but only a mucous rhonchus, the bubbles of which seem unequal and larger than those of catarrh ; they appear to be formed of a fluid more liquid, and burst more frequently.

136. *Polypi in the bronchiæ* do not give any particular stethoscopic signs. And in a case where the greatest space remaining for the passage of the air did not exceed half a line, neither respiration, nor pectoriloquy, was impeded, which were evident in an excavation situated in the upper portion of the lungs.

137. In ulceration of the bronchiæ ; in the case of the introduction of foreign bodies into

them ; in affections of the bronchial glands ; in hypertrophy of the lungs ; and in atrophy of the lungs—the stethoscopic signs are *either* of no importance, or such as *are mentioned* in other parts of this work : and the general laws under every variety of circumstance of these affections in their various modifications would evidently indicate them.

CHAPTER III.

STETHOSCOPIC SIGNS IN AFFECTIONS OF THE
PULMONARY TISSUE.

138. In *emphysema* of the lungs, these signs vary as the emphysema is vesicular or interlobular.

139. In *vesicular emphysema*, if it be general, the thorax renders on percussion a very clear sound, and assumes a rounded or cylindrical form. When the emphysema affects one lung only, or is to a greater extent in one lung than in the other, that side is evidently more rounded, more voluminous, and gives out a clearer sound on percussion, although the other may have much resonance.

140. Notwithstanding the chest has this great resonance, yet the respiratory murmur is very feeble ; sometimes entirely absent in different

places, varying its locality so that on a sudden it appears where but just before it was not audible, and is almost always accompanied here and there by a light hissing rattle, or one analogous to the clicking of a little valve.

141. These last signs are common to emphysema of the lungs, and to dry catarrh, with which it is almost always united. The more voluminous form of the chest, and the greater resonance given out by percussion, will, at all times, sufficiently distinguish pulmonary emphysema from simple dry catarrh, in which these two signs are not observed.

142. *Interlobular emphysema* is characterized by the dry crepitous rattle with great bubbles, occurring with scarcely any intermission: this rattle is also sometimes heard in vesicular emphysema, and is doubtless produced by the rupture of some over-distended vesicles, but it is of rare occurrence and of short duration.

143. This crackling rattle is often accompanied with sounds of the *ascending friction* in inspiration, and *descending friction* in expiration: these are not always present, and require

much practice to detect them. But though these sounds are considered as signs of interlobular emphysema, further observations are necessary to establish them as certain and constant attendants and proofs.

144. *Œdema of the lungs* is evinced by a diminution of resonance in the chest ; by a greater diminution of the respiratory murmur than would be expected from the efforts made by the patient in respiration, and the manner in which the chest expands ; and by the appearance of a light crepitous rattle, to be distinguished from that which takes place in pneumonia of the first degree, by its bubbles seeming to be larger and more humid. And at all times this crepitous rattle scarcely allows a distinction to be made between these two affections, without the aid of general symptoms.

145. These signs are much obscured, or altogether lost, where œdema co-exists with emphysema or dry catarrh. The only sign which can then lead to a suspicion of œdema, is the subcrepitous rattle, which sometimes arises during cough and very deep inspirations.

146. *Pulmonary apoplexy* is evinced by a flat circumscribed and but slightly heard sound ; by a remarkable diminution, or a total absence, of the respiratory murmur at the same spot ; and by a crepitous rattle which exists only around the affected part. And where the respiratory sound is not heard, there bronchial respiration and bronchophony take place. And in addition, near the great bronchiæ, the mucous rattle of great bubbles is heard ; appearing to the ear to be produced by a fluid more liquid than bronchial mucus.

147. These signs are often obscured by the small extent of the hæmoptic congestion, or by its diffusion into a great number of pulmonary lobules ; and much more so if pneumonia exists at the same time. Nevertheless, in almost all cases, the nature of the expectoration and the course of the disease will give them a sufficient value.

148. *Suppuration* of a circumscribed nucleus of pulmonary apoplexy, and the consequent formation of an excavation in the lungs, will give rise to pectoriloquy, to cavernous rattle, and to cavernous respiration. And here

the nature of the expectoration will easily distinguish this case from a tuberculous or other excavation of the lungs.

149. In *pneumonia*, as the alteration in the lungs which constitutes this disease varies at different periods, so vary the stethoscopic signs.

150. Whilst yet there is only congestion of the pulmonary tissue, the sound produced by percussion is but little altered; and is only obscured by the congestion extending and approaching a state of hepatisation. The respiratory murmur is only weakened and more or less marked by crepitous rattle, the characteristic phenomenon of this stage of the disease. The extent over which the crepitous rattle is heard, indicates the extent of the inflamed part.

151. When the inflamed lung has arrived at a state of hepatisation, the sound produced by percussion is more or less completely flat, accordingly as the alteration in the pulmonary tissue is superficial or deep: the respiratory murmur entirely fails, and is replaced by bronchial respiration; bronchophony, more or less

distinct, is heard in all those points where the respiratory sound ceases, or where the sound by percussion is flat, and it is the more sensible as the hepatisation approaches to the surface.

152. Whilst these phenomena are manifest, the characteristic crepitous rattle disappears, merely to re-appear elsewhere: thus, as it were, marching in advance of hepatisation, which instantly follows.

153. When the inflammation has passed on to a state of purulent infiltration, the preceding signs remain; and in addition a mucous rattle is heard more or less distinctly.

154. When pus collects in the pulmonary tissue, and advances into the bronchiæ, then pectoriloquy, rhonchus, and the cavernous cough, and respiration become evident, where bronchophony and bronchial respiration were previously heard. And if the purulent collection be situated near the surface of the lung, or has only very thin or soft parietes, then also may be heard the *blowing respiration*, or the *veiled blowing*. But it must be borne in mind, that abscesses in the lungs are very rare; that the bronchial very nearly approach the cavern-

ous phenomena ; and that the blowing respiration, and the veiled blowing, may themselves take place, when there is a voluminous enlargement of the bronchiæ, surrounded by a simple induration of the pulmonary tissue, or only separated from the surface of the lungs by a portion not indurated.

155. *The resolution* of pneumonia is evinced by the absence of the crepitous rattle and the return of the respiratory murmur, provided the lung has not passed the degree of congestion ; and by the return of the crepitous rattle in the first place, followed by the respiratory murmur, when hepatisation or infiltration of purulent matter has taken place. In this last case the return of the crepitous rattle is ordinarily preceded by a mucous or submucous rattle, and sometimes replaced by the appearance of subcrepitous rattle, which, continuing a long time, denotes that œdema has succeeded to pneumonia.

156. The signs of resolution of pneumonia are at first generally manifested, when the pneumonia is very extensive, at those parts that were the last affected : but sometimes the contrary takes place.

157. The stethoscopic signs of pneumonia are sometimes very difficult to seize, as when the inflammation is central, very circumscribed, or disseminated in many lobules distant from each other. But even in this last case a *careful* examination will discover some traces of crepitous rattle and bronchophony: and when the inflammation is central it rarely escapes a well-conducted search, if it occupy any considerable extent. An ear but little practised even then seldom fails, at the same time that it hears the respiratory murmur freely exercised in the superficial parts of the lung, to discover either a crepitous rattle or a bronchial respiration and a deep bronchophony which appear to approach, as the disease advances, to the surface of the lungs, and finally to disappear.

But when the pneumonia is central and very circumscribed we have not much to regret in being ignorant of its existence.

158. The stethoscopic signs of pneumonia are sometimes difficult to seize when this disease is complicated with pulmonary catarrh or pleurisy. It is however seldom, that, in

the first case, those various bronchial rattles which may take place, entirely obscure either the crepitous rattle or bronchophony; and, as to its complication with pleurisy there exist signs sufficiently marked to make a clear distinction.

159. When the respiratory murmur ceases in an inflamed portion of the lungs, the respiration in the healthy portions becomes stronger and often puerile.

160. *Gangrene of the lungs* produces the same signs as inflammatory congestion when extensive and not circumscribed; but when it is circumscribed it produces very nearly the same signs as pulmonary abscess. But in either case the aspect and foetid character of the expectoration indicate it more than all the other signs.

161. *Chronic pneumonia* is evinced by the absence of sound on percussion and of the respiratory murmur,—and by the appearance of bronchial respiration and bronchophony. And these sounds also are found in all indurations of the pulmonary tissue, whether they be the result of inflammation or not.

CHAPTER IV.

STETHOSCOPIC SIGNS GIVEN IN ACCIDENTAL
PRODUCTIONS DEVELOPED IN THE LUNGS.

162. All those substances, foreign to the normal condition, which the various aberrations of nutrition can develop in our organs I call accidental productions. Def. by R. T. H. Laennec. Vol. II. p. 1. ed. 1831.

163. In *phthisis pulmonalis* the signs vary as the tubercles are softened down or not.

164. Before the tubercles are softened, the stethoscope can evince their existence by reason of their accumulation and extent only, rendering an evident portion of the lungs impermeable to the air: miliary tubercles disseminated over the whole extent of these organs are only to be discovered by general symptoms.

The accumulation of tubercles in any circumscribed part of the lungs is indicated by a flat sound produced on percussion, by a proportional diminution of the respiratory sound, and by a diffuse bronchophony or resonance of the voice more or less marked.

165. These signs are of the greatest value when they are discovered beneath the clavicles, and in that region comprised between these bones and the breasts; because it is at the summit of the lungs that tubercles are ordinarily developed, and because we can in this region more easily than in others discover every degree of resonance in the chest, as well as those of morbid bronchophony. But when they are discovered in the sides or in the back they do not merit an equal confidence; unless they are constant, strongly pronounced, and have place but on one side only.

166. When a softening (or suppuration) has commenced in the tubercles, then, in addition to the former signs, there takes place from time to time a deep gurgling, which the ear perceives during the cough, and which seems to result from the agitation of a thick fluid: and

at intervals some sounds of the voice are heard which seem more related to pectoriloquy than to bronchophony. In this state also percussion sometimes produces *the sound of a cracked vessel*, indicative of a very superficial excavation: but this sign is rare and may be easily feigned: (i. e. it may be produced by accidental circumstances,—note of the Author: and it is a sign of little value—note of M. Laennec).

167. When the tubercles are entirely softened, and their evacuation into the bronchiæ has occasioned an excavation of any extent, the sound given out by percussion becomes more clear where before it was completely flat; a cavernous respiration and rhonchus succeed to the almost inaudible or very feeble respiratory murmur,—and bronchophony is replaced by a pectoriloquy more or less obvious.

168. *Pectoriloquy* may be *perfect*, *imperfect* or *doubtful*, *continuous* or *intermitting*, or even suspended for a time: the resonance of the voice which constitutes it may be acute or grave, clear or obscure, confusedly or clearly articulated; it varies also according to the

timbre (nature) of the person's voice; and above all it varies as the excavation, which produces it, is superficial or deep, small, middling or great, smooth or rugged, uniform or broken, simple or multilocular, rounded or flattened, empty or half full, &c.; but in every case this sign is not truly pathognomical except when it is accompanied by a cavernous rhonchus and respiration, or at least one of these two phenomena.

169. A perfect pectoriloquy with cavernous respiration, and without a constant cavernous rhonchus, designates a pulmonary excavation completely empty and is ordinarily the sign of a fistulous cicatrix of the lung. A full or solid cicatrix of this organ can only be indicated by the diminution of the respiratory sound: a diminution appreciable with difficulty by reason of the small extent generally occupied by these cicatrices.

170. When the excavation in the lungs is most extensive, pectoriloquy is not generally present; but then the voice, respiration, and cough, are accompanied by the amphoric resonance, and a decided metallic tinkling is

sometimes heard. This tinkling is easily distinguished from that which takes place where the excavation opens into the pleura, in as much as then the sound of fluctuation is heard on succussion, which seldom if ever occurs in a simple excavation of the lungs.

171. *Cysts and vesicular worms* developed in the lungs give no signs of their existence until they become very voluminous and compress the lungs, so as to render it in part impermeable to the air. These last also give rise, when they are entire and living, to a slight gurgling, which is distinguishable from bronchial and vesicular rhonchus by reason of its want of isochronism with the respiratory murmur: and they produce, when evacuation takes place into the bronchiæ, excavations occasioning pectoriloquy and the other signs of pulmonary caverns.

172. *Melanism and medullary tumours* in the lungs give the same stethoscopic signs as those of tubercles previously to their softened state. Excavations in the lungs formed by the

softening (or suppuration) of these accidental productions are very rarely found.

173. In *asthma* with *puerile respiration*, no other phenomenon exists, than that from which the name of the disease is taken.

174. In *neuralgia* of the lungs and in *nervous dyspnœa*, there is a total absence of all the stethoscopic signs.

In *spasmodic asthma*, the stethoscopic phenomena are reduced to a mere variableness in the respiratory murmur, which in general is very feeble, especially during an exacerbation ; and to a slight dry crepitous or subsibilous rattle, such as is observed in dry catarrh, and vesicular emphysema.

175. In *pleurisy* the signs vary accordingly as an effusion takes place into the pleura, or merely a simple plastic exudation upon the surface of this membrane.

176. In this last case as in *pleurodynia* there is no stethoscopic sign ; unless notice be taken of the less moveability of the affected side. Yet the ascending and descending friction

sound may be taken as the pathognomonic sign of this variety of pleurisy.

177. A flatness of sound more or less complete furnished by percussion, a great diminution or entire absence of the respiratory sound, and ægophony, are the principal signs of pleurisy with effusion. To these may be added as symptoms, the dilatation of the affected side during the existence of the effusion, and its contraction after the absorption of the fluid, and the conversion of false membrane into accidental serous plates or into a fibro-cartilaginous tissue.

178. The dull sound is evinced as soon as the effusion has gained some little extent. It is observed at first at the inferior part of the affected side ; it rises upwards as the effusion becomes more abundant ; it changes place with the position of the individual ; and it thus determines very accurately the level of the effused fluid, provided the quantity of fluid be not sufficient to occupy the whole cavity of the pleura, and that this membrane be free from former adhesions.

179. The absence or diminution of the

respiratory murmur is always in the direct ratio of the quantity of fluid effused into the pleura. When the effusion is moderate, the respiratory sound is only weakened and deep ; but when the effusion is very abundant, there is a complete absence of the respiratory murmur, and often co-extensive with the whole side of the patient, except along the vertebral column—a space corresponding to that part towards which the lung is compressed.

180. This continuance of the respiratory murmur towards the root of the lung, and its sudden absence from the other points, are sufficient to distinguish pleuritis from pneumonia, in which the diminution or absence of the respiratory sound is always preceded by the crepitous rattle, and is never so completely absent as not to allow here and there some traces of respiration.

181. The absence or diminution of the respiratory sound in the diseased side is ordinarily attended by an exaggeration of it in the healthy side : nevertheless this only takes place in chronic pleurisy, or towards the middle period of the acute.

182. As soon as the effusion is observable ægophony appears ; it remains as long as the effusion is moderate ; disappears when the fluid becomes abundant ; re-appears when the fluid diminishes ; and finally ceases with the absorption of the effusion. It is heard at first near the inferior angle of the scapula, changes its place with the different positions of the patient, and appears constantly to follow the upper level of the effused fluid. It may in fact exist throughout the whole extent of the affected side, whenever the effusion is not very abundant and is uniformly spread, by reason of old adhesions of the pleura, over the whole surface of the lung.

183. The dilatation of the affected side in pleurisy is not observed until the effusion is very abundant and has existed during a certain time. It is principally in chronic pleurisy that this dilatation is observed, and when, more particularly, the intercostal spaces are enlarged and thrown out beyond the ribs, and the diaphragm strongly depressed. This is observed also in acute pleurisy, and even not rarely from its commencement, especially

in very thin persons. This enlargement disappears when the fluid diminishes, and is ordinarily followed by a contraction of the affected side.

184. This contraction of the chest is the consequence of the complete absorption of the effusion, and the conversion of false membrane into accidental fibro-cellular or fibro-cartilaginous tissues. It is always attended by a loss of resonance in the affected side, and by a very marked diminution of the respiratory sound—phenomena that continue for a very long time, and even very often during the remainder of life.

185. In *chronic pleurisy* the stethoscopic signs differ in no way from those of the acute; except that ægophony is more rare, and which seems a necessary effect of the disease, since the effusion is abundant during a longer period.

186. *Partial or circumscribed pleurisy* always produces a diminution of sound in the chest, and of the respiratory murmur in its

own locality. Sometimes it gives rise to an ægophony which is the more remarkable in its isolated seat. But in general the stethoscopic signs are very obscure, particularly when the effusion is inclosed between the diaphragm and the base of the lungs.

187. In *pleuro-pneumonia*, all the signs of simple pleurisy and those of pneumonia are united; these are—the dull sound; the sudden absence or diminution of the respiratory murmur; ægophony in one part, and the crepitous rhonchus in another; bronchial respiration and bronchophony. The combination of this morbid bronchophony with ægophony, gives rise to that peculiar sound which is like the voice of Punch.

188. The distinction of these two orders of signs is in general easily accomplished, when care is taken to examine the patient in different positions, and especially when laid upon his face: then ægophony is discovered at the side, and the crepitous rattle and bronchophony appear at the back, where, before there was a complete absence of all respiratory sound.

189. In addition to these, the sound of the *ascending and descending friction* may be taken as a sign of pleuro-pneumonia, and particularly so where pneumonia predominates over pleurisy, in which consequently there is little or no effusion.

190. *Dropsy of the pleuræ* gives rise to the same stethoscopic signs as simple pleurisy, viz. the dull sound, the absence of respiratory murmur and ægophony ; it is only by the aid of general symptoms and the progress of the disease that these two affections can be distinguished.

191. *Effusions of blood* into the pleura give stethoscopic signs differing in no respect from those in other liquid effusions of the pleura. It must be expected that ægophony will necessarily disappear as soon as the blood becomes coagulated.

192. In *pneumato-thorax* the stethoscopic signs vary as this lesion is simple or complicated with a liquid effusion, or a fistulous communication between the bronchiæ and the pleura.

193. *Simple pneumato-thorax* is recognised by a perfect resonance, sometimes even tympanitic, in one side of the chest; and at the same time a total absence of all respiratory sound in every part, except at the root of the bronchiæ of the same side. Sometimes there is also a manifest dilatation of the diseased side; but this symptom is not constant.

194. When *pneumato-thorax* is complicated with a liquid effusion, the preceding signs are present; and moreover a dull sound is given out at the lowermost points of the chest; this point must however vary according to the different positions of the patient; and succussion will give the sense of fluctuation.

195. Lastly—when to a liquid and aëri-form effusion a fistulous opening between the bronchiæ and the pleura is joined, all the preceding signs are present; and in addition metallic tinkling and the amphoric resonance are heard; and more frequently these two phenomena alternate with each other.

196. *Simple pneumato-thorax* cannot be mistaken for any other complaint. *Emphysema* of the lungs is characterised by a great

resonance of the chest, joined to an extreme feebleness, or total absence of the respiratory murmur ; but then we discover here and there in deep inspirations either some remains of the respiratory murmur ; or the subsibilous rhonchus (compared to the clicking of little valves) ; or the dry crepitous rattle of great bubbles. In pneumato-thorax, on the contrary, the absence of the respiratory murmur is complete, with whatever force the chest may be expanded.

197. *Pneumato-thorax* with liquid effusion and fistulous communication between the pleura and the bronchiæ, can only be confounded with an extensive tuberculous excavation, since metallic tinkling and amphoric resonance may be present in this affection. But then there is no thoracic fluctuation ; the other stethoscopic phenomena are limited to a portion of the diseased side ; and we discover some degree of pectoriloquy and cavernous gurgling which never take place in pneumato-thorax.

198. Sometimes metallic tinkling is also heard in hydro-pneumato-thorax without the communication of the pleura and the bronchiæ ;

but this is of very rare occurrence, and seems to take place only on the patient raising himself up quietly in his bed, a drop of fluid which had adhered to the upper side of the chest becomes detached and falls to the bottom.

199. *Accidental productions* of the pleura are suspected rather than recognised by the absence of sound in the chest, and of the respiratory murmur. When they are accompanied by effusion, ægophony also takes place.

PART III.**AUSCULTATION OF THE CIRCULATORY SYSTEM.**

CHAPTER I.**OF THE ACTION OF THE HEART.**

200. When exploring the actions of the heart, the obturator should be placed in the stethoscope.*

201. In these examinations *two regions* of the præcordia must be distinguished ; the right, and the left. The right region corresponds with the inferior third of the sternum ; the left corresponds with the cartilages of the 4th, 5th, 6th, and 7th ribs. The movements of the left cavities of the heart are principally heard in this latter region, and those of the right cavi-

* See note (1), p. 119.

ties in the former ; so that when a disease affects one side of the heart, the analysis of the actions of this organ gives different results in the two regions.

202. In examining the actions of the heart by the stethoscope, four principal objects are to be studied : 1st, The extent to which they may be heard : 2nd, The shock or impulse which they communicate to the ear : 3rd, The nature and intensity of the sound which they occasion : 4th, The rhythm, or order, of their succession.

203. *The extent* to which the actions of the heart may be heard varies according to the various circumstances of age, embonpoint, conformation, vital energy, calmness, or agitation of the spirits, and others which are necessary to be appreciated in the analysis of the actions of this organ.

204. With a man in a state of health, whose embonpoint is moderate, and whose heart is of proper proportions, the extent to which the actions of the heart may be heard is limited to the præcordial regions : and sometimes when the sternum is short they are heard in the

epigastrium. With very fat subjects, and with those in whom these actions are not sensible to the hand, the extent to which they may be heard by means of the stethoscope is confined to a surface of about a square inch. With thin subjects, on the contrary; with those who have a narrow chest; with infants, and especially those of tender age; these actions are heard along the half or three lower quarters of the sternum, and sometimes along its whole extent; at the anterior superior part of the left breast, and often, though less sensibly, under the right clavicle. Just to such an extent there is nothing unnatural, in hearing the actions of the heart especially when they are less sensibly heard beneath the clavicles than in the præcordia.

205. When these limits are passed—the actions of the heart are heard successively in the following order, and with an intensity of sound proportionally diminishing:

1st. In the whole extent of the left side of the chest, from the axilla to the region of the stomach.

2nd. In the right side of the chest to the same extent.

3rd. In the *posterior* portion of the left side of the chest.

4th. Lastly and rarely in the *posterior* portion of the right side of the chest.

206. *The unaccustomed extent* to which the actions of the heart may be heard, is in the direct ratio of the weakness and thinness of the walls of this organ ; and in the inverse ratio of their strength and thickness. It denotes therefore a passive dilatation of this organ.

207. But it must be always borne in mind, that accidental causes can create a temporary increase of the heart's actions. More especially such causes as nervous agitation, a somewhat intense fever, hæmoptysis, and generally all those causes that increase the action of the pulse. Such also are the hepatisation of the lungs, or their induration, by reason of the developement of tubercles or other accidental productions ; the existence of excavations with firm or solid walls in these organs ; and their compression by a pleuritic effusion, pneumato-

thorax ; and the malformation of the chest by rachitis, &c.

208. *The impulse* of the heart's action is in the inverse ratio of the extent to which the action is heard. Little or nothing when in an healthy state, particularly in a man of moderate embonpoint, it augments as the walls of the heart acquire more thickness ; and may become so strong as to raise up the head of the auscultator, and even to produce a disagreeable shock to the ear. On the contrary, it diminishes as the walls of the heart lose their thickness,—and will then become insensible even when the heart's action is most violent.

209. A *strong impulse* must therefore be taken as a principal symptom of hypertrophy of the heart. The *absence* of all impulse, on the contrary, must be taken as a proof of the dilatation of this organ.

210. *The impulse of the heart* is generally perceived only at the præcordial region or at most of the inferior half of the sternum : and also at the epigastrium in those subjects whose

sternum is short, and their heart powerful. It may also become sensible below the clavicles on the left side, and sometimes also in a slight degree at the back, when the walls of the heart are thickened and dilated at the same time.

211. *The heart's impulse* is sensible to the stethoscope, even when the hand applied to the præcordia cannot feel it : and on the contrary, the hand can discover, in thin and very excitable persons, the actions of the heart when the stethoscope demonstrates the absence of all real force of impulsion.

212. *The impulse of the heart* diminishes or almost entirely ceases, even though hypertrophy exists, whenever a very intense dyspnœa supervenes as a consequence of hepatisation of the lungs, of pleuritic effusion, of pulmonary œdema, of asthma, or any congestion of the lungs. Sanguineous evacuations, diarrhœa, long continued abstinence, and in general all causes capable of producing debility of the animal economy produce the same effect.

213. Rapid walking, the chase, ascending stairs, nervous agitations, palpitations, fever, on the contrary, augment the impulsion of the

heart ; especially when this organ is firm and somewhat thickened : and still more so when this disposition is carried so far as to constitute a true hypertrophy.

214. *The sound* produced by the heart's action is resolved into two successive sounds, which the stethoscope detects though the heart be of the smallest volume and strength : the one is clear, sharp, analogous to that of the clapper valve of a bellows and appears to correspond to the action of the auricles ; whilst the other more dull and prolonged, coincides with the beat of the pulse as well as with the impulsion communicated to the ear by the stethoscope, and it evidently indicates the contraction of the ventricles.

215. In a natural state the sounds of the heart's actions are no where so strongly heard as at the præcordial regions, and they become fainter in those different points of the chest, according to the progression set forth in § 205. The sound is similar and equal in the two præcordial regions. The sounds of the right cavities are heard under the sternum ; those of

the left under the cartilages of the ribs : and all difference between them denotes a pathological condition.

216. The sound of the heart's action is heard the more plainly as the walls of the heart are thinner and the impulsion more feeble. It diminishes so much in hypertrophy, that the contraction of the ventricles sometimes produces nothing more than a shock without any sound, and the clacking of the auricle becomes dull and scarcely audible. It increases in dilatation to such an extent, that the sound produced by the contraction of the ventricles approaches that of the contraction of the auricles, and becomes sometimes equally clear and intense.

217. The sound of the heart's actions, and particularly that which coincides with the contraction of the auricles, becomes more dull and less distinct when the anterior edges of the lungs are stretched over the heart and entirely cover it. And the same effect takes place when the heart becomes softened. In these cases the *absence* of impulsion proves that the dimi-

nution of sound does not arise from hypertrophy of the heart.

218. *The rhythm* of the actions of the heart is the result of the order in which the different parts of the heart contract, of the respective durations of those contractions, of their succession, and of their relations.

219. In a state of health, and when the pulse is felt at the same time that we apply the stethoscope over the heart, the ear is slightly raised at the same moment that the artery strikes the finger, by a motion of the heart that is accompanied by a dull sound and is isochronous with the action of the artery : this is the contraction of the ventricles. Immediately afterwards, and without any interval, a clear sound is heard, shorter, and unaccompanied by any movement sensible to the ear, appearing to interrupt the former sound abruptly, and resulting most probably from the contraction of the auricles. This sound is immediately followed by a very short but well marked period of repose ; after which the two sounds are again repeated in the same order.

220. The respective durations of the two sounds of the heart, and of its repose, may be exactly described, by saying, that out of the total duration of one complete contraction of the heart, a third part at most, or even a fourth part, is taken up by the contraction of the auricles; a fourth, or something less, by the absolute repose, and the half or nearly so, by the contraction of the ventricles. These observations, though minute, are easily verified by the auscultation of the actions of the heart in a healthy man, whose pulse is somewhat slow, for when the pulse is frequent, the period of the repose is less marked, the duration of the contraction of the ventricles still less so, and the isochronism of the pulse and the heart's action is more difficult to seize.

221. The *rhythm* of the action of the heart is altered when diseased by hypertrophy or by dilatation. *In the first case*, the contractions of the ventricles are more dull, more prolonged, and appear to trespass upon the time of the repose; the contractions of the auricles also are more dull, but of *shorter* duration; and when the disease is extreme, the ear dis-

covers nothing more than an impulse isochronous with the pulse, without any distinct sound, and without any appreciable repose.—*In the second case*, the contraction of the ventricles is of shorter duration, more sonorous, gives but little or no impulse, resembles more or less completely the contractions of the auricles, is less distinctly isochronous with the pulse, and sometimes not distinguishable at all, since the pulse in such cases is generally very frequent.

222. *The sound and the rhythm* of the actions of the heart are subject to various anomalies, and which do not always coincide with any real disease of the organ. These anomalies are designated under the several names of, *bellows sound, rasp sound, new leather sound, the purring tremor, &c.* Those of rhythm have been long known by the names of *palpitations, irregularities, and intermissions, &c. &c.*

223. *The bellows sound*, sufficiently characterized by its name, may accompany the contractions of the ventricles, or of the auricles, or even both at the same time; and it is so related to them that it replaces and substitutes

itself for their natural sound. It is, however, more common to hear it during the contraction of the ventricles only; very often it exists merely in one ventricle. It is *rarely constant*. It ceases and reappears abruptly, and often without any other apparent cause than a slight moral emotion.

224. *The bellows sound* often accompanies arterial action, and then it is sometimes sibilous, and even *musical*. It has been heard in almost all the arteries; and principally in the carotids, the subclavians, in the abdominal aorta, and in the crural and brachial arteries. It is not often that the arteries give out the bellows sound without the heart producing it also: but, on the contrary, this sound often exists in the heart in a high degree without the least semblance of it in the arteries.

225. *The bellows sound* very often exists in hearts affected with dilatation and hypertrophy; and as frequently in the case of a narrowing of the orifices of this organ: but it is yet more frequently found in the hearts of the most perfectly healthy. The same may be said but of the existence of this sound in the arteries:

both cases are very common in hypochondriacs and hysterical females, in persons attacked or threatened with various hæmorrhages, &c. &c. The bellows sound, both of the heart and of the arteries, may probably be the consequence of some enervating affection or disturbance, or perhaps, of some modification of the mass or qualities of the blood.*

226. *The rasp sound* perfectly resembles the sound produced by the action of a rasp upon a piece of wood somewhat soft, is heard in the heart only, and may, like the bellows sound, accompany the actions both of the ventricles and of the auricles. Whenever once developed it *never ceases*, and appears to arise from a constriction or narrowing of an orifice of the heart. The particular orifice obstructed may be determined, by observing whether the sound be more distinct during the contraction of the auricle of the ventricle; or under the sternum or the cartilages of the ribs.

227. *The new leather sound*, similar to that produced by sitting upon a new saddle, exists only at the heart, and accompanies the con-

* See note (2), p. 219.

traction of the ventricles. This sound appears to be produced by the friction between the two surfaces of the pericardium, at the moment when the heart is borne forward ; and denotes that the internal surface of this serous membrane has become rough and unequal by reason of inflammation : at least it has never been heard but in subjects affected with pericarditis.

228. *The purring tremor* is a particular sensation which the hand perceives when placed on the region of the heart, and which is compared to the tremor that attends the murmur of satisfaction expressed by the cat when carressed. This phenomenon constantly accompanies the rasp sound, and like it indicates a mechanical obstruction to the course of the blood, by the narrowing of some one of the orifices of the heart. Something analogous to this tremor is discoverable in the arteries which present the bellows sound ; but this sign is fluctuating, and appears, like the bellows sound, to arise from a simple nervous disturbance.

229. The action of the heart may sometimes be heard at a distance, without any necessity for applying the ear mediately or immediately

to the sides of the chest. With some the action of the heart may be heard at a distance of some inches, or even of one or two feet. This rare phenomenon may take place with or without any disease of the heart: and seems to arise from some gaseous exhalation in the pericardium, or even in the stomach.

230. By *palpitations* of the heart is meant in common language, a *beating* of the heart sensible and incommodious to the patient, more frequent than in a natural state, and sometimes unequal in its frequency and force. In many cases, and particularly when the heart is affected with dilatation, the palpitation consists uniformly of an augmentation of the frequency of the heart's action. When, on the contrary, the heart has thick walls, the palpitations consist of an augmentation of the *force as well as frequency* of the heart's action. Those palpitations which take place in a man otherwise healthy, in consequence of some violent action, or the influence of some moral affection, have equally this *double* character. As a consequence, therefore, the analysis of these actions must only be made after a long

repose if the individual has used exercise, or when in a state of the most perfect tranquillity of spirits ; in order to draw correct conclusions as to any real malady of the heart.

231. *Irregularities* of the heart's action are generally joined with palpitations ; nevertheless, and principally with old men, they may take place without palpitation. Irregularity with palpitations, most frequently consists of the variation in the frequency of the heart's action. Sometimes this frequency varies at every instant ; sometimes, on the contrary, pulsations are heard from time to time more rapid and shorter than the others ; sometimes even but one single pulsation is perceived, which produces in the pulse a sort of intermission. Often also, the irregularities result from a change in the duration of the contractions of the auricles and ventricles respectively. Generally it is the contraction of the ventricles, and are longer or shorter than they ought to be : and in this case, the duration of the repose of the heart, is also augmented or diminished. An alteration in the length of the auricular contractions is more rarely observed. Sometimes, however,

each contraction of the ventricles is followed by several contractions of the auricles, rapid, short, and as it were convulsive, and which altogether do not occupy more time than one ordinary contraction. At other times, one contraction anticipates another, and sometimes even masks it entirely.

232. *Intermissions* in the actions of the heart often accompany palpitations. They always take place after the contraction of the auricles, and are, consequently, the result of an unaccustomed prolongation of the ordinary repose of the heart. Their duration is variable; sometimes equal to a complete contraction of the heart, sometimes only a third or a half. Their return is irregular, and takes place sometimes after two or three complete pulsations of the heart, sometimes after 10, 20, 30, or even 100. They are observed very often in old persons, without any disturbance of the health or the slightest indisposition. In adults, on the contrary, they are seldom observed, but when there is some malady of the heart, principally hypertrophy, and when at the same time there are palpitations.

With these *true intermissions*, and which really consist of a complete suspension of the heart's contractions, care must be taken not to confound the *false intermissions*, which consist of such feeble contractions as are not perceptible in the arteries, and scarcely produce in them any sensible impulse. This species of intermissions, which at bottom is but an irregularity, is often observable on the approach of critical diarrhœa.

233. The exploration of the heart's action by the aid of the stethoscope, exactly indicates, according to the great or little impulse of these actions, what may be the real energy of the circulatory system ; and, in consequence, furnish the indication for blood-letting and depletion with much more certainty than any examination of the pulse.

PART IV.

CHAPTER I.**STETHOSCOPIC SIGNS IN DISEASES OF THE
HEART.**

234. The stethoscopic signs in diseases of the heart are principally drawn from the alteration of the sound, and of the impulse of the heart's actions. The alterations of rhythm indicate of themselves no certain disease, and rarely deserve to be taken into consideration.

235. *Hypertrophy* of the heart is characterized by an augmentation of the impulse, and by a diminution of sound ; and a consequent diminution of the extent to which the actions of this organ may be heard. Very frequently palpitations are joined to hypertrophy, espe-

cially of the left cavities of the heart, which consist more in the augmentation of impulsion of the ventricles than of sound, and which are rarely accompanied by irregularities or intermissions: unless when the hypertrophy is unequal, that is, greater in some points of the heart's parietes, and less in others.

236. When the hypertrophy has its seat in the left ventricle, its contractions, explored between the cartilages of the fifth and seventh ribs, give a stronger impulsion, which raises the head of the examiner, and a duller sound, than when in a natural state. These contractions, also, are more prolonged than they ought to be, whilst the contractions of the auricle are, on the contrary, shorter, less sonorous, and consequently scarcely audible. Often, too, when the hypertrophy is extreme, but one impulse more or less marked is perceived, without the possibility of distinguishing the two successive contractions. And in every case the heart's actions can only be perceived over a small extent, and in a space included between the cartilages of the fifth and seventh ribs alone.

237. When the hypertrophy has its seat in the right ventricle, the impulsion of the heart's action is equally augmented, whilst the extent over which it may be heard is equally limited ; but then it is under the inferior portion of the sternum that the impulsion is the strongest. The sound of its contractions is also a little less dull than in the hypertrophy of the left ventricle.

238. This distinction between the hypertrophy of the two ventricles, according to the place where the heart is heard with the greatest force, is unerring. There is, however, a case in which this great distinction is difficult to be established ; thus when a hypertrophy has increased the left ventricle to an enormous volume, it becomes anterior, and is more easily heard under the sternum than in the left cardiac region ;—whilst the right ventricle, as it were, involved in the parietes of the left, becomes posterior, and is not heard at all. But in this case, other signs assist the investigation, and particularly that of the swelling up and pulsations of the jugular veins, which are always constant in hypertrophy of the right ventricle,

but are as constantly wanting in this disease of the left.

239. The simultaneous hypertrophy of both ventricles is distinguished by the augmentation of the impulse of the heart, being as powerfully marked in the right as in the left præcordial regions.

240. *Dilatation of the heart* is characterized by the diminution of impulse, by the augmentation of sound, and by the greater extent over which the heart's action may be heard.

These phenomena are present in both præcordial regions, when the dilatation is general; and the degree of dilatation may be measured by the extent to which the heart's action may be heard. When the dilatation is limited to one ventricle, the greater sonorousness of the heart's contraction is only heard in one cardiac region; or at least, it is much more marked there.

Palpitations are rather frequent in dilatation of the heart, and consist principally of an increased frequency and sound of the contractions.

Irregularities and *intermissions* are, on the contrary, rather rare, though less so, however, than in hypertrophy.

241. *Hypertrophy with dilatation*, an affection much more common than simple dilatation, and still more so than hypertrophy *without* dilatation, is characterised by the presence of impulse and sound at the same time. The contractions of the ventricles give a strong impulse and a well marked sound ; those of the auricles are sonorous. Both are heard over a great extent. By an alternate examination of both cardiac regions, the exact part affected may be ascertained ; as well as whether one ventricle only is diseased, or both, as is more commonly the case.

It is in hypertrophy with dilatation, that the heart's actions are most sensible to the hand, especially when there are palpitations. And then it is not unusual to see the whole body of the patient, even though in the most perfect calm, and even the bed clothes, shaken or disturbed at every contraction of the heart. These palpitations, examined by the stethoscope, have no other characteristics, the exag-

generation excepted, than those previously indicated, and are rarely accompanied with irregularities.

242. *Hypertrophy of one ventricle with dilatation of the other*, is a complication by no means rare. The signs are therefore a mixture of those of hypertrophy, and those of dilatation, with a predominance of the one or the other in one of the cardiac regions, according to the affected ventricle.

243. Although the appreciation of these various signs be a matter of great facility in the greatest number of cases, yet general symptoms must be brought in aid, and the examinations of the heart should be repeated several times, before a judgment be pronounced upon the state of this organ. An examination at a moment of nervous agitation would lead to the supposition of a disease which had no existence; and on the other hand, by reason of a dyspnœa arising out of a concomitant pulmonary complaint, or other cause, a disease of the heart, even in an advanced state, might be overlooked. It must not be forgotten, that the action of the heart in young children, and lean and nervous people, appears more energetic, without any

increase in the volume of this organ; and that in the young and vigorous adult, the heart may become more voluminous, without producing a disturbance sensible to the individual.

244. *Dilatation and hypertrophy of the auricles of the heart* are affections of very rare occurrence and never isolated. Their signs are confounded with those of the lesions which accompany them, and particularly of the narrowing or constriction of the auriculo-ventricular orifices.

245. *Induration of the heart* gives the same signs as hypertrophy, with which this alteration almost constantly coincides.

The signs of a *softening of the heart*, an alteration which almost constantly coincides with some other affections of this organ, consist of a simultaneous diminution both of sound and impulse. When the softening is combined with dilatation, the sound produced by the contractions of the heart, although marked, yet is somewhat dull, and loses that clear character which dilatation ordinarily gives out; when it is combined with hypertrophy, the sound becomes

so obtuse as scarcely to be heard ; and in extreme cases an impulse only, without sound, is perceived.

246. *Cartilaginous or osseous induration of the valves of the heart*, and the narrowing of its orifices which is the consequence, are recognized by the *rasp sound* and the *purring tremor*, which almost constantly attend them. The rasp sound takes place on the contraction of the auricle when the mitral valve is the seat of induration ; but, on the contrary, when the seat of the induration is the sigmoid valves of the aorta, the rasp sound coincides with the contraction of the ventricle. The tricuspid valves, or the sigmoid valves of the pulmonary arteries, are very seldom the seats of cartilaginous, or osseous indurations ; but it is probable, that such a case might be recognized by the greater force of the rasp sound under the sternum, rather than under the ribs.*

247. The lessening of the orifices of the heart, from *verruucose vegetations* upon the valves of this organ, have for their signs the same rasp sound and purring tremor ; but this

* See Note (3), p. 120.

tremor is less sensible to the hand, and the rasp sound is more dull, and more nearly resembles the bellows sound, than in the cartilaginous or osseous indurations of the valves.*

248. No other organic affections of the heart present certain and constant stethoscopic signs.

Dislocations of the heart, when they take place, are only known by the change of place where the actions of the heart are heard.

Polypi of the heart may be suspected by the sudden confusion manifested in those contractions of the heart which were previously regular.

Partial dilatations of the heart; inflammations of this organ; ulcers; ruptures; malformations, &c.; have no signs capable of making them known before death.

249. *Pericarditis* is rather suspected than recognised, by the irregularity of the force and duration which the contractions of the heart suddenly present, especially those of the ventricles, in a subject who previously presented no symptoms whatever of a diseased heart.

* See Note (4), p. 120.

The diagnostic becomes more certain, if for some hours, or days, as the disease may be acute or chronic, the new leather sound is heard ; and still more certain, if at the same time that these stethoscopic phenomena take place, the præcordial region, properly struck, renders a sound evidently more flat than in a natural state.

In this affection, also, the aid of general symptoms is most necessary.

250. *Hydro-pericardium* has for its signs tumultuous actions of the heart, which are obscure ; seem to affect the ear and the hand through a soft medium ; are heard over a space rather extensive ; and are more distinct sometimes in one place, sometimes in another. A flatness of sound in the præcordial region is however, the indispensable sign of its confirmation.

251. *Pneumato pericardium* is most probably the cause of the heart's actions being heard at a distance ; and consequently ought to be taken as the most rational sign.

252. *Aneurysms of the aorta* have no other stethoscopic signs than simple pulsations,

which are heard along the sternum or vertebral column, according to the position of the aneurism. But this sign often fails ; and here more than in any other disease within the chest it is necessary to call into assistance every method of investigation ; and particularly that of inspection, of the application of the hand, of percussion, as well as of general symptoms.

APPENDIX.**ON THE APPLICATION OF AUSCULTATION
TO OTHER DISEASES AND AFFECTIONS.**

CHAPTER I.**STETHOSCOPIC SIGNS OF THE GRAVID UTERUS.**

253. On applying the stethoscope to the abdominal parietes over the region of the gravid uterus, two motions may be distinctly perceived, which indicate two very different pulsations ; the one *fœtal*, the other *placental* : and a third motion is evident when other parts of the abdomen are examined. This last arises from the action of the adult heart, but as it may be perceived over the region of the uterus also, care must be taken not to confound it with the two former motions.

254. *The pulsations of the fœtal heart* are recognised by a frequency apparently double those of the maternal pulse, and not isochronous with it in any degree.

255. *The fœtal pulsations* may be recognised about the sixth month of gestation, or rather earlier.

256. They may be heard over a tolerable extent; about a foot in one direction, and three or four inches in breadth. It is probable that the extent over which these pulsations may be heard will depend upon the proximity of the fœtus to the abdominal parietes, and consequently upon the quantity of fluid in the amnios.

257. *The place* where these pulsations are heard, varies from time to time according to the position of the infant. But it is always a matter of facility to discover its precise locality, by reason of the intensity of the sound, increasing as we approach, and diminishing as we recede from the true place.

258. Sometimes these pulsations cannot be discovered for some hours, or even days, and they appear to be suspended: this doubtless

arises from debility, and change of position. Since, in order that they may be easily recognized, the body of the fœtus, the membranes, the uterus, and the abdominal parietes, should be in immediate contact, the intrusion of folds of the intestines between the uterus and the abdominal parietes or an excessive quantity of liquor amnii, would prevent this auscultation.

259. Any agitation of the maternal does not appear to affect the fœtal circulation; and *vice versâ*. For during an examination, the fœtal heart will be heard to pulsate with a sudden and great increase of velocity and of force, without the least disturbance of the mother's pulse.

260. Whatever may be the increase of the force of the fœtal pulsations, there never is any impulse, or remarkable alteration in the rhythm: although the sound be nearly equal to that of an adult heart.

261. The second phenomenon is denominated *pulsations with bellows-sound*; this is evidently arterial, and is isochronous with the pulse.

262. This is the *placental sound*, and

appears to take place at the point of insertion of the placenta.

263. This sound is heard generally on the side directly opposite to that of the fœtus ; and its extent is limited to a very small space, about three or four square inches. Its position will vary in different individuals, but where once heard, there it is *constantly* found ; whilst the fœtal pulsations may change their locality several times in the same person.

264. The unerring and distinctive characteristics of the two uterine pulsations are,—that the *fœtal* are more rapid than the pulse ; the *placental* are isochronous with the pulse : the fœtal change place ; the placental remain constant to one place : the fœtal are heard over a tolerable extent ; the placental are confined to very narrow limits.

265. At the moment of separating the umbilical chord, the placental pulsations cease : this fact is decisive.

266. *The placental pulsations* are not always manifest ; debility, and the interposition of intestines will cause their occasional apparent suspension.

267. A double or multiple impregnation will produce a corresponding repetition of the foetal and placental pulsations. But greater caution is to be employed in this investigation than when exploring the thorax, since all the sounds are much more feeble. And more time must be expended in the investigation ; and since the phenomena are intermittent, several examinations must be made before an opinion be definitively pronounced.

CHAPTER II.

STETHOSCOPIC SIGNS IN CASES OF FRACTURED
BONES.

268. *The crepitation* between the fractured extremities of bones is instantly detected by the stethoscope, on the slightest possible motion of the parts. And the nearer the stethoscope can be placed to the fracture, the more plainly is the crepitus heard.

269. In hard bones the sound given out to the ear, is like the cracking noise of a piece of wood broken across the knee ; in spongy bones it is more dull, more like the sound of a rasp or file grating upon the bone.

270. The crepitation of a fractured femur may be heard even upon the cranium ; and consequently where the stethoscope cannot be

applied over or near the supposed fracture by reason of the tumefaction of the soft parts ; the diagnostic will be at once determined by its application to the next bone articulated with the injured limb.

271. *Oblique fractures* give a louder crepitation than the transverse ; in unequal fractures the sound is more obscure.

Comminuted fractures give the sound of many separate splinters.

272. When any effusion has taken place around the fractured extremities of bone, the crepitation is attended with a gurgling, compared to that produced by the foot in a shoe full of water.

273. When the fracture is complicated with a wound that penetrates to the broken parts, the crepitation is attended with a sound similar to that made by a powerful breathing with the mouth wide open.

274. The crepitation produced by fractured bones cannot be mistaken for that which is produced by the articulating surfaces of dislocated joints ; for this sensation is dull and

obscure ; it is that of two polished and humid surfaces gliding upon each other.

275. From these laws and applications of the stethoscope, its great importance in investigating cases of fractures is obvious.

Obscure fractures, such as frequently cannot be detected by the most experienced surgeon, and the doubts often entertained as to the re-union of the bones, may be determined by the stethoscope on a single application, and without giving pain to the patient by long and continued extension and motion in the first instance ; and without the risk and danger of disturbing the partial union of the fractured extremities of the bone, towards the close of a cure, when that cure may rest a matter of doubt.

276. By way of illustration the following fractures, often extremely difficult to ascertain, may be easily discovered by the stethoscope. Fractures of the neck and condyles of the femur ; of the fibula, especially its inferior extremity ; of the internal malleolus ; longitudinal and oblique fractures of the patella ;

those of the pelvis; those of the radius and ulna, when only one of these bones is broken; those of the neck and condyles of the humerus; of the acromion of the scapula; of the scapula and its edges; of the vertebral column, &c. &c.

CHAPTER III.

STETHOSCOPIC SIGNS OF CALCULI IN THE
BLADDER ;—IN SOME OTHER CASES ; IN
ABSCESSSES OF THE LIVER ; IN DISEASES OF
THE EAR ; AND A NOTICE OF THE USE OF
THE STEHOSCOPE IN VETERINARY SURGERY.

Signs of Calculi in the Bladder.

277. The operation of cutting for the stone has been performed in some of the capitals of Europe, and no stone has followed the knife ; such a catastrophe the stethoscope renders impossible.

278. The stethoscope applied to the pubes or sacrum during cathertism will make the shock of the catheter against the stone more sensible than it would have been to the unassisted ear (or hand) ; and in obscure cases, the sensation will be as obvious and certain as when a stone is struck by the sound in the open air.

279. When the urine is almost entirely evacuated, *if no stone* be in the bladder, a gurgling, analogous to the sound produced by rapidly urging the saliva between the teeth when the mouth is closed, will be heard.

280. When the bladder is entirely empty, the motions of the catheter will be heard, like the play of a force pump. This sound is without doubt owing to a certain quantity of air introduced by the catheter into the bladder.

281 *A fungoid production* has been mistaken for a calculus : but fungoid productions in the bladder render no other sounds by the stethoscope than those of the empty viscus, or when the viscus is empty, or when it contains but a small quantity of urine.

In some other Cases.

282. There are a multitude of other cases in which our present methods of examination leaves us in great uncertainty, but in which the stethoscope, applied to the neighbouring parts, in conjunction with the sound or probe, would clear up all doubt ; as in cases of the introduction of extraneous bodies *into* the ear, the

nasal fossæ, the pharynx, the æsophagus, the rectum, and wounds, especially gunshot wounds. It is not doubted, that the sensation conveyed to the ear by the stethoscope, of the shock given by *the sound* (or probe) upon a bullet, point of a sword, or splinter of a shell placed deeply near a bone, or imbedded into its substance, would enable us to recognise these objects more easily than that conveyed to the hand by the probe or sound alone. And the same may be supposed of all similar cases, when the ear and hand can alone be employed as the means of investigation. And, upon the same principle that excavations of the lungs are determined, so, probably, would fistulous and cavernous abscesses be ascertained; as an injection thrown into them would give the cavernous gurgling, or cavernous ronchus.

In Abscesses of the Liver.

283. These signs at present are merely conjectural. It is considered that the stethoscope would recognize abscesses in the liver, and hydatids formed in this organ, when about to open into the stomach or intestines, or even into the lungs, as sometimes has been observed.

284. In the two former cases, on pressing the abdomen in the hypochondriac region, it is probable a gurgling would become manifest, arising from the introduction of intestinal gas into the emptied cavity of the liver.

285. In the latter case, that is, of fistulous communication between the abscess of the liver and the bronchiæ, there is no doubt that cavernous cough and respiration, and cavernous rhonchus also would be perceived, and probably the transmission of the voice through the stethoscope ; and if the excavation should be very great, the metallic tinkling would be manifest.

In Diseases of the Ear.

286. The stethoscope should be furnished with an obturator of smaller dimensions at its external end, for the purpose of the auscultation of the ear and parts adjacent.

287. The stethoscope applied upon the mastoid process, and also upon the other cavities of the face, will render the circulation of the air in these cavities perfectly audible : and the voice also will be heard to resound through them. This resonance is called *rhinophony*.

288. If the nostril on one side be closed by a finger, whilst the patient blows through the other nostril with some force, the rushing of the air into the chamber of the tympanum will be very evident, on applying the stethoscope to the mastoid process on the opposite side. And if any mucus should be in the eustachian tube, or in the ear, a gurgling like the mucous rhonchus will be heard; this often takes place in coryza.

289. It is obvious, therefore, that the permeability, or the obliteration, of the eustachian tube, is a matter of easy discovery by means of the stethoscope.

And so also, the nature of any extraneous substance introduced into the ear, can be ascertained by the conjoined use of the sound or probe, and stethoscope.

Of the Use of the Stethoscope in Veterinary Surgery.

290. The great Laennec has written but a few sentences upon this subject, contenting himself with throwing out the suggestion to the practitioner in animal pathology. Nor was it

necessary to write much, since all the principles and applications of the stethoscope, already set forth in his work, must necessarily be the same, for its uses in the brute animal, as in the human being.

The value of auscultation in Veterinary Surgery is now duly appreciated; and Mr. Youatt, in his 25th lecture on Veterinary Medicine, delivered at the London University, has explained its advantages, and demonstrated the best method of its application. And in his 27th lecture he says, "Although we cannot yet carry this so far as the practitioner of human medicine does, we can derive most important advantages from the use of auscultation. We can at least ascertain the seat of inflammation, and the presence of morbid sound, or the gradual recurrence of the healthy one will point out the extent of the disease: while other indications, and obtained in the same way, will as faithfully tell us the mischief and disorganization occasioned by the inflammation. *Once more, gentlemen, let me urge you carefully to study the indications by immediate auscultation.* They will rarely

deceive you, and you will not long accustom yourselves to this mode of exploration without highly prizing it."—*Lancet*, Vol. ii. 1830. No. 450. and some following numbers.



NOTES.

NOTE (1).

Thus it appears that "Laennec employed the stethoscope, in its entire state, to examine the heart; and the presence of the plug (or obturator) is certainly advantageous in ascertaining the impulse. But for observing the sounds of the heart, the instrument is much better without the plug. The excavation renders the sounds far more audible." It is often useful to make the patient suspend his breath for a few moments while we are listening to the sounds of the heart. The murmur of respiration is sometimes mistaken for a cardiac bellows sound, and in dyspnœa the sounds of the lungs sometimes completely overpower those of the heart."—*Dr. Elliotson's Lumleyan Lectures on the Heart*, note, p. 16. An. 1830.

NOTE (2).

"I once witnessed a remarkable instance of the temporary occurrence of this sound. In this case there was ascites, and the bellows-sound, which was in the region of the left ventricle, and took place at the ventricular action, instantly ceased on the removal of the fluid from the abdomen, and was not heard for several weeks, when the fluid again accumulated, and it again became audible."—*Dr. Elliotson's Lumleyan Lectures*, p. 18.

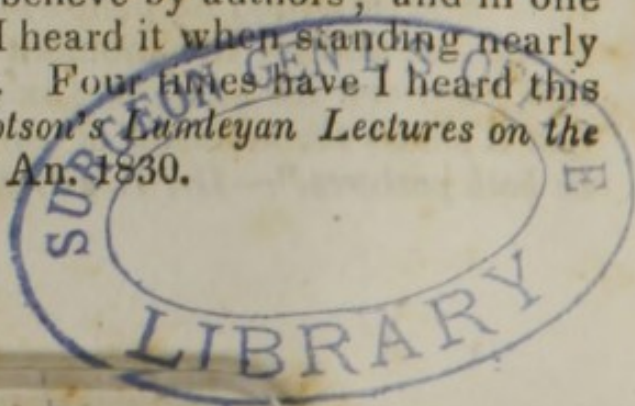
"A patient was some months ago in St. Thomas's Hospital, in whom the recumbent posture produced it (the bellows-sound). She was a young woman with chronic bronchitis, dyspnœa, livid lips, and œdematous legs, and afforded no bellows-sound while erect; but it became audible the moment she lay down. I have since noticed the same fact in other cases of dyspnœa; and it shows the necessity of carefully examining patients in both postures."—*Dr. E.'s Lectures as above*, p. 18.

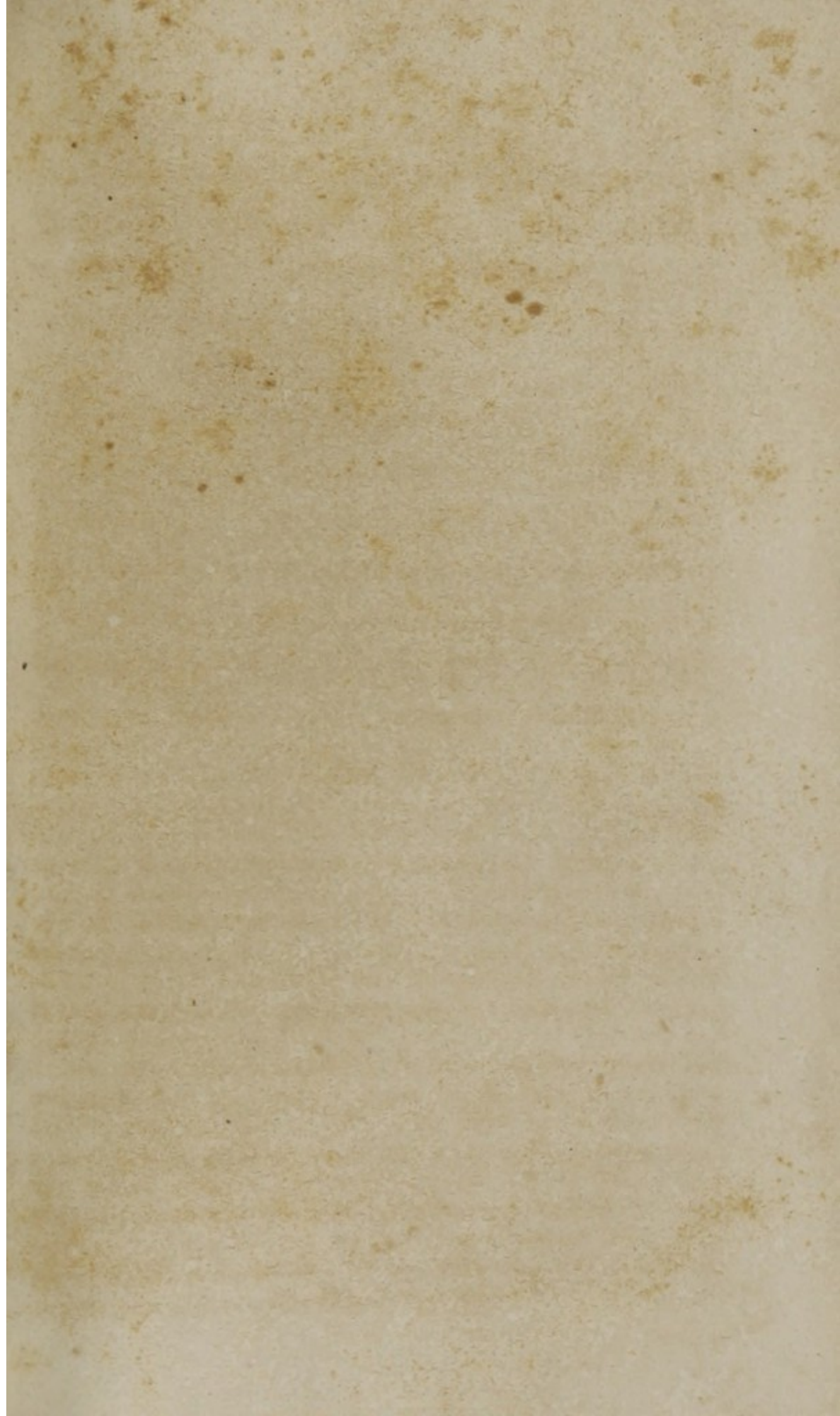
NOTE (3).

It appears in Dr. E.'s Lectures before quoted, that a *permanent patency* of the tricuspid or mitral valves, when these are thickened and their opening narrowed, is not uncommon; this morbid condition produces the bellows-sound.—*Vide pp. 19 & 20 of the Doctor's Lectures, as above quoted.*

NOTE (4).

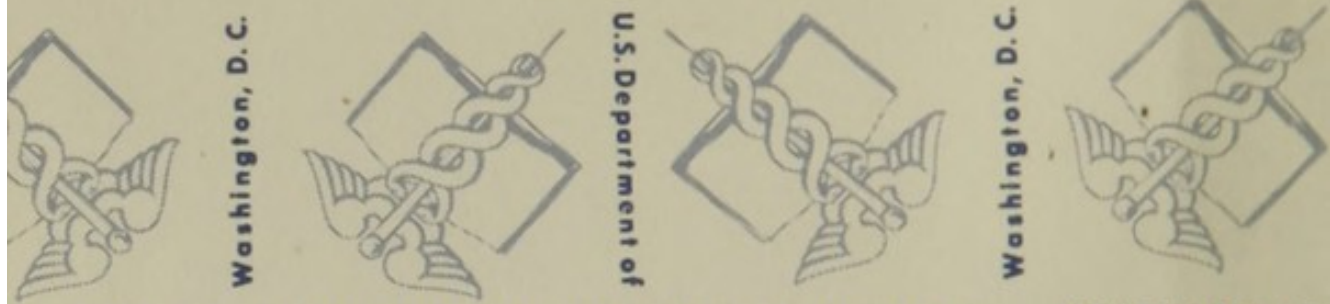
"I have never, except in one, and that a most extraordinary case, seen the opening leading from an auricle or ventricle materially narrowed, without having heard a preternatural sound at the moment of the contraction of the auricle or ventricle behind it. The sound is sometimes protracted, and sometimes, while one portion of it resembles the blowing of a bellows, I have heard another resemble the filing of wood, or the action of a fine saw, though this compound is not mentioned by authors. Once, where the pulsations of the heart varied in force, the sound which occurred at the auricular contraction and in the right side of the heart, was loud, rough, and sawing, at the strong pulsations; and small and shrill at the weaker. In some other cases in which the force of the pulse varied, the bellows-sound (ventricular and at the right side of the cardiac region) was perceptible at the strong pulsations only: and in all these cases, immediately after the preternatural sounds, a faint sucking or aspiring sound was heard. In one case, apparently of constriction of the opening of the mitral valve, the sound was small and shrill (*bruit de râpe*) at the centre of the sternum, but full and bass at the cartilages to the left, and of this nature, though fainter, all over the rest of the front of the chest, and all over the left half of the back. Sometimes it altogether resembles the sound of a file or saw: and at times I have heard it exactly resemble the cooing of a dove,—a variety not mentioned I believe by authors; and in one case it was so loud that I heard it when standing nearly a foot from the patient. Four times have I heard this cooing sound.—*Dr. Elliotson's Lumleian Lectures on the Heart, p. 15. and notes. An. 1830.*







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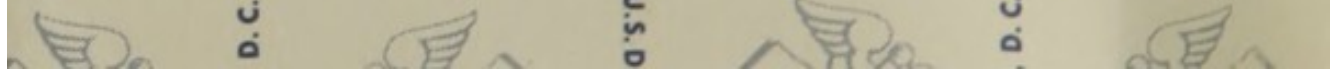
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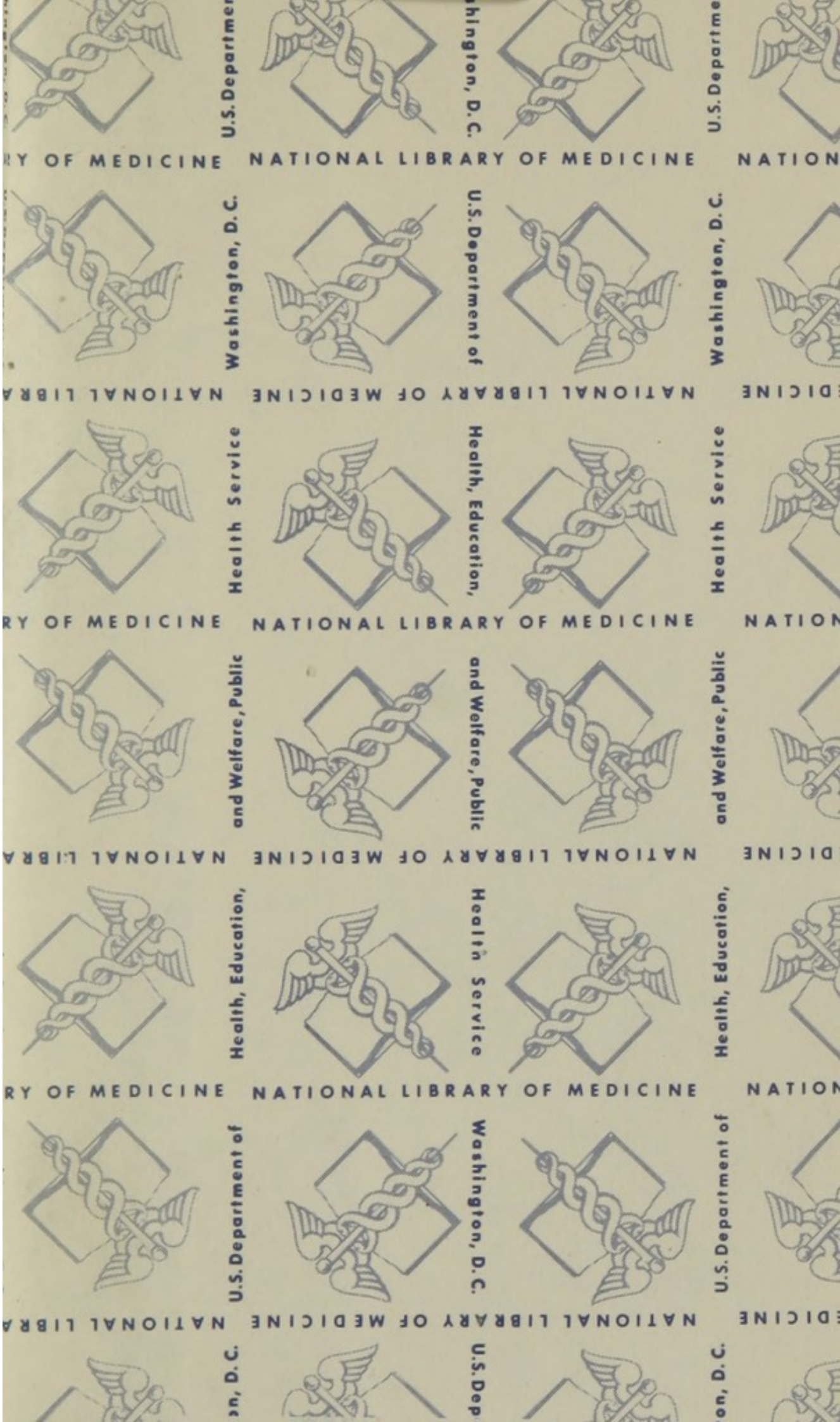


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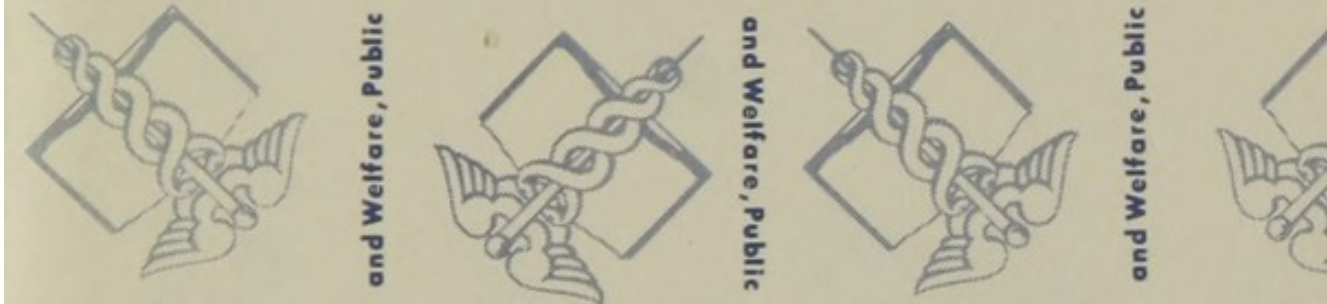
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