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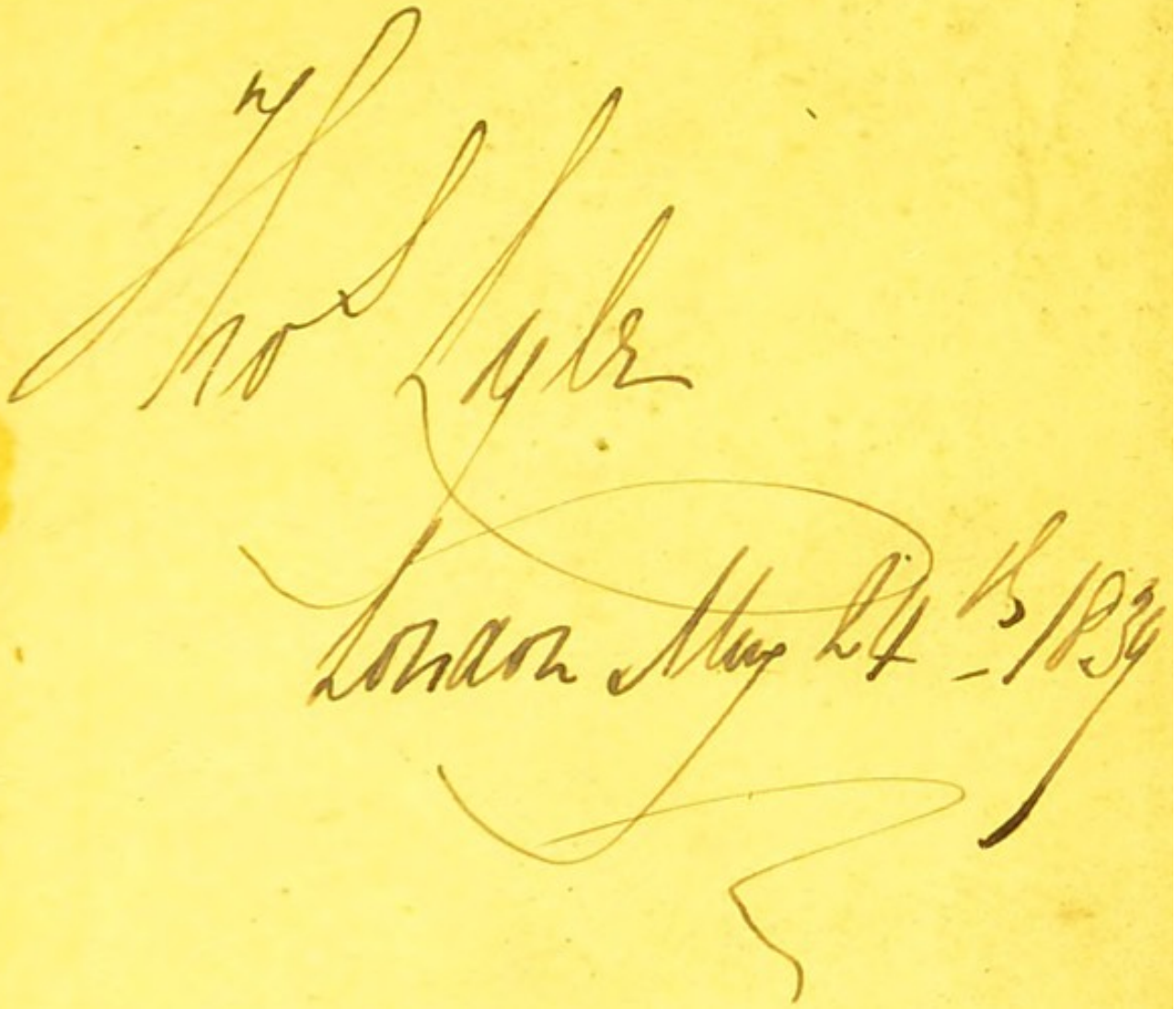
MANUAL
OF
AUSCULTATION



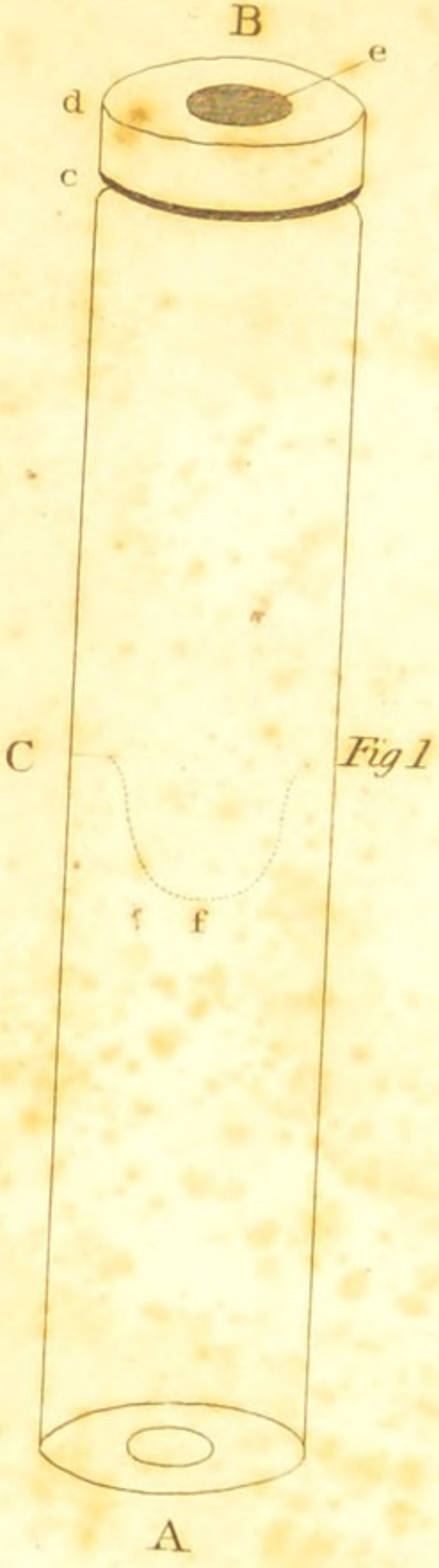


Fig 1

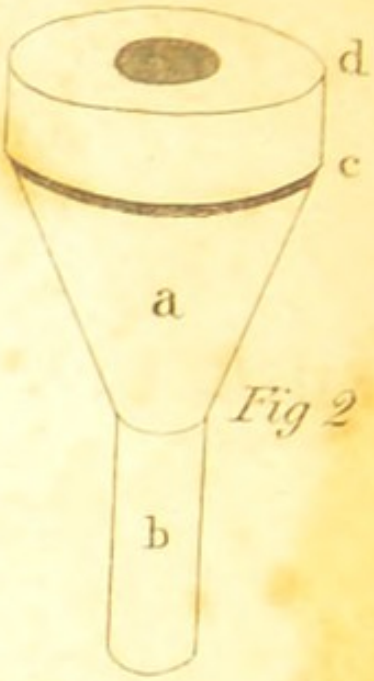


Fig 2

Fig 3

Fig 4

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A

MANUAL

OF

AUSCULTATION AND PERCUSSION.

PRINCIPALLY COMPILED FROM

MERIÉDEC LAENNEC'S EDITION

OF

LAENNEC'S GREAT WORK.

BY JAMES BIRCH SHARPE, M.R.C.S.L.,

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

Second Edition,

WITH IMPORTANT ADDITIONS.

LONDON:

SAMUEL HIGHLEY, 32, FLEET STREET.

1838.

LONDON:
J. GREEN AND CO., BARTLETT'S BUILDINGS.

TO

JOHN ELLIOTSON, M.D. CANTAB.

F.R.S.

PROFESSOR OF THE PRINCIPLES AND PRACTICE OF MEDICINE AND OF CLINICAL MEDICINE IN UNIVERSITY COLLEGE, LONDON; AND SENIOR PHYSICIAN TO UNIVERSITY COLLEGE HOSPITAL; PRESIDENT OF THE PHRENOLOGICAL SOCIETY, ETC.

THIS MANUAL

IS INSCRIBED

AS A TRIBUTE OF RESPECT TO HIS DISTINGUISHED LEARNING, HIS LOVE OF TRUTH AND HIS INFLEXIBLE FIRMNESS IN MAINTAINING IT, AND AS AN HUMBLE ACKNOWLEDGMENT OF THE GREAT ADVANTAGES WHICH THE SUBJECT OF THIS WORK HAS DERIVED FROM SO ABLE AN AUSCULTATOR,

BY

THE AUTHOR.

Windsor, November, 1838.

PREFACE TO THE FIRST EDITION.

The Stethoscope is now too well known, and its value is too accurately estimated, to require an essay for its description, or an argument for the proof of its utility and importance.

These considerations form the basis upon which the present work has been undertaken. Upon them alone rests its claim to the attention of the medical student, and upon them it must also depend for the favorable notice of my professional brethren.

The idea of this work was suggested on perusing the last edition of the celebrated Laennec's work on Mediate Auscultation, published in three volumes, last year, by his cousin Meriédec Laennec. In this new edition, Meriédec Laennec has composed, at the termination of every leading subject, or at the close of each volume, an abstract,

or summary, of all the leading facts and essential principles of the author. These abstracts, drawn up with great skill, displaying a perfect mastery of the subject, and so unostentatiously appended to the great work, would, if set apart and published in a separate form, constitute a volume of no little importance to the student, presenting, as they do, very nearly a complete epitome of the semeiology of the original.

If an apology were necessary for producing this translation and composition as a Manual, how many manuals, epitomes, summaries, and digests, might be adduced to plead in defence of the undertaking! In these the voluminous contents of ponderous volumes have been advantageously sifted and condensed; and the laws and principles, from amidst a vast mass of evidence, history, argument, and illustration, necessary for the support of a new science, are brought out, in that simple form in which alone the student should consider them, and presenting nothing more to his mind than is necessary to be learned and perpetually retained in the memory. The universal circulation of such works upon all the known

sciences renders further comment a matter of supererogation.

From such examples it may be concluded that the three ponderous volumes of Laennec's work are no longer necessary for the purpose of propounding the principles and practice of the stethoscope. Those principles are too well admitted to stand in need of illustration or defence, and the practice is too general to require a single case to be adduced in favour of its necessity or to enforce its continuance.

The translation of these abstracts constitutes the great bulk of the following pages; but, where the original work appeared sufficiently concise, no abstract has been composed by M. Mer. Laennec. In such cases, therefore, I have supplied the deficiency by the composition of a summary from the great work, in order to render this Manual perfect in all its parts.

The primary object, contemplated in this Manual, is to present the student with a work containing all that is essential for him to learn in the art of Mediate Auscultation and Percussion: and, whilst all extraneous matter has been carefully

excluded on the one hand, not a single fact, however minute, has been omitted on the other. Nor is the advantage of the student alone considered; the established practitioner, also, whose time is necessarily too occupied to allow of extensive reading or elaborate research, will thus be afforded a means of obtaining a perfect knowledge of an essential department of his profession at an easy price and at a trifling cost of time.

It is not intended by this Manual to supersede the extensive and elaborate work of Laennec. His book may be read with equal benefit by the prejudiced objectors to auscultation and by the more advanced student. But the principal objections which exist against the voluminous original apply to Dr. Forbes's translation with nearly equal force; which, at the same time that it is not, *re vera*, a translation of the entire work, is yet exceedingly bulky and of a higher price than the original. The great labour of reading a voluminous medical work in a foreign tongue, the high price, and the bulk, both of the original and translation, have doubtless been the principal

causes of the tardy progress that mediate auscultation has made in this country.

May this Manual supply the *desideratum*, and be the means of facilitating and spreading more universally the study of the most important art of auscultation.

A critical examination of the original would be foreign to the purpose of this summary, and extend the pages of my preliminary observations to an undue length; yet it cannot but be lamented that a work, displaying so much original thought and such laborious and scientific research, should at the same time exhibit such a lamentable deficiency in the most essential part of a work of science,—perspicuity of language; and this has caused the greatest labour and difficulty in making a correct translation. But the order and arrangement of the subject is most scientific and beautiful, and the book, "with all its imperfections on its head," will bestow an immortality upon its Author.

J. B. S.

PREFACE TO THE SECOND EDITION.

The reception which the First Edition of this Manual has met with, and the steady demand for it by the Professional Student, have now established it as a regular Class Book and rendered a Second Edition necessary.

The Author cannot but flatter himself that these facts may be taken as solid proofs of the eminent success of his design in compiling the work, namely, "of facilitating and spreading more universally the study of this most useful art of Auscultation."*

Independently of the correction of those errors that had escaped the revision of the former edition,

* See Preliminary Remarks to the First Edition, p. ix.

an entire new chapter, treating of the Auscultation of the Arteries, is now subjoined to Part IV., by which this edition is rendered more effective and complete.

J. B. S.

Windsor, November, 1838.

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* Dr. Elliotson has forcibly pointed out the absurdity of this appellation. Apoplexy is a general loss of sense and motion, with stertorous breathing, and is a disease of the encephalon. The lungs can be affected with apoplexy no more than with dyspepsia or amaurosis. But, because extreme congestion and effusion of blood within the head is a com-

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mon cause of the symptoms called apoplexy, congestion and effusion of blood in the air-cells and cellular membrane of the lungs have received this same name. Compression of the brain, by an effusion of serum or pus, will equally cause apoplexy; and therefore the effusion of serum or pus in the head, in the lungs, and indeed in every part, has the same pretensions with congestion and effusion of blood to be called apoplexy. Those who so preposterously applied the term apoplexy to the lungs forgot that the word designated certain *symptoms*, and not the mechanical causes of these symptoms. It is discreditable to writers to persevere in saying apoplexy of the lungs. Dr. Elliotson described this disease before Laennec. (See Lumleyan Lectures, p. 32.) He proposes to employ the word ecchymosis.

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* This word *pneumato*-thorax is in Laennec's works written *pneumo*-thorax; but the writer, for the sake of using a more correct orthography, has changed its form. "Such compound words are formed from the genitive or dative of the first, the final being usually made *o*, with the nominative of the second noun. Thus we say pneumatology, pneumatomphalos, and pneumatocele, and should also say pneumato-thorax, as pneuma makes pneumatos, pneumati." See Dr. Elliotson's paper on Creosote, in the Royal Med. Chir. Trans. vol. xix. p. 226, and his Physiology, p. 323. From neglect of the rules in coining such words, the student is perplexed on finding *pneumo*-gastric intended to mean *lung*-stomach; and *pneumo*-thorax to mean *air* in thorax.

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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.

C. A line in the centre, showing a division made in some stethoscopes, either by a screw or by a stopper, and the corresponding hollow as shown by the dotted line at f.

c. d. The length of the outer part of the obturator, being about 5 or 6-tenths of an inch long.

e. The opening of the tube which passes through the entire 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 outer 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 greater 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. He employs one made of cedar wood; 8 or 9 inches in length, and 1 inch and 11-sixteenths in diameter.

PART I.

CHAPTER I.

ON PERCUSSION.

1. *By Percussion* is meant the 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 with 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.

3. 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 they should be 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 the 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, horn, or ivory, or even at times on 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. Dr. Elliotson considers that nothing is superior, and few things equal, to the fingers. He finds it best to lay the fingers of one hand on the part, and strike them with the points of those of the other; and quite sufficient to employ one finger only of each hand.

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. The method of examining by *Percussion* is applied to every part of the human body.—(See De la Percussion Mediate, par P. A. Piorry, D. M. P. Paris, 1 vol. 8vo.)

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.—This 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 this 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, 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, on account 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 distension 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 arm-pit 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 that the liver is more than ordinarily elevated, and that the right lung, by being pressed upwards, has become 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 distension 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 the 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, from the thickness of the muscles which occupy the space, and from their various directions. Yet sometimes it gives out a moderate, and, in thin persons, tolerably clear sound, 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 there is none at all: and almost always it is obscure on account of the locality of the liver. On the left side the sound is deceitful, owing to the before-mentioned distension 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 it only is used, no certain and satisfactory result can be obtained.

The Method of using the Stethoscope.

16. The obturator extremity of the stethoscope should be applied perpendicularly over the part

intended to be examined, and in such a way that no space be left 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 place need not be naked, but 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 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 the 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. In examining the back, the patient should bend forwards; if one side is to be examined, he should lean over to the other; and so of other parts.

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, and pages xxiii. and xxiv.

Definition of Mediate Auscultation.

24. Mediate auscultation is the method of ascertaining through the instrumentality of the stethoscope, the internal vibrations and sounds which the actions of the viscera of the human body produce, whether in a healthy or morbid condition.

CHAPTER II.

AUSCULTATION OF RESPIRATION.

PRELIMINARY OBSERVATIONS.

A claim to novelty has of late been set up by a medical writer, who imagines he has made a discovery in auscultation, and would persuade his readers that, as *respiration* is physiologically divided into the two periods of *inspiration* and *expiration*, the former only has been attended to, and that "no practical consequence has been deduced, and no separate description given of their respective modifications either in health or disease." Now the very first article in Laennec's work, upon the auscultation of respiration, commences in these terms: "*Pulmonic respiratory sound*, or *Vesicular respiration*. If we apply the stethoscope, without its

obturator, upon the thorax of a healthy man, we shall hear, during *inspiration* and *expiration*, a gentle murmur which indicates the *penetration* of the air into the pulmonary tissue and its *expulsion*." And Meriédec Laennec, in a note upon this passage, observes, "Since the respiratory sound *indicates the penetration of the air into the pulmonary tissue and its expulsion*, we adopt the expression of *vesicular respiration* as being shorter and contrasting better with the term *bronchial* respiration, which will be found farther on." Therefore it is obvious that both the Laennecs comprehended *expiration*, as well as *inspiration*, in the term *respiration*, in a state of health. As to a state of disease, the pupil will find in sections 38, 90, and 143, and many others of this and the former edition, the most important practical consequences deduced from a separate consideration of the *two periods* 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 mediate 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 expansion 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 it 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 loud in proportion to the rapidity of the respirations: a slow and deep breathing scarcely, but a short breathing, though incomplete, plainly, developes the respiratory murmur. Hence the *inspiration* is louder than the *expiration*, which is not performed, under ordinary circumstances, so rapidly as *inspiration*, and the elasticity of the lungs assists the exit of the air.

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, and it is then 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 hepatization 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 the highest necessity, 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, and in expiration as if driven back into the ear, of the auscultator: 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 auscultator 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.

The pupil is requested to bear in mind that the term AUSCULTATION throughout these pages is used for the sake of brevity, instead of the more correct term MEDIATE AUSCULTATION.

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 speaker's 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 heard more plainly than the voice itself.

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 hepatization of the inferior lobes of the lungs. It also as often occurs at the armpits 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 just as 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. Dr. Elliotson states that pectoriloquy may often be easily detected on making the patient speak in a strong whisper, although it be doubtful when he speaks aloud. He also recommends that, when there is any doubt as to pectoriloquy or bronchophony, the voice should be explored on each side, for comparison, with the plug of the stethoscope removed.

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 tremulous jerking voice like that of the goat, with 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. Dr. Elliotson states that in one case ægophony is pectoriloquous, — passes distinctly through the tube like pectoriloquy, and this is where the portion of lung is solidified which has an effusion around it producing the ægophony.

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 anatomical 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 pleurisy under three conditions; 1st. When the effusion of fluid is very rapid and very abundant; 2nd. 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 at 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 whether 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 hepatization, 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 nor 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 through a momentary obstruction of the bronchial tubes

by sputa, the cough, expelling these, reproduces the sound, or at least gives the *cavernous rattle* which is an equivalent sign; it also opens any fistulous communications which may 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 timid 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 only can render the *crepitant rattle* audible where it exists,—a pathognomonic sign of incipient peripneumony. Crepitant rattle, Dr. Elliotson observes, becomes the most evident if the patient finishes a cough with a strong inspiration.

78. Yet, on account of fatiguing the patient, we should not examine by the cough but where respiration is not sufficient: 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 in 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 crepitant; 2nd, the mucous; 3rd, the sonorous; 4th, the whistling, or sibilant; 5th the crackling.

82. The *crepitant 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 *crepitant rattle* is evidently the result of the penetration of air into the air cells 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 two last cases it appears to be produced by larger bubbles, and approximates to the *mucous rattle*, and may be called the *subcrepitant 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 crepitant 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 hæmoptysis, 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 a softened tubercular 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 is sometimes similar to snoring, sometimes to the sound of a bass string rubbed by the finger, and very often 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 *sibilant rattle* is a very variable sound. Sometimes, if much prolonged, it a little resembles *whistling,* grave or sharp, dull or loud. At other times it is of very short duration, and similar to the cry of little birds, or to 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 *whistling* or *sibilant rattle,* like the sonorous, is heard in pulmonary catarrh.

90. The *crackling rattle* (or crepitant rattle of great bubbles) is a sound similar to that which is made by the inflation of a dry bladder. It takes place in inspiration only, 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, which is 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 to or distant from the surface of the lungs. This vibration is stronger in the *mucous* and the *sonorous* rattles than in the others.

92. *The rattles* in general are not heard even at a

little distance from the space occupied by the lesions which produce them; and this is particularly so in the mucous and crepitant rattles. The sonorous and sibilant 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 a piece of metal, glass, or china, with a pin; or by dropping 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. 1st, In that of the co-existence of a serous or purulent discharge in the pleura with pneumato-thorax. 2nd, When a large tubercular excavation is partly filled with 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 spaces.

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.

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 is 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, as long as there is a communication between the cavity and the air, either by the external wound, or by 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 confunction with the dry crepitant 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. 3rd, When there is a moderate effusion, and old adhesions do not, in certain positions of the body

obstruct the lungs, 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 BRONCHITIS AND BRONCHORRHŒA, OR IN PULMONARY CATARRH.

111. All pulmonary catarrhs are attended by a rattle, or rhoncus, 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 sibilant, or the mucous, or the submucous or subcrepitant. Those who think the crepitant rattle itself may be heard in these cases mistake it for the latter. The sonorous, sibilant, and mucous are loudest in expiration; and expiration is slower than in health.

113. The sonorous, sibilant, 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 murmur.

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

117. This diminution, therefore, of the respira-

tory murmur, like the rattle, may be taken as the measure of the extent and severity of the catarrh; and it must be borne in mind that these signs commence in the lower portions of the lungs, and proceed upwards—the reverse of the course of phthisis; and usually commence in both sides.—(M. Louis).

118. *In acute mucous catarrh,* a dull sonorous rattle is at first heard, sometimes conjoined with the sibilant 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 sibilant 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 sibilant rattle is heard more or less powerful, often mixed 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 sibilant 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 sonorous or sibilant 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 sibilant 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 resonant as in a state of health. Dr. Elliotson

remarks that, in the bronchitis of children, so low a degree of sonorous rattle often occurs, that the breathing appears only more rough and loud. At any age, if the patient has just expectorated fully, or the disease affects the largest tubes only, no rattle may be detected on auscultation. When rattle can be detected in no other part, the stethoscope frequently discovers it at the sides of the spine, while the patient coughs. The sonorous, sibilant, and mucous rattles, even when in the trachea, are all louder at expiration than at inspiration,—the reverse of what is observed in regard to crepitant rattle.

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 with 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 resonance on percussion is sometimes less than in a natural state of things, by reason of the compression of the pulmonary tissue. The bronchiæ are dilated most frequently in the scapular, mammary, and lateral regions, and usually on one side only.

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 resonant; crepitant 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 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 just before it was not audible,

and is almost always accompanied here and there by a light whistling 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 crepitant 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 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 over a greater or less extent of its *posterior and more dependent* portions; and by the appearance of a light crepitant 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 crepitant 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 subcrepitant rattle, which sometimes arises during cough and very deep inspirations.

146. *Pulmonary ecchymosis* (*pulmonary apoplexy*) is evinced by a flat, circumscribed, and but slight sound; by a remarkable diminution, or a total absence, of respiratory murmur at the same spot; and by a crepitant rattle, which exists only around the affected part. Where the respiratory sound is not heard, there bronchial respiration and

bronchophony take place. 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 hæmoptoic 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 ecchymosis, and the consequent formation of an excavation in the lungs, will give rise to pectoriloquy, to cavernous rattle, and to cavernous respiration. Here the nature of the expectoration will easily distinguish this case from a tubercular 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 consolidation. The respiratory murmur is

only weakened and more or less marked by crepitant rattle, the characteristic phenomenon of this stage of the disease. The extent over which the crepitant rattle is heard indicates the extent of the inflamed part.

151. When the inflamed lung has arrived at *a state of consolidation,** 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 resonance by percussion is flat, and it is the more sensible as the consolidation approaches to the surface. The motion of the ribs over the affected part is diminished. Dr. Elliotson declares that he has known the consolidation give rise to such bronchial, as to be

* French writers say *hepatization;* but Dr. Elliotson remarks that, as the term is intended to signify that the organ is become only as solid as liver, and is used synonymously with consolidation or solidification, these words are sufficient, and do not convey the erroneous idea which the term hepatization really means, viz. that the part is converted to liver. The adoption of the term hepatization from the French is as discreditable to us as of pulmonary apoplexy.

tracheal, respiration, and to such bronchophony as to be pectoriloquy, so that he could discover no difference between them and the cavernous respiration and pectoriloquy of a phthisical cavity.

152. Whilst these phenomena are manifest, the characteristic crepitant rattle disappears, merely to re-appear elsewhere: thus, as it were, marching in advance of consolidation, 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, pectoriloquy, rhonchus, and the cavernous cough and respiration, become evident, where bronchophony and bronchial respiration were previously heard. 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 cavernous phenomena; and that the blowing respiration and the veiled blowing may themselves take place when there is a voluminous enlarge-

ment 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 crepitant rattle and the return of the respiratory murmur, provided the lung has not passed the degree of congestion; and by the return of the crepitant rattle in the first place, followed by the respiratory murmur, when consolidation or infiltration of purulent matter has taken place. The bronchial character of the respiration and bronchophony decline; and percussion gives gradually a more natural sound. In this last case the return of the crepitant rattle is ordinarily preceded by a mucous or submucous rattle, and sometimes replaced by the appearance of subcrepitant rattle, which, if it continues 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 crepitant 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 crepitant 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 also 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 crepitant 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*, when extensive and not circumscribed, produces the same signs as inflammatory congestion; but, when it is circumscribed, it produces very nearly the same signs as pulmonary abscess. But in either case the aspect and fœtid 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. These sounds are found also in all indurations of the pulmonary tissue, whether they be the result of inflammation or not.

* Pneumonia rarely affects both sides at the same time. Under the age of 50, the *lower lobes* are most generally attacked, and, after that age, the *upper lobes*.—(M. Louis.)

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 develope 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, these rendering an evident portion of the lungs impermeable to the air: miliary tubercles disseminated over the whole extent of these organs are to be discovered by general symptoms only.

The accumulation of tubercles in any circumscribed part of the lungs is indicated by a flat resonance on percussion. by a proportional dimi-

nution of the respiratory murmur, and its replacement by bronchial respiration, and by a diffuse bronchophony or resonance of the voice more or less marked. There is likewise less movement of the chest at the particular part. Sonorous, sibilant, or mucous rattle, are often heard; and either at length, or very early, the submucous or subcrepitant rattle, which often long prevails, and cavernous, and gurgling cough, and pectoriloquy.

165. These signs are of the greatest value when they are discovered beneath the clavicles and in the region comprised between these bones and the mammæ; 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 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 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 arise 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; but usually still remains very dull; 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. The chest becomes flattened at the part from the wasting of the lung, and sometimes greatly depressed. As one side is usually affected earlier than the other, there is often a marked contrast.

168. *Pectoriloquy* may be *perfect, imperfect* or *doubtful, continuous* or *intermitting,* or even suspended for a time: the sound 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 or 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 pathognomonical, 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 on account 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, inasmuch as then the sound of fluctuation is heard on succussion, which seldom if ever occurs in a simple excavation of the lungs.

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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.

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172. *Melanosis* and *encephaloid 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.

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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 crepitant, or subsibilant, rattle, such as is observed in dry catarrh and vesicular emphysema.

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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 more or less complete flatness of resonance on 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, diminished motion in, as well as diminished depression between, the

ribs, so that the chest looks more smooth and rounded; and even 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 resonance 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 that 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, 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 crepitant rattle, and is never so completely absent as not to allow here and there some traces of respiration.

Dr. Elliotson has, however, sometimes found no respiratory murmur in any part of the affected half of the chest, such has been the compression of the lung even close to the spine.

181. The absence or diminution of the respiratory sound in the diseased side is ordinarily attended by an increase of it in the healthy side : nevertheless this only takes place in chronic pleurisy, or towards the middle period of the acute. The fluid will sometimes so push the mediastinum, that there is a loss of resonance and respiratory murmur for some little distance on the healthy side.

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 in-

ferior 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.

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185. *In chronic pleurisy* the stethoscopic signs differ in no way from those of the acute; except that ægophony is more rare, and this seems a necessary effect of the disease, since the effusion is abundant during a longer period. A large effusion on the right side may push the part a little more to the left; and one on the left often pushes it considerably to the right. A grooved needle may be thrust into the chest in case of doubtful effusion, as recommended by Dr. Davis, when a few drops of any fluid in the pleura will generally escape. But Dr. Elliotson mentions a case in which no fluid escaped on the needle, and yet the symptoms proved the existence of the effusion so strongly that he urged paracentesis, which was performed with the effect of removing a large quantity of fluid.

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186. *Partial* or *circumscribed pleurisy* always produces a diminution of resonance in the chest, and of the respiratory murmur in its own locality. Sometimes it gives rise to ægophony, which is 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.

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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 crepitant rattle 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 he is laid upon his face: then ægophony is discovered at the side, and the crepitant rattle and bronchophony appear at the back, where previously 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.

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190. *Dropsy of the pleura* 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.

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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.

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

193. *Simple pneumato-thorax* is recognised by a perfect resonance, sometimes even tympanitic, of 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. The air may push the mediastinum so much as to cause tympanitic resonance and deficient respiratory murmur for some little way on the healthy side. Sometimes there is also a manifest dilatation of the diseased side; but this

symptom is not constant. The side has little or no motion, and gives an elastic sensation to the finger. The heart may be pushed to the left if the effusion is on the right side; and very much to the right, if it is on the left side of the chest.

194. When *pneumato-thorax* is complicated with a liquid effusion, the preceding signs are present, and moreover a dull sound is afforded by striking the lowest points of the chest; these points 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 aëriform 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. When the quantity of air has been considerable, Dr. Elliotson has heard metallic tinkling distinctly on the healthy side of the median line; and he remarks that, if the opening of the lungs is free, so that the air can pass and repass, the distension of the chest and dyspnœa are much less.

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 subsibilant rattle (compared to the clicking of little valves); or the dry crepitant 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.

Dr. Elliotson remarks that this metallic tinkling may often be heard in the region of the stomach, when this organ is much distended by air; and he mentions having known the organ so distended, as to push up the diaphragm and heart, and give metallic tinkling touches on the left side of the chest and completely deceive him many years ago.

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 when, 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 resonance 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.

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 sound 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.

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 cavities 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 its actions 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 may 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 circumstances that increase the pulse. Such also are the consolidation of the lungs or their induration by reason of the development of tubercles or other accidental productions;* the existence

* Dr. Elliotson asks, "Can these circumstances be said to increase the action of the heart? Is it not the fact solely that the shock of the heart is communicated more strongly than in health?"

of excavations with firm or solid walls in these organs; their compression by a pleuritic effusion, pneumato-thorax; the malformation of the chest by rachitis, &c.

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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 a 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 at the inferior half of the sternum: and also at the epigastrium in those subjects whose sternum is short and 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 exciteable persons, the actions of the heart when the stethoscope demonstrates no real force of impulsion.

212. *The impulse of the heart* diminishes or almost entirely ceases, even though hypertrophy exist, whenever a very intense dyspnœa supervenes as a consequence of consolidation of the lungs, of pleuritic effusion, of pulmonary œdema, of asthma, or of 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 impulse 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 pulse as well as with the impulsion communicated to the ear by the stethoscope, and it evidently indicates the contraction of the ventricles. A more correct expression than this, Dr. Elliotson remarks, is that the ventricular sound coincides with the pulse of the arteries near the heart, but takes place a moment before the pulse at the wrist and other distant parts, and the second sound a moment after this.

215. In a natural state, the sounds of the heart's actions are nowhere so strongly heard as at the præcordial regions, and they become fainter in these different points of the chest according to the order set forth in § 205. The sounds are 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 sounds of the heart's action are heard the more plainly as the walls of the heart are thinner and the impulse more feeble. They diminish 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 auricles becomes dull and scarcely audible. They increas 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 sounds of the heart's actions, and particularly that which coincides with the contraction of the auricles, become more dull and less distinct when the anterior edges of the lungs are stretched over the heart and entirely cover it. The same effect takes place when the heart becomes softened. In these cases the *absence* of impulse proves that the diminution of sound does not arise from hypertrophy of the heart.

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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 (of an artery near the heart) 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 ventricle. 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 a fourth part at least, 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

* See Dr. Elliotson's Physiology, p. 172—5,

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 is 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 repose; the contractions of the auricles also are more dull, but of *shorter* duration: and, when the disease is extreme, the ear discovers 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, louder, 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, 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. Dr. Elliotson proposes the name *preternatural sound* as generic to them all. 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 of both at the same time; and 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. Dr. Elliotson considers that a diastolic preternatural sound is not only far less frequent than a systolic (i. e. one after than one before or with the pulse), but that a diastolic preternatural sound is almost always indicative of organic disease of the heart or roughness of the pericardium : and the double preternatural sound, of course, equally so.

224. *The bellows sound* often accompanies arterial action, and then it is sometimes sibilant, 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.

It appears in Dr. E.'s Lectures before quoted, p. 19 & 20, 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.

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 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 hemorrhages, &c. &c. Dr.

* Dr. Elliotson does not believe this though he finds the sound common in persons who formerly had pericarditis, and still have, probably, a roughness of the pericardium, notwithstanding they are troubled with little or no uneasiness.

Elliotson many years ago pointed out its frequency in chlorosis, and finds it more common in the neck than in the heart only, and more common or louder in the right side of the neck than in the left, in this affection 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, in thin persons, in flatulency, in chlorosis, &c. &c. &c. Dr. Elliotson has pointed out that mere distension of the abdomen, or even the horizontal position, both which will cause the heart to be pressed upwards, will increase or even produce a preternatural sound in the heart.

" I once witnessed," says he, " 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." " 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. Elliotson's Lumleyan Lectures*, p. 18.

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 it appears to arise from a contraction 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 or 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 contraction 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 a cat when caressed. 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.

Dr. Elliotson says, "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 resembling 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 resembling 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. This sound occurred in all the cases after the radial pulse: and in one an autopsy

took place, and disclosed a bunch of fibrinous excrescences on the outside of the mitral valve and on the portion of membrane issuing from this to the semilunar, from which bunch long ribbands streamed into the ventricle as far as the apex." —*Dr. Elliotson's Lumleyan Lectures on the Heart*, p. 15, and notes. An. 1830.

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 a few 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 only 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 during a state of the most perfect tranquillity of spirits, in order to draw correct conclusions as to any real disease of the heart.

231. *Irregularities* of the heart's action are generally joined with palpitations ; nevertheless, and principally with old persons, they may take place without palpitations. Irregularity with palpitations most frequently consist 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 of this kind 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. Most generally the contractions of the ventricles 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 action 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 to 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, Laennec thinks that they are seldom observed but when there is some malady of the heart, principally hypertrophy, and when at the

same time there are palpitations. But Dr. Elliotson remarks that they certainly often occur without disease of the heart, from mere disturbance of the mind or digestive organs, from oppression of the brain, or from idiosyncrasy.

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 intermission, which in fact 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, when the organ itself is healthy, 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 alterations 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 the organ may be heard. Very frequently palpitations are joined to hypertrophy, especially of the left cavities of the heart, and consist more in the

augmentation of impulse of the ventricles than of sound, and 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 strong impulse which raises the head of the examiner, and on percussion a duller sound than in the healthy state. These contractions, also, are more prolonged than they ought to be, whilst the contractions of the auricle are, on the contrary, shorter, less loud, and consequently scarcely audible. Often, too, when the hypertrophy is extreme, only one impulse more or less marked is perceived, without the possibility of distinguishing the two successive contractions. In every case the heart's actions can be perceived over a small extent only, and in a space included between the cartilages of the fifth and seventh ribs.

237. When the hypertrophy has its seat in *the right ventricle*, the impulse 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 impulse 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 hypertrophy has increased the left ventricle to an enormous volume, this becomes anterior, and is more easily heard under the sternum than in the left cardiac region;—whilst the right ventricle, involved, as it were, 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 pulsation 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 sound of the heart's contraction is heard only, or at least much more marked, in one cardiac region.

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 than in hypertrophy.

241. *Hypertrophy with dilatation,* an affection much more common than simple dilatation, and still more so than hypertrophy *without* dilatation, is characterized 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 loud. 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. It is then 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 augmentations excepted, than those previously indicated, and are rarely accompanied by 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 is a matter of great facility in the greatest number of cases, yet general symptoms must be brought in aid, and the *examination of the heart should be repeated several times before a*

judgment be pronounced upon the state of the 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 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 in 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. The signs are confounded with those of the lesions which accompany them, and particularly of the narrowing of the auriculo-ventricular orifices.

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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, consists 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, 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 *verrucose vegetations* upon the valves of this organ have for their signs the same rasp sound and purring tremor; but this 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.

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

Dislocations of the heart, when they take place, are known only by the change of place where the actions of the organ 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; mal-conformations, &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 showed no symptoms whatever of diseased heart. The diagnosis becomes more certain, if, for some hours or days,

as the disease may be acute or chronic, the new leather sound is heard, or the bellows sound, which is still more frequent; and the diagnosis is still more certain, if, at the same time that these stethoscopic phenomena take place, the præcordial region, properly struck, affords 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 resonance 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 aneurysm. 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 the observation of general symptoms.

CHAPTER II.

OF THE AUSCULTATION OF THE ARTERIES.

253. The friction of the current of blood against the internal surface of the arteries occasions a *dull blowing* or *bellows sound,* which varies in intensity according to the volume of the artery, the force and rapidity of the pulse, the age, sex, and constitution of the individual. It is the only sound heard in a healthy state, and corresponds to the contraction of the ventricle or the diastole of the artery.

254. Care must be taken not to press heavily upon the stethoscope, as the shock of the flowing column of blood against the compressed side of the artery will cause an exaggeration of the normal sound, and may therefore be mistaken, by the pupil, for a diagnostic of disease.

255. This *bellows sound* is of two kinds, the *intermittent* and the *continuous.*

256. The *intermittent* sound is heard in all those numerous affections which in any way produce pressure upon a large artery, or mechanically obstruct the current of the blood. M. Bouillaud discovered it in the left iliac region of a female, labouring under a tumour of the left ovarium.

It is present in all the following cases :—

Aneurysmal tumours.

Osseous or cartilaginous formations, with or without the narrowing of the artery.

The passage of arterial blood into a vein, *(aneurysme variqueux.)**

Derangements of the arterial system in emaciated persons and those labouring under anæmia and chlorosis.

Inflammations of the serous membrane of the brain.

In this last case it has received the appellation of *encephalic bellows sound*, and it is said to be diminished, and even to cease entirely, on pressing the carotid arteries. But, as some doubt the presence of this encephalic sound, the student should seize every opportunity of applying the stethoscope in all inflammatory affections of the brain.

257. The *continuous bellows sound*, or *devil sound*, (*bruit ou ronflement de diable.*) This sin-

* Nouveau Manuel, &c. par M. A. Raciborski.

gular name has been derived from the noise produced by a child's toy called in France the devil, (*le diable.*)*

This sound, though continuous, is not uniform, but becomes suddenly louder and softer, in jerks which correspond to the contraction of the ventricle; sometimes it resembles the cooing of the turtle dove, or the passage of the wind through a key-hole.

258. The *devil sound* is heard most frequently in the carotid and subclavian arteries, rarely in the crural arteries and never with the same degree of force. Sometimes it is heard on both sides, and then it is fainter on one side than on the other, and it ceases on the pressure of the vessel, though the canal of this be not entirely closed.

229. But the most remarkable feature is that this sound ceases and suddenly renews itself again without any assignable cause; though a change of position will occasionally produce the same effects.

* This toy consists of two hollow balls of very thin wood, connected together by a hollow tube of the same material. An opening is pierced in each ball. By means of a string, with a stick at each end, the toy is rapidly rotated, producing a loud, dull noise, upon the principle of the humming top.

360. There is another modification of the bellows sound in the arteries; but, as it appeared to owe its character rather to the lively imagination than to the philosophy of Laennec, no notice was made of it in the first edition of the Manual; it is now, however, inserted, for the purpose of making this second edition more complete.

The *musical*, or *whistling blowing*, is the term given to it; and Laennec seems to have been so completely enchanted that he has noted down its modulations in musical notation, making out a *major third* in the natural key of C.

But, as no pathological result has been deduced from this minute inquiry, it may be dismissed as purely speculative.

The French give the merit of this sub-division of the bellows sound to M. Bouillaud.

APPENDIX.

ON THE APPLICATION OF AUSCULTATION TO OTHER DISEASES AND AFFECTIONS.

CHAPTER I.

STETHOSCOPIC SIGNS OF THE GRAVID UTERUS.

261. On applying the stethoscope to the abdominal parietes over the region of the gravid uterus, two sounds may be distinctly perceived, which indicate two very different pulsations, the one *fœtal*, the other *placental:* and a third sound 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 sounds.

262. *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.

263. The *fœtal pulsations* may be recognised about the sixth month of gestation, or rather earlier; and from the 17th to 20th week, and even earlier, by a practised ear, according to some.

264. They may be heard over a tolerable extent; about a foot in one direction, and three or four inches in another. 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 amnion.

265. *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 the circumstance of the intensity of the sound increasing as we approach and diminishing as we recede from the true place.

266. 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 recognised, 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 a large quantity of liquor amnii, would prevent the perception of these sounds.

267. Any agitation of the maternal does not appeart 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.

268. 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.

269. The second phenomenon is denominated *pulsation with bellows sound;* this is evidently arterial, and is isochronous with the pulse.

270. This is the *placental sound*, and appears to take place at the point of insertion of the placenta.

271. The 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.

272. 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.

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

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

A double or multiple impregnation will produce a corresponding repetition of the fœtal 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. More time also must be expended in the investigation; and, since the phenomena are intermittent, several examinations

must be made before an opinion be definitively pronounced.

Throughout the whole circle of medical practice there are no cases requiring so great a caution in forming a correct diagnosis as those in which we have to ascertain a state of pregnancy; since a false judgment may, on the one hand, blast the reputation of the practitioner, and, on the other, overwhelm a virtuous female with suspicions of infamy.

CHAPTER II.

STETHOSCOPIC SIGNS IN CASES OF FRACTURED BONES.

275. *The crepitation* between the fractured extremities of bones is instantly detected with 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.

276. In hard bones, the sound given out to the ear is like the crackling 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.

277. 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.

278. *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.

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

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

281. 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.

282. 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 fractured 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.

283. By way of illustration, the following fractures, often extremely difficult to ascertain, may be easily discovered with 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 ABSCESSES OF THE LIVER; IN DISEASES OF THE EAR; AND A NOTICE OF THE USE OF THE STETHOSCOPE IN VETERINARY SURGERY.

Signs of Calculi in the Bladder.

284. 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.

285. The stethoscope applied to the pubes or sacrum during catheterism 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 by the sound when a stone is struck in the open air.

286. 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.

287. 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.

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

In some other Cases.

289. There are a multitude of other cases in which our present methods of examination leave 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 œsophagus, the rectum, and wounds, especially gunshot wounds. It is not doubted that the sensation, conveyed to the ear by the ste-

thoscope, 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 in its substance, would enable us to recognize 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 only can be employed as the means of investigation. Upon the same principle that excavations of the lungs are determined would probably fistulous and cavernous abscesses be ascertained; as an injection thrown into them would give the cavernous gurgling or cavernous rattle.

In Abscesses of the Liver.

290. 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.

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

292. 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 rattle, also would be perceived, as well probably as the transmission of the voice through the stethoscope: and, if the excavation should be very great, the metalic tinkling would be manifest.

In Diseases of the Ear.

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

294. The stethoscope applied upon a 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. The sound in these parts is called *rhinophony*.

295. If the nostril on one side is 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. If any mucus should exist in the eustachian tube, or in the

ear, a gurgling like the mucous rattle will be heard; this often takes place in coryza.

296. 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.

So, likewise, 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.

297. The great Laennec has written but a few sentences upon this subject, contenting himself with throwing out the suggestion to the practitioner in brute 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 twenty-fifth lecture on Veterinary Medicine, delivered in University College, London, has explained its advantages and demonstrated the best method of its application. In his twenty-seventh lecture

he says, "Although we cannot yet carry this so far as the practitioner of human medicine does, we can derive most important advantage 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 mediate 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.

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