Notes upon the physical examination of the respiratory and circulatory systems / by John Wyllie.

NOTES

UPON THE

PHYSICAL EXAMINATION OF THE RESPIRATORY AND CIRCULATORY SYSTEMS.

BY

JOHN WYLLIE, M.D.

E D. Murray Lyon.

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RESPIRATORY SYSTEM.

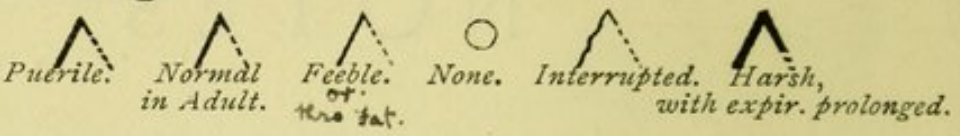
PART I.

AUSCULTATION.

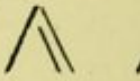
Listen for (1) Type of Breathing, (2) Accompaniments, (3) Vocal Resonance.

I. Types of Breathing.

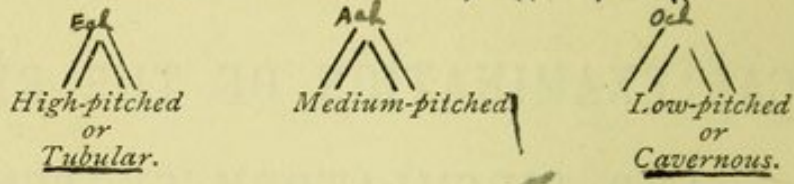
(1) VESICULAR or RUSHING.



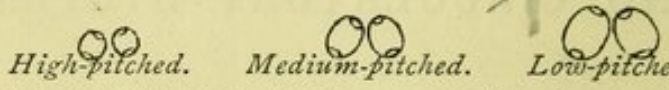
Transition Type. (*Broncho-vesicular or "indeterminate" breathing.*)



(2) BRONCHIAL or BLOWING.



(3) AMPHORIC.



NOTES.—1. VESICULAR BREATH-SOUNDS.—*In the auscultation of normal Vesicular Breathing, the* Inspiratory sound, *represented in the diagrams by a single line, is a fine, continuous, rushing sound, soft in the adult and loud in the child, and audible from beginning to end of the act. The* Expiratory sound, *on the other hand, is thin in quality and of short duration, being audible only during the earlier part of the Expiratory act. It is generally believed that in normal Vesicular Breathing the Expiratory sound passes, as represented in the diagram, directly into the Expiratory without a break. Having, however, paid special attention to this point, Dr W. believes that there is often, in perfectly normal Vesicular Breathing, a distinct break between the two sounds. When the breathing is quiet and easy, the Expiratory sound is often totally inaudible, even in children; but in such cases it can usually be brought out by causing the patient to breathe deeply.*

The term "prolonged expiration" is used to signify not a prolongation of the act of Expiration, but only a prolongation of the Expiratory sound, resulting from the encroachment of the audible upon the inaudible part of the act. There is indeed one form of breathing, common to advanced Emphysema and Asthma, in which the act itself is really prolonged, being often much longer than the Inspiration. In such "Asthmatic" breathing, the type of respiration, primarily Vesicular, is as a rule totally masked by the loud wheezing accompaniments of both Inspiration and Expiration.

2. BRONCHIAL BREATHING.—*The auscultatory sound of Bronchial Breathing, indicated in the diagrams by a double line, can be imitated, as pointed out by Skoda, by holding the tongue in the position for the pronunciation of the guttural* ch *sound (as in the German word* Ach *or the Scotch word* Loch), *and causing the air to pass inwards and outwards over it. The blowing sound thus produced can be made to represent the various pitches indicated in the diagram. There is always in Bronchial Breathing a distinct break between the sounds of Inspiration and Expiration, and the two sounds closely resemble each other. The higher-pitched varieties of Bronchial Breathing should be associated in the mind with conditions of consolidation of Lung Substance, such as that of Pneumonia and the Low-pitched or Cavernous variety with Excavation, as in Phthisical cavity. Bronchial Breathing is never produced by Bronchitis.*

3. *The* AMPHORIC *type of breath-sound can be well imitated by whistling with the mouth. Inspiratory and Expiratory sounds can thus be produced by causing the air to pass inwards and outwards, and the pitch can be varied according to the variety of Amphoric Breathing that is being imitated. Amphoric Breathing is best developed in Pneumothorax, but is also sometimes met with in very large Phthisical cavities.*

4. *In the* Healthy Chest *the respiratory sounds are purely Vesicular (without harshness of quality or prolongation of expiration) over the whole surface of the lungs, except* (1) *opposite the* Roots of the Lungs, *at level of third dorsal vertebra behind, and lower part of manubrium sterni in front, where the proximity of the large Bronchi generally renders the breathing* Broncho-vesicular, *by the addition of a Blowing or Bronchial element, most distinct during expiration;* (2) *over the* Apex of the Right Lung, *especially above the Clavicle and Spine of Scapula, where, in health, from causes as yet imperfectly ascertained, the Vesicular Breath-sound has very generally a more or less prolonged, and often harsh or even somewhat blowing, expiration.*

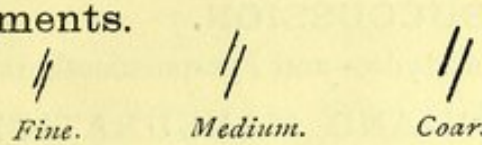
The only example of purely Bronchial *Breathing that can be heard on auscultating the healthy subject, is the* "Tracheal" *Breathing, to be obtained by placing the stethoscope over the Larynx or Trachea. This is low in pitch, and if heard over the apex of the Lung would be termed "Cavernous."*

[*Unfortunately some of the great original authorities on Auscultation applied the term "Bronchial" to the type of breathing heard over the roots of the Lungs, but, as this is partly of Bronchial and partly of Vesicular origin, the term "Broncho-vesicular" is much more appropriate.*]

RESPIRATORY SYSTEM.

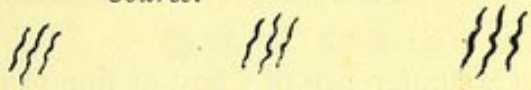
II. Accompaniments.

(1) Friction (in Pleurisy).



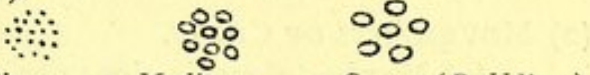
Fine. *Medium.* *Coarse.*

(2) Dry Sounds, or Rhonchi (in Bronchitis).



High-pitched. (*Cooing, Wheezing, etc., called "Sibilant."*) *Medium-pitched.* *Low-pitched.* (*Sonorous.*)

(3) Moist Râles, or Crepitations. (1 and 2 in Pneumonia, 2 in Bronchitis, 2 and 3 in Phthisis.)



1. *Fine.* 2. *Medium.* 3. *Coarse* (*Bubbling.*)

May be Consonating *in three degrees—tough, metallic, tinkling.* (*Tinkling râles are specially important in connection with Pneumothorax.*)

III. Vocal Resonance.

(1) Simple Increase. (*a*) Slight, comparative.
(*b*) Marked (Bronchophony).
(*c*) Very marked (Pectoriloquy).
(The chief conditions which cause Increase of Vocal Resonance are Consolidation and Excavation of the Lung substance.)

(2) Simple Decrease. (*a*) Slight, comparative.
(*b*) Marked decrease.
(*c*) Total absence.
(Decrease of Vocal Resonance is most frequently due to Thickening of the Pleura or to Pleuritic Effusion.)

(3) Qualitative Alterations, (*a*) Aegophony (Nasal timbre).
(*b*) With metallic echo (Amphoric Resonance, or Nachklang).
(Aegophony occurs in Pleurisy with Effusion when the layer of fluid is thin. Metallic echo is one of the signs of Pneumothorax.)

PERCUSSION.

(1) Hyper-resonance.
(*a*) Slight.
(*b*) Marked.
(*c*) Very marked (Tympanites). (α) High- (β) Medium- (γ) Low-pitched.
(Emphysema causes slight Hyper-resonance. Relaxation of Lung substance, as in the Superior lobe when the Inferior is solid from Pneumonia or compressed by Pleuritic Effusion, is a cause of marked Hyper-resonance. Pneumothorax is the commonest cause of true Tympanites.)

(2) Deficient Resonance. (*a*) Slight, comparative dulness.
(*b*) Marked dulness.
(*c*) Absolute dulness.
(Consolidation of Lung substance, thickening of the Pleura, and Pleuritic Effusions are the chief causes of Deficient Resonance.)

(3) Mixture of Dulness and Resonance, *i.e.*, a Wooden or Boxy Note. (This is one of the most important signs of a Phthisical Cavity.)

(4) Special Quality. (*a*) Cracked-pot sound.
(Another very important sign of a Phthisical Cavity.)
(*b*) Dulness, with vibratile thrill to finger.
(In Hydatid Tumour of the Liver.)
(*c*) Bell sound, got with two coins and stethoscope.
(One of the signs of Pneumothorax.)

RESPIRATORY SYSTEM.

SUCCUSSION.

Called "Hippocratic;" used in Hydro- and Pyo-pneumothorax. (See Part II.)

INSPECTION AND MENSURATION.

(1) Form and Size of Chest.

- (*a*) Circumference of Chest at line of nipples.
- (*b*) General Form (flat, barrel-shaped, etc.)
- (*c*) Local alterations in Form (local flattening, bulging, etc.)

(2) Movements of Chest.

- (*a*) Number of respirations per minute.
- (*b*) General type of movement (thoracico-abdominal, abdominal, thoracic).
- (*c*) Rhythm and Volume of respirations; and their Special Character, as in the "Cheyne-Stokes" type, etc.
- (*d*) Local movements (sucking in of intercostal spaces, etc.)
- (*e*) Deficient Expansion (over one apex, over one side, etc.)

(3) Parts outside Chest.

- (*a*) Box of Larynx (its upward and downward movement).
- (*b*) Alae Nasi (their action in difficult breathing).
- (*c*) Bulging of Apices in neck on coughing.
- (*d*) Action of the Scaleni and other Extraordinary Muscles of Respiration.

PALPATION.

Note increase or diminution of Vocal Fremitus. Test by palpation the comparative expansion of the two sides.

EXTRA AUSCULTATION.

A. Of the Sounds of *Obstruction* in Respiratory Passages.

(1) Obstruction to Breathing in Nose,	(*a*) From hardened or fluid Mucus. (*b*) From paralysis of Alae.	Nasal Bubbling and Sniffling.
(2) Obstruction in Back of Throat,	(*a*) Nasal Snore. (*b*) Oral Snore.	Stertorous Breathing.
(3) Obstruction in Larynx,	(*a*) Swelling of Cords. (*b*) Paralysis or Spasm of Glottis.	Stridulous Breathing.
(4) Obstruction in Trachea,	(*a*) From Aneurism (Leopard-growl). (*b*) Death Rattle.	
(5) Obstruction in Bronchi,	(*a*) Musical Sounds (Wheezing, etc.) (*b*) Crepitant Sounds.	

B. Of the *Cough*.

The following are some of the more common varieties of Cough:—

(1) *Cough of the ordinary type*, such as is met with in—(*a*) Common Colds; (*b*) Some conditions of mere nervousness; (*c*) Irritation of certain peripheral nerves, as those of stomach, ear, etc.; (*d*) Early Phthisis, when, however, it is apt to be specially hacking and irritating; (*e*) Later Phthisis, when it may vary much in severity, from moderate, though frequent, to severely paroxysmal. Phthisical cough is often succeeded by vomiting.

(2) *The frequent, prolonged, paroxysmal, and often wheezing Cough* that is characteristic of severe Bronchitis.

(3) *The frequent, short, "suppressed" Cough* of Pneumonia with associated Pleurisy, and of simple acute Pleurisy. It is "suppressed" because it excites pain in the side.

(4) *The husky and sometimes stridulous or "croupy" Cough* that is characteristic of Laryngitis.

(5) *The peculiarly "brassy" or ringing Cough* (like the cry of a gander) that is met with in many cases of Aortic Aneurism or Mediastinal Tumour with pressure on the Trachea.

(6) *The prolonged paroxysm of fully-developed Whooping Cough*, with its rapid and long-continued succession of short, sharp coughs, and its final long-drawn stridulous inspiration. A succession of these paroxysms is very often succeeded by vomiting.

(7) *The loud Barking Cough* met with in some cases of Hysteria.

NOTE.—*The* Sputum *should be carefully examined and described. Its more common types are*—(a) *Viscid, mucous, and often pigmented, in common Catarrh;* (b) *Bloody, in Haemoptysis;* (c) "*Nummular*," *in advanced Phthisis;* (d) *Copious, frothy, mucous or muco-purulent, in Bronchitis;* (e) *Sticky, gelatinous, and rusty, in Pneumonia; and* (f) *Extremely fœtid, in Gangrene of the Lung and some cases of Bronchiectasis.*

In special cases a report should be made of the Microscopic characters of the Sputum. When, with cough, there is no expectoration, its absence should be noted.

PART II.

PHYSICAL SIGNS OF THE LEADING DISEASES.

I. Bronchitis.

In this affection the physical signs vary much in their intensity, according as the case is slight or severe.

(*a*) **In slight cases**, in which the catarrhal inflammation has extended only to the large bronchial tubes, there is generally some harshness of breathing, with prolongation of expiration, more or less over the whole chest, in front and behind ( ). Along with this, there may be a few sibilations ( ) or sonorous rhonchi ( ), but there are seldom any moist sounds. There is nothing abnormal to be observed on Extra-auscultation or on Inspection, Palpation, or Mensuration, and there is no dulness on Percussion.

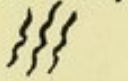
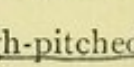
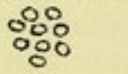
(*b*) **In severe cases** the physical signs are much more marked.

On **Extra-auscultation** you may hear more or less wheezing in the patient's chest as you stand by his bedside. In pure Bronchitis this wheezing is not generally very marked, and it is present in about equal degree in inspiration and expiration. It is frequently associated with a crackling noise, which is the equivalent of the moist sounds that can be detected with the stethoscope. When either marked Emphysema or Spasmodic Asthma exists as a complication of Bronchitis, the wheezing is more marked, and preponderates in expiration, which is rendered more prolonged and difficult than inspiration, thus :— Extreme difficulty during expiration is more especially marked in Spasmodic Asthma. The **cough** in severe Bronchitis will be frequent, prolonged, paroxysmal, and often wheezing, with generally a copious, whitish, frothy expectoration.

On **Inspection, Palpation,** and **Mensuration,** the chief points to be noted are those indicative of the difficulty of breathing, produced by the obstruction in the bronchial tubes. The patient may have orthopnoea, occasionally or continually. If, in a chronic case, there be marked Emphysema, the chest may be barrel-shaped, the sternum and whole anterior thoracic wall being too prominent, and the chest too deep in its antero-posterior diameter. In severe Bronchitis inspection of the Respiratory Movements will show that the respirations are somewhat accelerated, and at the same time rendered very laborious and difficult. As evidence of this difficulty, the workings of the extraordinary muscles of inspiration and of expiration may be remarked; for example, the working of the Scaleni, Sterno-mastoids, and even,

sometimes, of the Pectorals. At the same time there will be noticed an excess of movement in the wall of the chest as a whole, as well as in the wall of the abdomen, an exaggerated thoracico-abdominal type of breathing. Further evidence of respiratory labour may be found in the sympathetic working of the Alae Nasi; and in the marked upward and downward movement of the box of the Larynx, which descends with Inspiration often to the extent of three-quarters of an inch, and ascends with Expiration; in the sucking in of the intercostal spaces during inspiration; and, when the patient is young, in the drawing in of the lower costal margin and lower end of the sternum by the action of the Diaphragm. If there be marked Emphysema, the apices of the lungs will bulge upwards into the root of the neck when the patient coughs.

On **Percussion** the note obtained is usually quite normal. But, if there be marked Emphysema, the percussion note over the Emphysematous areas—usually the sternal region and about the apices—may be slightly hyper-resonant. Bronchitis of itself can never produce dulness, and does not cause any alteration of the Vocal Resonance. If there be dulness, evidence of Phthisis, Pneumonia, Pleurisy, or of Basic Oedema, must be looked for.

On **Auscultation** there is generally the same harsh type of breathing with prolonged expiration () as was observed in the slighter varieties, but the accompaniments are much more marked. These accompaniments are the characteristic dry and moist sounds. The dry sounds may present all varieties of pitch, from the low-pitched sonorous rhonchi () to the high-pitched sibilations (), the pitch being dependent on the size of the tube in which the sound is produced. In a severe case of "Capillary" Bronchitis there is a full chorus of high-pitched sibilant rhonchi all over the chest, in front and behind. The moist sounds are of the medium variety, "subcrepitations" (). As they are produced by fluid mucus, and as fluid tends to seek the lowest level, the moist sounds will generally be found to be most abundant at the bases of the lungs posteriorly. It should be specially noted that, in ordinary Bronchitis, these physical signs are developed equally in both lungs, and that, except for the preponderance of moist sounds at the bases, there is no tendency to concentration of the physical signs in any particular area. Should Bronchitic râles be found concentrated at the apex, the possibility of Phthisis must be considered. Should the moist sounds be more abundant at one base than at the other, and should there be any dulness on percussion in that locality, evidence of Oedema, or of Pneumonia, or of Basic Phthisis must be looked for. Bronchial Breathing is never produced by Bronchitis, the type of breathing being vesicular, though harsh with prolonged expiration, as already explained. Often the type of breathing cannot be made out at all, as the breath-sounds are drowned in the accompaniments. Vocal Resonance and Fremitus are generally normal in Bronchitis.

II. Croupous Pneumonia.

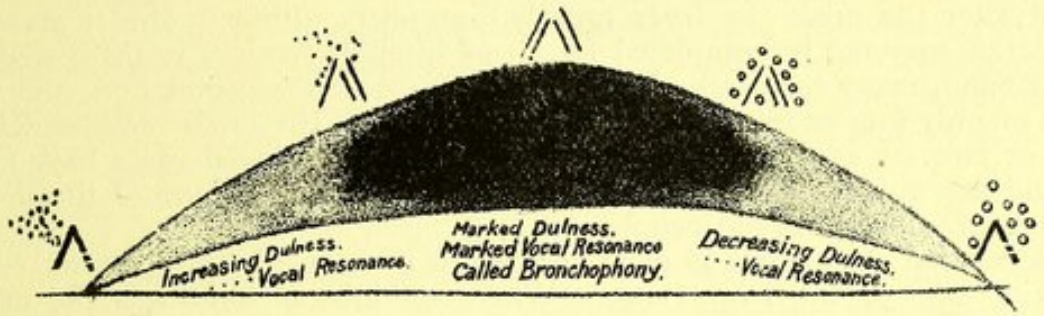
In this acute affection the signs rapidly develop from day to day.

On **Extra-auscultation,** the only thing to be noted is the frequent, short, "suppressed" cough, which is associated with a sticky, gelatinous and rusty sputum.

On **Inspection,** etc., there will be observed marked acceleration of breathing, the respirations running in a severe case as high as 50 or 60 per minute; but, although accelerated, the breathing is not usually laborious or difficult, there being no impediment in the air-passages. Orthopnoea and marked labour of the extra-ordinary muscles are only occasionally met with, in very bad cases. There is often sympathetic working of the Alae Nasi, and frequently a little upward and downward

movement of the Larynx. The face is usually flushed, with a slightly leaden tint in the redness, and, upon the lip or about the side of the nose, there is frequently a patch of Herpes Labialis.

The physical signs on **Percussion** and on **Auscultation** may, perhaps, be best represented in a diagrammatic manner, the diagram showing the progress of a case from its beginning in acute congestion, up to its full development in pneumonic consolidation, and down again to final restoration to health, by a process of resolution, thus :—



The teaching of this diagram will be best understood if the student will, in the first instance, concentrate his attention upon the middle part of it, where the shading is deepest. This represents the state of complete consolidation of the lung substance, in which each vesicle is entirely filled with solid exudation, and therefore ceases to be itself a source of any sound, normal or abnormal. But, though the vesicles are themselves silent, they are now, in their solid condition, far better conductors of sound than they were when filled with air, and thus it is that, listening over the solid area, one hears high-pitched and loud Tubular Breathing (high-pitched Bronchial) conducted from the subjacent bronchial tubes, and so well conducted as to appear to the ear to be produced immediately below the end of the stethoscope. In like manner, the Vocal Resonance at this stage is admirably conducted through the solid lung, and its marked increase is indicated by the name "Bronchophony." There are no accompaniments at this stage, as air cannot enter the air-vesicles.

Turning now to the first stage, the student should realise that the process begins with acute congestion, and that from the congested blood-vessels the exudation poured into the vesicles is at first fluid, and only gradually becomes solid. For a time the air, still entering the vesicles, mingles with the fluid and produces a copious burst of Fine Crepitations at the end of inspiration; but these crepitations gradually diminish as the accommodation for the air becomes less. In like manner, during this first stage, the type of breath-sound becomes altered. Harsh Vesicular with prolonged expiration at the very beginning of the process, it gradually loses its vesicular and acquires a Bronchial character, as the air-vesicles get filled up and become good conductors. In the transition it naturally passes through the Broncho-vesicular phase, in which the bronchial element is at first developed in the expiration only. The Vocal Resonance, it will be further understood, becomes more and more marked as the solidification increases.

In the third stage, that of Resolution, the signs gradually pass through a similar transition, but in the opposite direction, the breath-sounds returning from the Bronchial,

through the Broncho-vesicular, to the Harsh Vesicular, and finally to the Normal type; and the Vocal Resonance gradually decreasing until it is reduced to the normal degree. The accompaniments of the third stage, however, differ from those of the first, the crepitation, which indicates the re-entrance of air into the vesicles and its mixture with the softening exudation, being coarser than the crepitation of the first stage, and occurring with both inspiration and expiration. It is called "Redux" Crepitation, and is of the same coarseness as the sub-crepitation of Bronchitis, though, as a rule, it is more abundant.

Nothing can be said here of the various dangers and complications of Pneumonia, but it may be remarked that Pneumonia varies much in its duration, and in the completeness of its development. A typical case frequently has its crisis on the eighth day, and after the crisis the fever rapidly disappears, although the re-absorption of the exudation may not be completed for an additional fortnight or three weeks. On the other hand, many cases are abortive, with imperfect consolidation, and may run a course of only four or five days; and, in other cases, the crisis may be delayed for a week or two, or even longer. Some of the long-continued cases have no proper crisis, and are apt to pass gradually into Phthisis. This is one of the dangers of Pneumonia in weakly and old people.

Observe that Pneumonia in most cases seizes upon one lobe only, most commonly the inferior lobe of the Right lung. When this lobe is solidified, the margin of dulness will correspond with the interlobular fissure, and will present a line, not horizontal, but oblique, ascending from below upwards and backwards. In rarer cases the upper lobe of either lung may be affected, and in some the Pneumonia may be double, affecting, say, the inferior lobe of each lung. In an ordinary case of Basic Pneumonia, the lower lobe being consolidated and dull, the Upper Lobe will be found to yield a more than usually Resonant Note on Percussion. This resonance is generally ascribed to a certain degree of relaxation of the lung substance in this part, owing to the swelling of the affected lobe below.

NOTE.—*The foregoing Diagram and Description apply in all details only to fully-developed cases of Pneumonia. It should be remembered that very many cases are more or less abortive, and are recovered from by passing into Resolution before Consolidation is completed. Such cases might be represented by modifying the Diagram so as to omit the second or middle stage altogether.*

III. Pleurisy.

The physical signs of Pleurisy differ so greatly in individual cases, according as there is or is not copious effusion of serum in the pleural sac, that it is best to consider the condition under two headings, viz.: those of Dry Pleurisy, and Pleurisy with Effusion. Either form may be acute or chronic, but the majority of dry cases are acute and of brief duration, while the majority of cases of Pleurisy with Effusion are chronic and tedious. A Pleurisy, dry and acute in the first instance, may develop into one of Pleurisy with Effusion. Both forms occur rather more commonly on the left than on the right side of the chest, unless the side be determined by the existence of some other form of disease, such as Phthisis or Pneumonia, which may have excited the Pleuritic Inflammation.

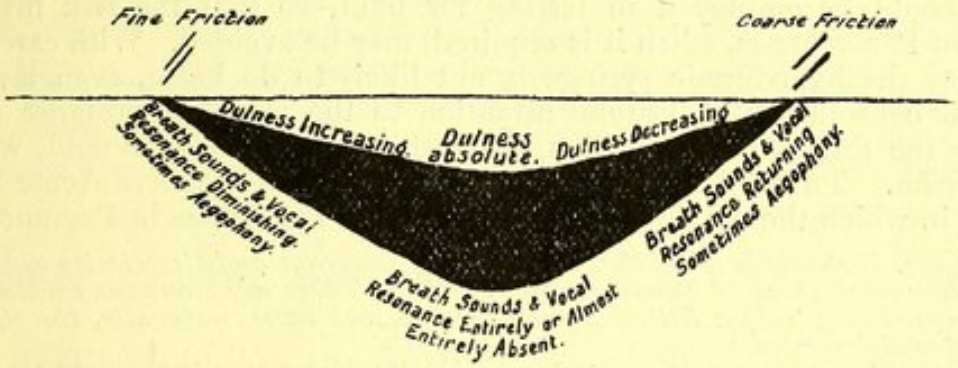
(*a*) **Dry Pleurisy.** Here the new material exuded upon the serous membrane is so scanty that no dulness on percussion is produced, nor any alteration of the Vocal Resonance. There is only one leading symptom, namely, a stabbing pain, aggravated by coughing or by taking a long breath, and often associated, more or less, with a suppressed and painful cough, like that of Pneumonia. There is only one physical sign, namely, friction at the seat of inflammation, this friction being usually fine and painful, and being best marked when the patient is caused to take a long breath.

(*b*) **Pleurisy with Effusion.** Here the physical signs are more complicated, being due to gradual separation of the two layers of the Pleura by the accumulation of fluid in the sac, and to the gradual compression of the lung substance.

On **Inspection,** when the patient is at rest, there is not as a rule any marked disturbance of breathing, but the respirations are usually accelerated to some extent, and, if the case be a serious one, there may be paroxysms of dyspnoea from time to time, especially during the night. Usually the patient has observed that, for some time, he has been short of breath on exertion. Slight bulging of the affected side may sometimes be detected, along with immobility of that side during the Respiratory movements.

On **Percussion,** if the fluid be abundant, the note will be Absolutely Dull, with marked sense of Resistance, as will be presently explained. It is of importance to mark out the superior limit of the dulness, which will often be found to be almost horizontal, and not to correspond, as in Pneumonia, with the line of the Interlobular Fissure. Above the limit of dulness, the floating lung will often yield a note unnaturally resonant or even tympanitic, owing probably to the relaxation of the semi-compressed lung substance. (A similar increase of resonance has already been noted as occurring in the upper lobe of a lung, whose lower lobe is in a state of Pneumonic consolidation.)

The Physical Signs on Percussion and on Auscultation may be represented diagramatically very much in the same fashion as those of a Pneumonia; but in order that the two diagrams may be the more easily distinguished, that for Pleurisy may be placed below, instead of above, the horizontal line, thus:—



In studying this, as in studying the pneumonic diagram, the student will do well to begin with the middle stage, in which the condition is fully developed, the pleural sac containing at this stage several pints of fluid, upon the surface of which the lung floats, in a more or less compressed and relaxed condition. He should recognise that a large collection of fluid is Absolutely Dull, and that fluid is incompressible, so that Percussion over it is painful to the fingers; he should further remember that it is a very bad conductor, so that the breath-sounds and the Vocal Resonance are alike rendered very faint or altogether inaudible; and he should realise that there is nothing at this stage capable of producing accompaniments, such as friction, dry sounds or moist sounds.

Turning now to the first stage, the friction at the very beginning of the process, or, later on, at the upper margin of the effusion, will be noticed. This indicates that the inflamed layers are still unseparated and are rubbing together. As they get

separated the friction disappears, whilst the breath-sounds and the Vocal Resonance are gradually interfered with and diminished, the Vocal Resonance often becoming Ægophonic, and remaining of this character so long as the layer of interposed fluid is comparatively thin. With increasing fluid there is Increasing Dulness, along with Diminishing Breath-sound and Vocal Resonance.

In the third stage there is a gradual transition from dead silence to a restoration of normal breath-sound and Vocal Resonance, and from absolute dulness on percussion to the normal percussion note. At the end of the process friction returns, because the two layers once more come together and rub upon each other. This "Redux" friction, though painless, is generally very loud and creaking, and can be felt by the patient himself as a disagreeable rubbing of rough surfaces within the chest. It can often be felt through the chest-wall when the hand is placed over the locality.

The above is an account of the physical signs in an ordinary typical case; but it must be borne in mind that there are exceptional cases, not a few, occurring most commonly among children, in which the Vocal Resonance may be fairly preserved and the breath-sounds, instead of being simply obscured, may pass into the broncho-vesicular or even tubular type as in Pneumonia, and remain loudly audible, especially about the angle of the scapula and in the interscapular region, when the pleural sac is full of fluid. This is difficult of explanation, but it may be surmised that, in such cases, the ribs are excellent conductors of sound, as bone generally is in young people, and that the tubular breathing may be conducted by the spinal column and ribs from the roots of the lungs and the Bronchial tubes of the other side. In an acute case of this sort the diagnosis should be carefully made, and, if necessary, the hypodermic syringe should be employed in testing for fluid, so that the risk involved in the omission of Paracentesis, when it is required, may be avoided. With careful antiseptic precautions the hypodermic syringe is not likely to do harm, even if the case be a pneumonic consolidation. Careful attention to the marked resistance and inelastic feeling to the fingers on percussion, when the dulness is due to fluid, will often help the physician. The difficulty of diagnosis is greatest in cases of Acute Pleurisy with Effusion, in which the patient is sometimes highly feverish as in Pneumonia.

NOTES.—1. *It should be noted that the foregoing Diagram and Description apply in all details only to well-marked cases of Pleurisy with Effusion. There are many cases which are recovered from after producing only a little Effusion, and in such cases, naturally, the signs are not so typical and well developed.*

2. *On the left side, great effusion often pushes the Heart over to the right of the sternum; on the right side, it may push the Liver down into the abdomen. The evidences of such displacements should be noted under the headings of Inspection, Palpation, Percussion, and Auscultation.*

3. *Effusion, when it accumulates rapidly, may dangerously compress the Heart without displacing it to any marked degree.*

IV. Phthisis.

Phthisis in the course of its development passes through several phases, each of which has its characteristic physical signs. As a rule the disease begins at the apex of the lung and spreads downwards. It begins with scattered deposits, which increase, coalesce, and ultimately suppurate and break down, so as to form excavations, termed Vomicæ or Phthisical Cavities. As it is of great importance, in the interest of the patient, that the condition should be recognised at its first beginnings, it will be well to consider the physical signs which may, in most cases, be detected, when the deposits are yet minute and strictly limited to the apex itself.

First Stage.—Let us suppose that, as yet, there are only about half-a-dozen small deposits, like peas, scattered in the substance of one apex. What physical signs are likely to be produced by these? Note that the solid matter is not sufficient in amount to produce any dulness on Percussion, or any increase of Vocal Resonance, and that the apex, as yet, expands freely on Inspiration, so that there is neither

defective expansion nor local flattening to be observed on Inspection. The physical signs will thus be found exclusively on Auscultation. In trying to explain them, we must think of the irritation and congestion which these small deposits are producing all around them in the lung substance and in the small bronchial tubes. It will be remembered that there is so much congestion that Hæmoptysis is common at this stage, owing to rupture of surcharged capillaries. On applying the stethoscope over this congested area, the breathing will generally be found to be Harsh with Prolonged Expiration, just as when the bronchial tubes are congested in a case of Bronchitis. Sometimes a sibilation or two may be heard along with the harsh breathing. Thus it may be said that, in this early stage of Phthisis, the physical signs are identical with those of slight Bronchitis, with this all-important difference, that here the signs are strictly limited to the affected apex, whereas in Bronchitis they are diffused over the whole chest. Two additional notes may be made in this connection—first, that harsh breathing, with some prolongation of expiration, is often present at the Right apex in the condition of perfect health, owing, it is supposed, to the comparatively high position of the Right Bronchus, so that, at the Right apex, this sign can only have a pathological significance, when more marked than usual, or when diffused over an unusually large area; secondly, in a few cases, the breathing may be of interrupted or wavy character; but this type of breathing is so often due to nervous action of the Respiratory Muscles, or to the communicated movement from a palpitating heart, that little importance may be attached to its occurrence. In this early stage the parts to be examined with special care are, the region above and over the clavicle in front, and that above the spine of the Scapula behind.

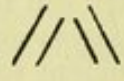
Second Stage.—This stage is developed out of the first by the further increase of the tubercular deposits, and by the inflammatory consolidation of the lung substance between them. The solid matter is now sufficient to produce Dulness on percussion, either Slight, Comparative, or more or less Marked. It is also sufficient to cause more or less Increase of Vocal Resonance on Auscultation, and of vocal Fremitus on palpation. There is not generally, as yet, any distinct flattening at the apex on inspection, or any marked defect of expansion during Inspiration, but in a chronic case, with much fibroid change, both of these latter may be already noticeable. On Auscultation, the harsh breathing of the first stage has generally become still harsher, and the expiration, besides becoming more prolonged than ever, has often acquired a distinctly bronchial character, so that the breathing in such cases is best described by the term "Broncho-vesicular" (). On the whole, therefore, the physical signs of this stage make an approach to those of an apical Pneumonia, but the consolidation being as a rule incomplete, the breath-sounds seldom become purely bronchial, and the dulness and the vocal resonance are seldom so marked as in Pneumonia. In some cases the deposits are so much scattered that the disease passes from the first stage into the third without any marked development of dulness, the second stage being, in such cases, practically omitted.

Third Stage.—This stage develops itself out of the second, or sometimes, as already said, out of the first. It is constituted by the appearance of suppurative action in the tubercular deposits and their surroundings, and its characteristic sign is the appearance on Auscultation of Subcrepitations, sometimes in moderate abundance, sometimes in the form of isolated cracklings or "clicks." These sounds are closely analagous to the subcrepitations of Bronchitis, but their localisation distinguishes them from these, and the fluid producing them is pus, not fluid mucus. The addition of these moist sounds to the physical signs of the first or of the second stage, in itself constitutes the third stage. (Allowance must be made here for the occurrence of one other condition which sometimes produces moist sounds in a phthisical apex, namely, the presence in the air-vesicles of fluid Blood, which has been drawn into them by

inspiration during an attack of Hæmoptysis. This condition sometimes produces moist sounds, which may persist for several days after the attack of Hæmoptysis is over.)

Fourth Stage—that of cavities of considerable size. These have grown by a process of suppuration and ulceration out of the suppurating points detected in the third stage. The cavities may now be of considerable size, and they are usually largest in the neighbourhood of the apex, where the disease is of oldest standing. Naturally a cavity ought to yield a resonant or tympanitic note on Percussion, but it must be remembered that each of these cavities is surrounded by a dense and solid wall which necessarily yields a dull percussion note. In practice, therefore, the percussion note is more frequently Dull than tympanitic, and when any degree of tympanitis is present, it is so mixed up with dulness that the combination results in what is called the "Wooden or Boxy note"—a very important physical sign of a cavity. Whenever a boxy note is obtained the student should try to elicit also the "Cracked-Pot" sound. This he will best do by causing the patient to breathe audibly with the mouth open, whilst somewhat forcible percussion is being made over the situation of the Vomica. The chinking, metallic sound produced in this manner by sudden expulsion of air from the cavity has suggested the title of "cracked-pot" note.

On **Inspection, Palpation,** etc., there is generally found in this stage a distinct flattening below the Clavicle with hollowing above it, and in the same situation a distinct defect of expansile movement on Inspiration.

On **Auscultation** the physical signs of a cavity will vary according as it is empty or partly filled with pus. If empty, the breath-sounds are generally of low-pitched, blowing, cavernous character (), and in the case of a very large cavity they may be even Amphoric, although this is rare. When there is much pus in the cavity the accompaniments are so loud as partly or wholly to obscure the type of breath-sound. These accompaniments are Moist Sounds of the coarsest description, Bubbling, Splashing, or Gurgling (), and are often very impressive in their suggestion of utter disintegration. When only a little pus is present in a large cavity the moist sounds are comparatively few, and are apt to have a Consonating character, Tough, Metallic, or Tinkling, which at once suggests that they are being produced within a large and resonating chamber. The Vocal Resonance is very markedly increased when there is a cavity, so that the speech appears to come directly from the chest and strikes upon the ear quite painfully. This is called "Pectoriloquy." It is detectable in whispered as well as in ordinary speech.

It is of importance, in some cases, to make the patient Cough when a cavity is being examined, as, sometimes, moist sounds can be elicited by the act of coughing, when they are not otherwise detectable.

It will thus be seen that, in ordinary Phthisis, the breath-sounds, from the beginning to the end of the process, are usually rendered louder and harsher than in health. It should be remarked, however, that this is not the invariable rule. In slow, chronic Phthisis, with much Fibroid change in the substance of the Lung and much Thickening of the Pleura, the expansion of the Lung and the entrance of air into it, are greatly interfered with, and the Respiratory sounds may be Diminished and rendered very faint instead of being increased. This deviation from the normal must be noted as carefully as that in the opposite direction, and its explanation sought in a careful consideration of the case as a whole.

Every case of Phthisis is complicated by Pleurisy. In the majority of cases this produces merely dry inflammation with stitching pain and ultimate adhesion of the Pleura at the part affected, but, in not a few cases, Pleurisy with Effusion is developed

and constitutes in itself an important complication. Generally the Adhesions resulting from Pleurisy suffice to save the patient from the development of Pneumo-thorax, but in a few cases a small Phthisical Vomica at the surface of the Lung bursts into the Pleural sac, before its layers have been rendered adherent by Pleurisy, and the result is the establishment of a more or less extensive and dangerous Pneumo-thorax.

NOTE.—*It must be borne in mind that although the great majority of cases of Phthisis begin at the apex, the disease sometimes begins at the Base of the lung. These Basic cases result generally from the degeneration of Croupous Pneumonia into Phthisis, and such degeneration is most common in the constitutionally feeble and in the old.*

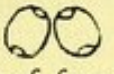
V. Pneumo-thorax.

In almost all cases this condition is established suddenly by the escape of air from the lung into the Pleural sac. Many diseases besides Phthisis are capable of producing it, but the majority of cases are brought about by Phthisis in the manner already described. The severity of the symptoms will depend greatly upon the extent of the pleura that remains free from adhesion. If only the Apex be adherent, the Lung may be totally collapsed, and the patient brought into great danger from disablement of his Respiratory Apparatus. On the other hand, if the Lung be extensively adherent, there will be much less collapse and much less danger. Frequently the ruptured orifice in the Lung is small, so that, when the Lung is collapsed, the opening becomes valvular. It then admits of the entrance of air on Inspiration, and during the compressive stage of coughing, and yet it prevents its exit during Expiration. In such cases the air accumulates compressively and may lead to pressure upon, and displacement of, the Heart or the Liver.

On **Inspection,** etc., the signs of great dyspnoea are frequently present, the patient having Orthopnoea and employing the Extra-ordinary muscles of Respiration, and often, in dangerous cases, being more or less cyanosed. In milder cases, however, there may be an absence of serious distress, and only a moderate amount of acceleration of the respiratory acts. Sometimes, in the compressive cases already alluded to, distinct bulging can be observed upon the affected side.

Percussion in most cases yields a deep-toned, drum-like Tympanites, but, if the case be a compressive one, the note may be high of pitch and much less tympanitic. In addition to ordinary Percussion, the examiner should in a case of Pneumo-thorax endeavour to elicit the Bell Sound. In order to do this, an assistant places one coin flat on the patient's chest, and chinks gently upon it with the edge of another coin. The examiner, meanwhile, has applied his stethoscope some inches from the coins, or upon the opposite wall of the same side. If Pneumo-thorax be present, the chinking sound is curiously modified by its transmission through the air-filled chamber. If the case be a well-marked one, the sound reaches the examiner's ear as a soft musical note like the chime of a distant church bell. If less marked, it is less soft, but still musical, and it may be compared to the clinking hammer of a distant village blacksmith.

On **Auscultation** the Respiratory sound may be of typical Amphoric character

(), especially if the opening in the surface of the lung be such as to admit of free entrance and exit of air during Respiration. But if the case be a compressive one with valvular opening, there may be absence of breath-sound; or a faint and distant amphoric breathing may be transmitted through the cavity from the bronchial tubes of the other lung. The accompaniments are the characteristic Tinkling Râles, which are singularly clear and musical, sometimes moderately abundant, sometimes only isolated and occasional. The Vocal Resonance is modified characteristically, presenting the Amphoric Echo or Nachklang of Skoda.

Succussion is a method of physical examination practised exclusively in this

condition. It consists in having the patient shaken vigorously by an assistant, while the examiner has his ear applied over the affected side. In a pure Pneumo-thorax with air alone and no fluid, Succussion will yield nothing; but, in most cases of Pneumo-thorax, more or less fluid, serous or purulent, has collected at the bottom of the Pleural cavity, the case being thus converted into one of Hydro- or Pyo-Pneumo-thorax, and when the patient is shaken, this fluid is mingled with the air so as to produce a loud, splashing noise, which is of metallic resonance owing to the size of the cavity and the smoothness of its walls. Students should carefully note the conditions necessary to produce such splashing on Succussion. There must be air as well as fluid in the Pleural cavity. Fluid alone can never produce it, so that it is never obtained in cases of Pleurisy with Effusion.

ADDITIONAL NOTES.—*The foregoing are the five leading conditions which produce well-marked physical signs in connection with the organs of respiration. But before concluding the consideration of this part of the subject, it will be well to make a few notes regarding the physical signs of certain other minor conditions which are developed for the most part as Complications of the leading varieties already described.*

1. **Vesicular Emphysema** *has been already referred to as a common complication of Chronic Bronchitis. It is developed usually about the apices and anterior edges of the lungs, but it may also exist at the bases. It causes the parts affected to become unnaturally voluminous, so that the chest becomes barrel-shaped. The apices bulge up markedly into the neck when the patient coughs; the percussion note over the emphysematous parts is generally to a slight extent hyper-resonant, and, on auscultation, the breath-sounds over these parts are unnaturally faint, owing to the comparative stagnation of the air within the dilated air-vesicles.*

2. **Catarrhal or Lobular Pneumonia,** *a complication of Acute Capillary Bronchitis, forms small pea-like nodules of pneumonic consolidation. Its physical signs are generally drowned in those of the Capillary Bronchitis. Sometimes in the adult its establishment can be diagnosed by the marked rise of temperature which occurs along with it; but in the child this cannot be relied upon, since Acute Bronchitis itself may produce a very high temperature. Only in a few cases do the nodules coalesce sufficiently to produce breath-sounds of Broncho-vesicular or tubular type, with increased Vocal Resonance and dulness on percussion, as in Croupous Pneumonia. Chronic Catarrhal Pneumonia contributes to form the solid deposits in Phthisis.*

3. **Chronic Interstitial Pneumonia** *has been already referred to as the cause of the Fibroid Induration that is developed in the course of Chronic Phthisis. The Phthisical apex so affected shrinks, so that there is falling in of the chest-wall over it, and defect of expansion on inspiration. The breath-sounds are apt, in such an apex, to be feeble, owing to the partial obliterations and defective expansion of the air-vesicles. If the upper part of the Left Lung should thus be greatly contracted, the apex beat of the Heart may be displaced upwards. The condition is found associated with other conditions besides Phthisis, such as Chronic Dust, Bronchitis, and Bronchiectasis.*

4. **Bronchiectasis,** *a dilated condition of the Bronchial tubes, sometimes affecting only a few, sometimes many of them, is an occasional outcome of Chronic Bronchitis, and is usually associated with a very copious purulent sputum that may become very fœtid. It is often brought up at intervals in large quantities. If there be a large saccular dilatation, the physical signs may be exactly like those of a Phthisical Vomica; but the locality is different, the Bronchiectatic cavity being usually developed, not at the Apex, but at the base of the Lung, or in the neighbourhood of its root. The history of Bronchitis of long standing, and the less-marked development of Hectic symptoms, will also be of assistance in forming a diagnosis; but it must be said that in some cases the diagnosis between Bronchiectasis and Phthisis is extremely difficult.*

CONCLUDING NOTE AS TO THE MOST CONVENIENT ORDER OF EXAMINATION.

1. **Extra-Auscultation.** *Note to be made of the nature of any obstructive noises that accompany respiration, also of the characteristics and frequency of the cough. To the description of the cough it is convenient to add here a description of the expectoration.*

2. **Inspection and Mensuration.** *These should be taken up in the order already detailed in Part I.*

3. **Palpation.**

4. **Percussion.** *If there is a dull area anywhere, its limits should be carefully demarcated, and the shades of dulness in its various parts noted down. After the description of the dull area, proceed to describe the percussion of the remainder of the chest.*

5. **Auscultation.** *Should a dull area have been discovered on Percussion, the notes upon auscultation should begin with a careful description of the Ausculatory signs over the dull area. After this the notes should go on to describe the auscultatory condition of the remainder of the chest. Even in the absence of an area of dulness, it will be well, whenever there is anywhere a localised development of physical signs, to begin the report as to Auscultation with a description of these, and then to pass on to the other parts of the chest. Attention to this rule will do much to bring the important features of a case to the foreground of the picture.*

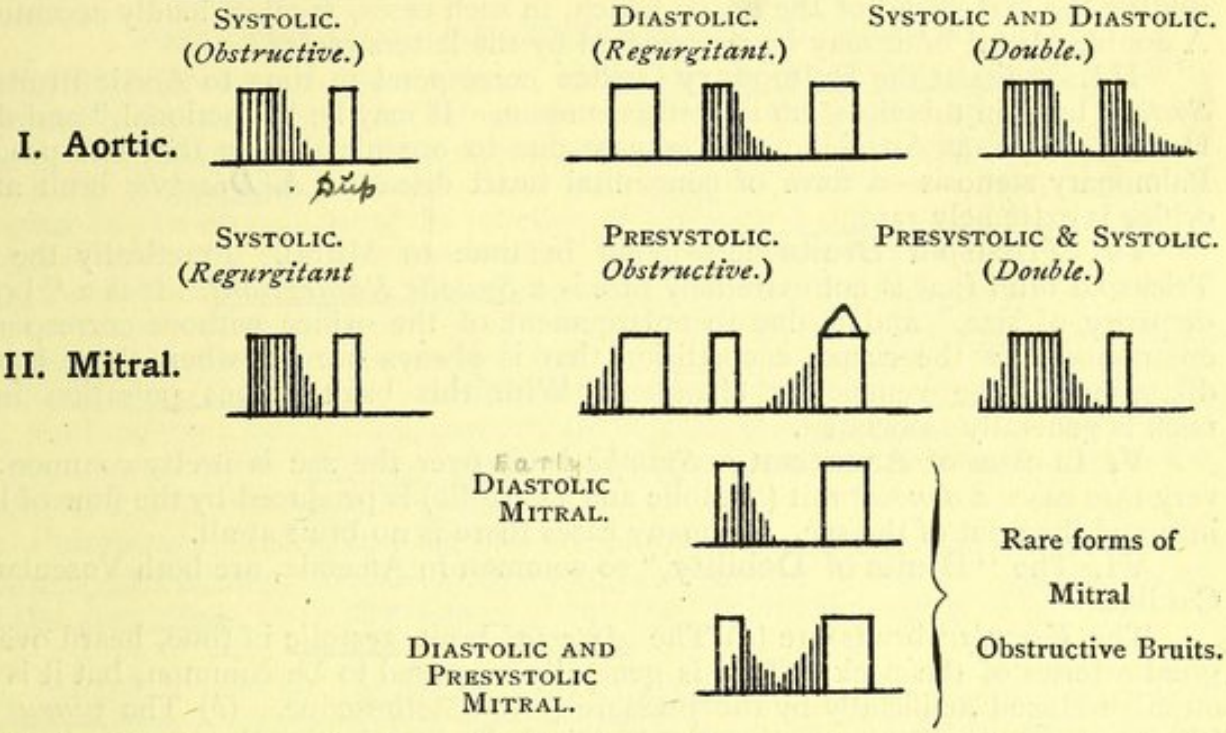
CIRCULATORY SYSTEM.

PART I.

AUSCULTATION.

ENDOCARDIAL BRUITS.*

1st Sound marks beginning of Systole. Systole continues through nearly whole of short pause.
2nd Sound marks beginning of Diastole. Diastole continues through nearly whole of long pause.



I. Aortic Bruits. As shown in the above diagram, there may be at the Aortic Orifice, a Systolic Bruit, indicative of obstruction, or a Diastolic, indicative of regurgitation ; and these bruits are frequently combined so as to constitute a Double Aortic bruit. A Systolic bruit is not always due to organic disease, being sometimes of Anæmic origin, as will be explained below, under "VI. The Bruits of Debility." This Hæmic Bruit is usually softer than a bruit of Organic origin. Aortic bruits, organic and hæmic, are produced at the Aortic Orifice, which is situated at the Sternal Articulation of the third left costal cartilage. They are thus Basic bruits.

II. Mitral Bruits. These are heard best at the apex of the heart. A Systolic bruit indicates Regurgitation. This may be due either to Organic disease of the Valve, or to dilatation of the Ventricle and its Auriculo-ventricular Orifice, the latter causing a "bruit of debility," owing to "Disparity of size" between the dilated orifice and its valve. The Obstructive bruits are always Organic, being due to Stenosis of the Mitral valve. Two forces cause the blood to flow through the Mitral Orifice during the Diastole of the Ventricle, viz., the suction of the Ventricle (a *vis a fronte*), and the propelling force of the Auricle (a *vis a tergo*). The suction is strongest near the beginning of the Diastole, and the propelling force at the end of it, immediately before the Ventricular Systole. When there is obstructive disease, the bruit is developed at the time when the flow of blood through the contracted orifice is rapid enough to produce a bruit. Generally it is limited to the period of Auricular contraction, and is therefore Presystolic. Sometimes, when the Auricle is weak, it occurs only at the period of greatest Ventricular suction, and is therefore Diastolic. Occasionally, again, it may be both Diastolic and Presystolic. Obstructive bruits are

** The diagrams of this set are modifications of the well-known diagrams of Sir William Gairdner. Parallelograms, instead of his vertical lines, are used for the representation of the Heart Sounds. With these, the exact relationships of the Bruits to the Heart Sounds can be brought out more clearly.*

rough and purring. They are often succeeded by the blowing bruit of Regurgitation, since the disease which produces obstruction often renders the valve incompetent at the same time. A common double Mitral bruit is thus a rough, obstructive Presystolic, running up to, and immediately succeeded by, a blowing, Systolic, regurgitant bruit. The relations of these bruits to each other are shown in the diagrams. In sound the rough Presystolic bruit might be represented by the letters *rrrp*, the terminal *p* representing the first sound of the heart, which, in such cases, is often loudly accentuated. A double Mitral bruit may be represented by the letters *rrrfff*.

III. Bruits at the **Pulmonary Orifice** correspond in time to Aortic Bruits. A *Systolic* bruit in this situation is pretty common. It may be "functional," and due to Hæmic causes, as Anæmia; or it may be due to organic disease that has produced Pulmonary stenosis—a form of congenital heart disease. A *Diastolic* bruit at this orifice is extremely rare.

IV. Tricuspid Bruits correspond in time to Mitral. Practically the only Tricuspid bruit that is not extremely rare is a *Systolic Regurgitant*. It is a "bruit of disparity of size," and is due to enlargement of the orifice without corresponding enlargement of the cusps, a condition that is always present when there is much dilatation of the ventricular chamber. With this bruit venous pulsation in the neck is generally associated.

V. In cases of **Aneurism** a *Systolic* bruit over the sac is pretty common. In very rare cases a *double* bruit (Systolic and Diastolic) is produced by the flow of blood into and then out of the sac. In many cases there is no bruit at all.

VI. The **"Bruits of Debility,"** so common in Anæmia, are both Vascular and Cardiac.

The *Vascular* bruits are (*a*) The *Arterial* bruit, systolic in time, heard over the great arteries of the neck. This is generally supposed to be common, but it is very often produced artificially by the pressure of the stethoscope. (*b*) The *venous hum* (the humming-top bruit, or "Bruit de Diable"), heard over the great veins of the neck, and sometimes over other large veins, such as the ophthalmic veins and the cerebral sinuses. This is very common and important. First to come & last to go.

The *Cardiac* bruits of Debility are variously classified and explained. A view largely supported is that they are *four* in number, one for each orifice of the ventricles; that two are therefore basic and are heard over the Aortic and Pulmonary regions respectively, being probably due to the onward rushing of the thin anæmic blood through the Aortic and Pulmonary orifices; and that the other two, Mitral and Tricuspid, are heard over the left and right apices, and are due to dilatation of the ventricular chambers, which has produced the "disparity of size" between the auriculo-ventricular orifices and their cusps already alluded to. Both of the latter are thus regurgitant.

Of these *six* bruits (Vascular and Cardiac) *three* are common in Anæmia, namely, (1) the Bruit de Diable in the neck, (2) the Basic bruit in the Pulmonary region, (3) the Mitral bruit at the Apex; and that is the order of their development.

Observe that all the Cardiac bruits of debility are *Systolic* in time. Systolic bruits may thus be either of functional or of organic origin, while Presystolic and Diastolic bruits are always of organic origin.

VII. Exocardial Bruits. (*a*) *Pericardial friction*, due to Pericarditis, is generally a "to-and-fro" or double bruit (Systolic and Diastolic). It is most apt to be confounded with a double Aortic bruit, but its superficial rubbing and shuffling character generally renders the distinction easy. In most cases it appears first at the base of the heart, and spreads thence, if not arrested, over the whole organ. (*b*) A to-and-fro friction sound, of precisely the same character as the above, is sometimes produced by a *Pleurisy in the Precordial region*, the subjacent heart causing the inflamed surfaces of the pleura to rub against each other synchronously with its own movements.

Systolic Bruits may be functional or organic.

Diastolic Bruits

Diagramatically pericardial friction may be represented thus :— 

one rub during systole, and the other during diastole; but sometimes it assumes a triple rhythm with two rubs in diastole, thus :— 

PROPAGATION OF ENDOCARDIAL BRUITS.

1. **Aortic Bruits** are clearly heard about the third left costal cartilage at its junction with the sternum, that being the position of the Aortic valve. They are propagated to a distance by *three* agents, namely, (*a*) the *Heart* itself, which often carries them to the apex; (*b*) the *Aorta* and its great branches, a spot of special importance in this respect being the junction of the second right costal cartilage with the sternum (here the Aorta makes its first bend, and Aortic bruits are often heard even more distinctly than over the valve itself); and (*c*) the *Sternum*, which often conducts the sonorous vibrations of such bruits throughout its whole length. Obstructive Aortic bruits (Systolic) are carried best upwards, in the direction of the blood current, and are specially loud over the first bend of the aorta. Regurgitant Aortic bruits, produced by a descending current, are carried best downwards; and are very often heard better at the left edge of the sternum, close above its junction with the xiphisternum, than even over the Aortic valve.

2. **Pulmonary Bruits,** starting like the Aortic from opposite the third left costal cartilage at the Sternum, are carried obliquely upwards and to the left, in the second left costal interspace, for a distance of about two inches, the agent of propagation being the trunk of the Pulmonary artery.

3. **Mitral Bruits** are loudest at the left apex. The Regurgitant (Systolic) is propagated upwards and outwards towards the axilla, and the angle of the scapula. The Obstructive (Presystolic and Diastolic) are not propagated in any special direction, but are often best heard about an inch internal to the apex.

4. **Tricuspid Bruits** are heard best over the right ventricle, being audible over an area of some inches in diameter, whose centre is situated at the left edge of the sternum, close to its junction with the xiphisternum.

NOTES.—1. *Endocardial bruits vary in acoustic quality, some being soft and blowing like the letter* f *prolonged, others twanging and musical, and others rough and purring like the letter* r *roughly prolonged. Regurgitant bruits are generally either blowing or musical. Obstructive bruits are generally more or less rough, the presystolic mitral being notoriously always rough and purring; "the bruits of debility" are generally soft and blowing, with the exception of the bruit over the pulmonary area, which is sometimes rather rough and superficial.*

2. *In timing a bruit the best guide is the beat of the Apex. If this cannot be got, the next best guide is the pulsation of the carotid artery. Both of these are synchronous with the systole of the heart. The radial pulse is not quite synchronous, and as a guide is therefore less satisfactory. Bruits synchronous with the Apex beat are systolic, bruits alternating with it are diastolic.*

3. *Whilst the detection and timing of a bruit are extremely important as affording grounds for a* diagnosis, *little importance should be attached to its* loudness *in forming a* prognosis, *as very serious organic lesions often produce bruits that are barely audible. The bruits of organic disease may also vary in loudness, from time to time, and very often the patient is at his best in health when the bruit is at its loudest. The bruits of mitral stenosis (presystolic, etc.) are most apt of all to vary in loudness; they may even for a time be absent altogether.*

4. *The bruit denoted as "Mitral Diastolic" in the above diagram is by many improperly styled "Post-diastolic."*

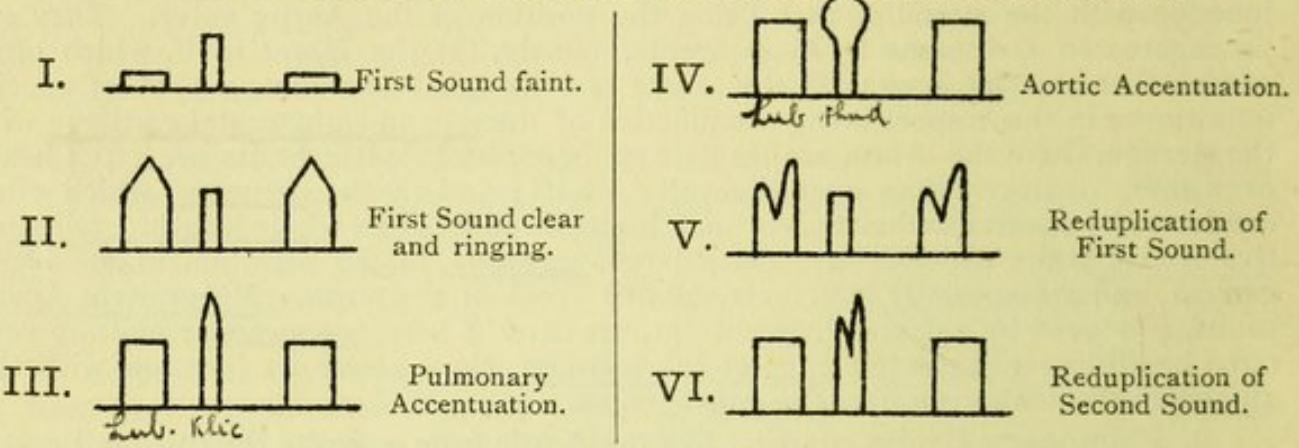
NOTES.—I. *When faintness of the first sound is due to the thickness of the ventricular walls, in* Hypertrophy, *the condition is generally betrayed by the abnormal position and strong heaving impulse of the apex beat. When it is due to* weakness *of the heart the impulse is feeble. In the weakness of Fever the first sound may be quite inaudible; this is a valuable indication for stimulants.*

II. *When the ventricular wall is thinned by dilatation, the first sound is often clear and ringing. It is also loud when the heart's action is violent from excitement.*

III. & IV. *In both of the conditions indicated the* second *sound is accentuated. Distinguish between* III., *the sharp clicking accentuation of Pulmonary engorgement, such as is apt to occur in valvular disease of the left side of the heart, and* IV., *the heavy thudding or booming accentuation which is one of the most constant and most important of the physical signs of Aneurism of the Aortic Arch.*

V. & VI. *Which indicate reduplications of the first and second sounds. Such reduplications are due to the want of perfect synchronism in the action of the two ventricles. They are sometimes present in the healthy subject, and in disease they often result from engorgement of the Pulmonary circulation. They are often associated with accentuation, in which case it is generally the latter half of the double sound that is accentuated.*

MODIFICATIONS OF HEART SOUNDS WITHOUT BRUITS.



PERCUSSION.

1. In health the area of "*Superficial Cardiac Dulness*" is of triangular shape; the apex or upper angle (truncated) reaches as high as the fourth left costal cartilage; the right border descends vertically along the middle of the sternum; the left border passes obliquely downwards and to the left until it reaches the outer limit of the apex beat; the base cannot be percussed out owing to the proximity of the Liver, but corresponds to a line drawn from the outer and inferior limit of the apex beat inwards until it meets the perpendicular limit of cardiac dulness, about mid-sternum. The measurement of the basic line is important; normally it measures about three or four inches.

2. The area of "*Deep Dulness*," obtained by heavy percussion, corresponds in shape to the area of superficial dulness, but is more extensive. It overlaps it about an inch on every side.

NOTE.—*In Disease the areas of Superficial and Deep Dulness may be specially extended to the right or left, according as the right or left chambers of the heart are specially enlarged.*

3. The percussion of the region of the *Aortic Arch* (above the level of the third costal cartilages) is especially important in cases of aneurism and of mediastinal tumour.

PALPATION.

1. Of the *Præcordia*.

(*a*) Determine the *position* of the apex beat. The normal position is between the fifth and sixth ribs, about half an inch within the vertical line of the nipple. When the left ventrical is enlarged there is displacement of the apex beat downwards and to the left. When the right ventricle is enlarged there is *apparent* displacement of the apex beat to the right, and there is often pulsation in the epigastrium.

(*b*) Note the *limitation* or *diffusion* of the apex beat.

(*c*) Note the force and character of the beat: whether moderate and deliberate, as in health; or strong and sudden, as in nervous excitement; or strong and slow (heaving) as in hypertrophy; or weak or imperceptible, as in debility.

The range of variation is considerable even in health, owing to the shape of the chest.

2. Of the *Aortic Region.* In cases of suspected aneurism note presence or absence of pulsation.

3. Of the *great vessels at the root of the neck.* Venous pulsation is scarcely palpable, though strikingly visible; arterial pulsation is as strikingly palpable as visible.

INSPECTION.

1. Of the *Præcordia* and *Aortic Region.*

(*a*) *Form.* Is there bulging over the præcordia or over the aortic region?

(*b*) *Movements.* (*a*) Movement of the apex beat: its situation, amount, and diffusion; (*b*) Pulsation in the Epigastrium; (*c*) Pulsation in the region of the Pulmonary Artery, common in anæmic debility; (*d*) Pulsation in the Aortic Region, often present in cases of aortic aneurism.

2. Of the *great vessels of the neck.* (*a*) Fulness of the great veins; (*b*) Pulsation in these veins; (*c*) Excessive pulsation in the arteries.

3. Of the *General Circulation:* as exhibited in the patient's complexion, the condition of his peripheral arteries and veins, the presence or absence of dropsy, etc.

4. Of the *Pupils,* in cases of Aneurism of the Aortic Arch.

CHARACTER OF THE RADIAL AND OTHER SUPERFICIAL PULSES.

1. The pulse wave—its rate and rhythm; its force and fulness; its slowness or suddenness of rise and fall; dicrotism.

2. The arterial tension—best estimated between the beats.

3. State of the arterial coats—condition as regards rigidity, tortuosity, or calcareous degeneration. Note also tortuosity, etc., of other superficial arteries, such as the temporals.

4. Equality or inequality of the two radial pulses. (In cases of suspected aneurism, examine also for equality or inequality of the two pupils.)

NOTE.—*In weak heart the radial pulse may be almost or wholly imperceptible; or only a proportion of the heart's contractions may produce blood-waves sufficiently strong to be propagated perceptibly to the radial artery, and thus the radial pulse may appear to be much slower than the rate of the heart's contractions; or the weak pulse may be affected by the patient's respiration, its beat being weakened by Inspiration and strengthened by Expiration. When a very weak pulse is unexpectedly felt, remember that it may be the pulse of the superficiales voli, the radial itself being in such cases behind the lower end of the radius instead of being in front of it.*

5. Between the beats of the pulse, test particularly the *Resistance of the artery to pressure.* Marked resistance may be due either to rigidity of the artery's coats or to high blood-pressure. Press the artery firmly against the bone, and examine the coats by rolling them beneath the finger.

6. In special cases take a sphygmographic tracing.

P.S.—*For teaching purposes it has probably been of advantage to adopt the order given above, and to begin the notes upon both Lungs and Heart with Auscultation; but in describing an actual case a clinical clerk will always find it expedient to adopt the reverse order, and therefore to begin with Inspection and finish with Auscultation.* (*See note at end of Part II.*)

PART II.

CLASSIFICATION OF HEART DISEASES AND DISORDERS.

In health the heart maintains a marked disparity of blood-pressure in the two sides of the circulation, Arterial and Venous, the pressure of the blood within the Arteries being kept comparatively high, and that within the veins very low. Anything

which diminishes the functional power of the heart will lead to a lowering of the Arterial and a raising of the Venous pressure. Among the symptoms of such cardiac debility there will accordingly be found some, such as faintness, which are referable to the Arterial defect, and others, such as dropsy, which are due to the Venous excess.

The following is a brief note of the various conditions, functional and organic, which may thus cause disturbance and debility of the Heart's action.

I. Nervous or Functional Disorders of the Heart.

Both Heart and Blood-vessels are under the control of the Nervous System, the Heart being acted upon through the nerves, both by centres which accelerate, and by centres which inhibit or control, its movements. A similar control is exercised on the Blood-vessels by the Vaso-motor system of nerves. Nervous derangements of various sorts tell upon the Heart in a great variety of ways. They may cause the action to be too rapid or too slow; or to be tumultuous and irregular as in palpitation; or they may so debilitate the Heart's muscular substance as to lead to the establishment of a tendency to progressive dilatation, with increasing, and possibly dangerous, debility. In the great majority of cases such Nervous derangements produce Disturbances of the Heart, like violent Palpitation, which are more alarming than really dangerous; but in a few cases, as in Exophthalmic Goitre, the Cardiac Debility resulting from Nervous causes may be a source of great danger, and even a cause of death. The cause of such Nervous derangements may be found primarily in the great Nerve Centres, as in cases of emotional or hysterical disturbance; or they may be found in some Peripheral part, such as the Stomach or Reproductive Organs, where irritation may tell upon the Heart reflexly through the Nerve Centres; or, lastly, the condition may be a Hæmic one, in the first instance, such as Anæmia, or Toxæmia from Tobacco, Tea, or Alcohol. Such conditions of abnormality in the blood cause a deranged nutrition of the Nerve Centres which tells secondarily upon the action of the Heart.

The physical signs of this class of cases are usually those indicative of deranged rate and rhythm. They do not, as a rule, include alteration of Percussion note, or the development of Bruits, yet in many cases Bruits are developed—the Bruits of Debility—and, when Anæmia is the primary condition, the whole six of these Bruits may sometimes be detected on examination of the Neck and Præcordia. Apart from Anæmia, also, mere Nervous Debility, such as occurs in Exophthalmic Goitre, may lead to such dilatation of the Heart's chambers as to enlarge the area of cardiac dulness, and bring about the establishment of "Bruits of Disparity of size" at the Mitral or Tricuspid Orifice.

II. Mechanical Interference with the Heart's Action from without.

The effects of Pressure upon the heart from without are well seen in some cases of Pleurisy with Effusion on the left side of the chest. Here the Heart is often injuriously pressed upon, so that symptoms of Arterial type, such as weak or irregular pulse, faintness, and Cardiac dyspnœa, may appear; and, in rarer cases, symptoms of Venous type also, such as dropsy and cyanosis. This class of case as a rule yields no Cardiac Bruit on Auscultation, but Inspection may show the Heart to be pushed, and the Apex to be displaced, more or less towards the Right side. Another example of pressure from without is found in Pericarditis with Effusion, which gives rise to symptoms similar to the above. Among its physical Signs are to be reckoned especially the marked extension of the Cardiac Dulness, the muffling of the Heart Sounds, and the obscuring of the Apex Beat, which is often displaced somewhat upwards.

Acute Pericarditis without Effusion does not cause mechanical compression of

the Heart, yet in some cases it may be attended with danger, and may even lead to sudden death. Probably the interference with the Heart's action in such cases is brought about by the extension of the acute inflammation to the subjacent muscular substance. The leading Physical Sign of Acute Pericarditis without Effusion is the to-and-fro friction already described. Its leading symptom is pain in the Precordial region, often associated with more or less cough, considerable fever, and sometimes delirium. In severe cases of Acute Pericarditis there is generally more or less of Effusion.

After recovery from Pericarditis permanent adhesions of the two layers of the Pericardium remain. When these unite the Pericardial Sac to the Heart over its whole surface they interfere more or less with the Heart's action and may lead to hypertrophy and dilatation. It is seldom that Adherent Pericardium can be diagnosed from physical examination; but there are some cases in which the Pleura over the Pericardium has also been involved in inflammation so that the thin portion of Lung substance lying upon the Pericardial Sac is bound by adhesions on the one side to that sac and on the other to the costal parietes; when such adhesions of Pericardium and Pleura co-exist the skin over the Heart's apex is puckered in during the cardiac systole in a marked manner. This sign, together with indications of Hypertrophy and a history of Pericarditis, may sometimes render a diagnosis of Adherent Pericardium possible.

III. Valvular Lesions, Obstructive and Regurgitant.

These are the results of Acute or Chronic Endocarditis. The Bruits produced by them have already been fully considered in the First Part of the Circulatory System. It may be here repeated that, whilst a Systolic Bruit may either be the evidence of a Functional disorder of the Heart, or the sign of an Organic Valvular Lesion, a Diastolic or a Presystolic Bruit has only one possible interpretation, being always produced by Organic disease of the valve. In many cases valvular lesions will be found associated with marked Hypertrophy or Dilatation of the Heart's chambers, and, therefore, with the evidences, on Percussion and Palpation, of enlargement of the Heart, and increase of its muscular power.

IV. Diseases of the Muscular Substance.

Of these diseases the chief representatives are Acute and Chronic Myocarditis, and Fatty Degeneration of the Heart. They constitute a very dangerous class, and, in the case of Fatty Heart, death sometimes is sudden. Even here, however, in the majority of cases, death is brought about slowly by the increasing debility and dilatation of the Heart's chambers, and the development of dropsical symptoms. Great feebleness and irregularity of pulse often attend upon this class of case, and Percussion frequently yields distinct evidence of Cardiac Enlargement. Bruits are not necessarily present, and, when developed, they are to be referred to the dilatation of the Cardiac chambers, and of the Auriculo-ventricular orifices. They are Bruits of Disparity of Size.

V. Obstructions in the Peripheral Circulation.

(*a*) The peripheral blood-vessels of the **Systemic Circulation** are apt, in Chronic Bright's Disease, to present an unusual amount of resistance to the onward course of the blood. This has been shown to be due, in part at least, to the development of new Connective Tissue round the walls of the smaller blood-vessels—an Arterio-capillary Fibrosis. To overcome this resistance the Left Ventricle of the Heart often becomes hypertrophied in a marked manner, without any Bruit making its appearance. Owing to the obstruction in front and the Cardiac Hypertrophy behind, the Arteries are subjected to an abnormally high blood-pressure, and if their

walls be diseased, a rupture of a Cerebral Artery may take place, with death of the patient from Apoplexy. This is a common termination of Chronic Bright's Disease.

(*b*) Obstruction in the capillaries of the **Pulmonary Circulation.** This is common in such diseases as Chronic Bronchitis, which interfere with the supply of Oxygen to the blood in the Lungs. Perhaps the impediment may be referred to the abnormality of the blood thus imperfectly oxygenated. It seems to be the case that an abnormal blood does not circulate so freely through the capillaries as a normal blood. The Pulmonary Circulation being thus impeded at its periphery, the Right side of the Heart soon begins to feel the resistance to the outward flow of blood from it. Sometimes it becomes hypertrophied to a considerable extent, but, in the majority of cases, Dilatation sets in early and becomes eventually marked, so that a Bruit of Disparity of Size is established, owing to Regurgitation at the Tricuspid Valve. Soon also the Left chambers of the Heart share in the Dilatation, owing probably to mal-nutrition. Dropsy and Cyanosis may in the longrun be brought about by Chronic Bronchitis, and the case in its physical signs, as well as its symptoms, may bear a close resemblance to one of advanced Mitral Regurgitation.

VI. Congenital Malformations of the Heart.

These are frequently the results of Endocarditis developed in the Heart of the Fœtus in Utero. The commonest example is the Contraction of the Pulmonary orifice thus produced—a lesion which is indicated, as explained in the First Part of the Circulatory System, by a systolic bruit over the Pulmonary Artery. The contraction of the Pulmonary orifice tends to interfere with the due closing up of the Interventricular Septum of the Fœtal Heart, so that the blood of the two sides is apt to get freely mixed. In other cases, and owing to other causes, the Foramen Ovale in the Interauricular Septum remains patent and permits of similar admixture. Another malformation which deserves mention is Patency of the Ductus Arteriosus; this has been known to lead to the formation of an aneurism upon the Pulmonary Artery and to incompetency of the Pulmonary Valve. Even when not thus complicated, it is sometimes associated with a thrill and a bruit in the second left intercostal space, which is constant and continuous with waves of varying loudness, as represented in this diagram :—

In other cases it is said to produce a simple Systolic Bruit and thrill in the same region. There are other Congenital changes which cannot here be enumerated.

It may be said that, in their results, Congenital defects greatly interfere with the patient's growth and development, that they are frequently associated with a marked degree of Cyanosis and clubbing of the nails and finger-tips, and that patients presenting them usually die young.

VII. Aneurism of the Aorta.

Over an aortic aneurism there may be, on Inspection, Bulging of the anterior wall of the chest in the region of the Aortic Arch—the region above a line drawn along the superior margins of the Third Costal Cartilages; on Palpation, there may be Heaving Pulsation; on Percussion, there may be distinct dulness; and on Auscultation, there may be a Systolic, or in very rare cases a Double, bruit. Alongside of these Physical Signs there may be equally well-marked Symptoms, such as Dyspnœa from pressure on the Trachea, with its characteristic Leopard growl and Trumpet Cough; or Dysphagia from pressure upon the Œsophagus; or Pains in the back from pressure upon and erosion of the Vertebræ; or Spasm of the Larnynx or Aphonia, from pressure on the left Recurrent Laryngeal Nerve; or Difference of the Pupils from

pressure upon the sympathetic nerves; or Difference in Strength, or Want of Synchronism in, the two Radial pulses; or occasional Hæmoptysis if the Aneurism has begun to "weep."

But it must be remembered that Aneurism sometimes exists with few or no Physical Signs or Symptoms. It has been well said that some aneurisms yield both Physical Signs and Symptoms; others have Symptoms without Physical signs; others have Physical Signs without Symptoms; and, lastly, some have neither Physical Signs nor Symptoms.

Addendum as to the Method of Examining Heart Cases.

The following method will be found to be convenient in practice:—

1. Let the Examiner carefully feel the Radial Pulse of the Patient, remembering as he does so that its frequency, rhythm, tension, etc., afford invaluable indications as to the condition of the Heart and general circulation.
2. If anything in the Pulse should excite suspicion as to the Heart, let the Examiner make note of the complexion, colour of lips, etc., and if there is any trace of Cyanosis let him enquire about swelling of the ankles.
3. When the patient has stripped let the Examination be proceeded with, in the following order:
   - A. Inspection (*a*) of the Præcordia; (*b*) of the Aortic Region; (*c*) of the Great Vessels at the root of the neck.
   - B. Palpation (*a*) of the Great Vessels at root of neck; (*b*) of the Aortic Region; (*c*) of the Præcordia. Let Palpation be concluded with the fixing of the apex beat by the points of the fingers.
   - C. Auscultation. Place the stethoscope (*a*) over the Apex beat; (*b*) over the Third left Costal Cartilage at its junction with the Sternum; (*c*) over the centre of the Tricuspid area. If a bruit is heard over any one of these situations time it, and then make note of its area and extent of propagation.
   - D. Percussion. Percuss out the area of cardiac dulness, superficial and deep. Measure its base transversely, and note how far it extends upwards, and to the right and the left.
4. Having completed the examination of the Heart itself, it will be well, if Heart Disease exist, that the Examiner should return to the examination of the arterial and venous circulation. He must make a Prognosis as well as a Diagnosis. Auscultation will have helped him most with the Diagnosis, but for the Prognosis he will have to consider the Effects which the lesion is producing upon the Heart itself, and upon the general circulation. Much Hypertrophy or Dilatation are serious indications, and still more serious are Cyanosis and Dropsy, with shortness of breath and cough, and weak, irregular pulse. In uncomplicated Aortic Regurgitation the pulse will often indicate whether the amount of regurgitation is slight or severe.

EDINBURGH, *October 1900.*