

A practical treatise on the diseases of the respiratory organs : including diseases of the larynx, trachea, lungs and pleura / by Charles J.B. Williams . With numerous additions and notes by Meredith Clymer.

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Williams, Charles J. B. 1805-1889.
Clymer, Meredith, 1817-1902.

Publication/Creation

Philadelphia : Lea and Blanchard, 1845, ©1844.

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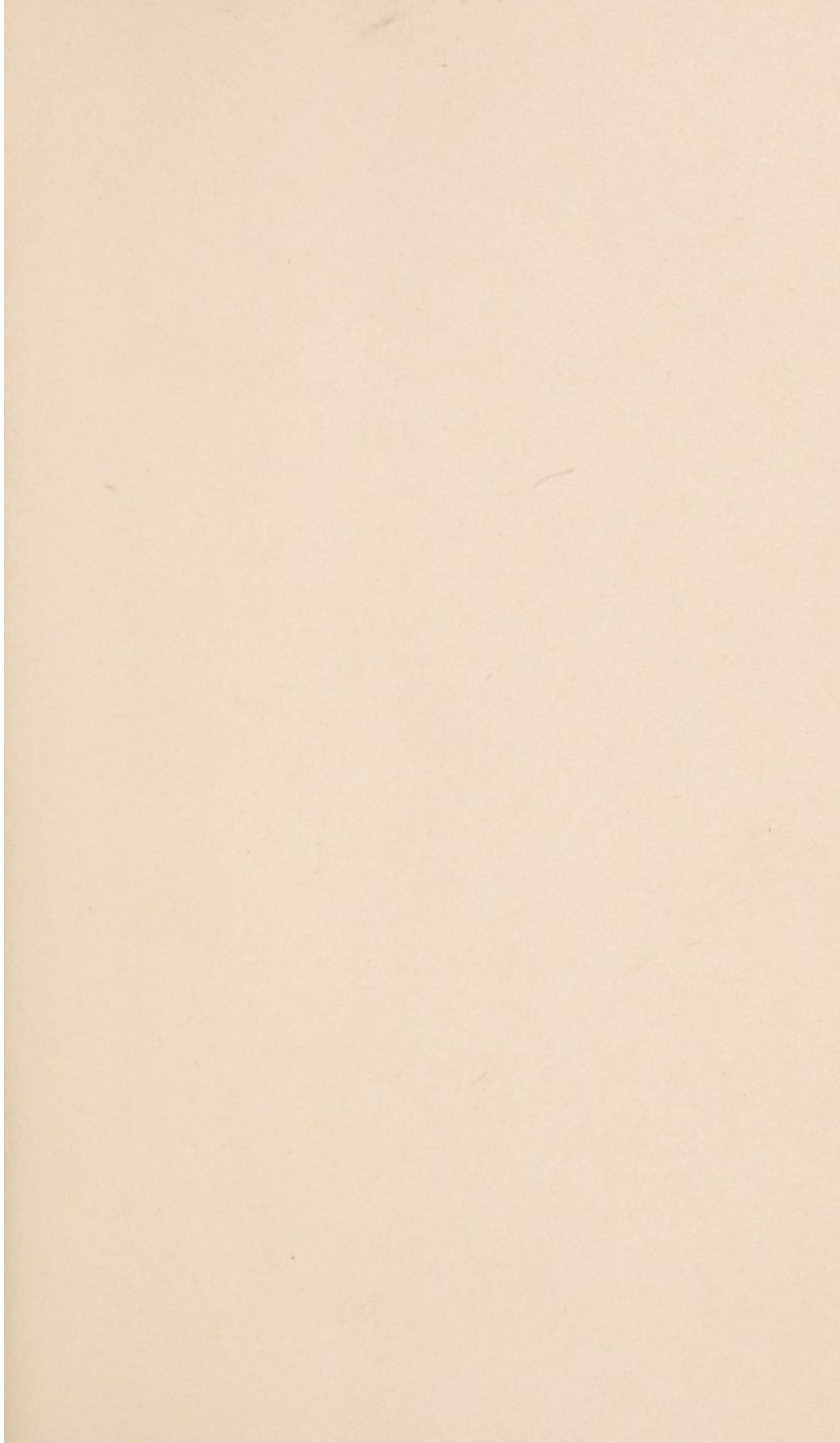
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PHYSIOLOGICAL

DISEASES

RESPIRATORY ORGANS

OF THE

RESPIRATORY SYSTEM

AND

ADJACENT

ORGANS



BY

W. H. WELLS, M.D.

A
PRACTICAL TREATISE
ON THE
DISEASES
OF THE
RESPIRATORY ORGANS:
INCLUDING DISEASES OF THE
LARYNX, TRACHEA, LUNGS AND PLEURA.

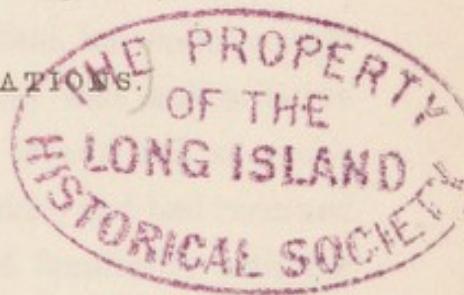
BY
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WITH NUMEROUS ADDITIONS AND NOTES,

BY
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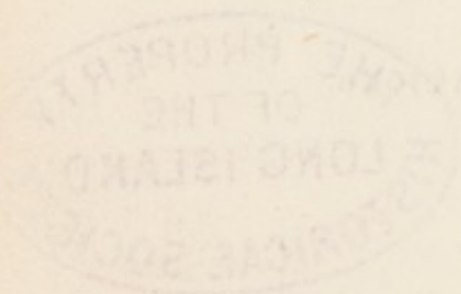
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PHILADELPHIA:
LEA AND BLANCHARD.
1845.

THE
PRACTICAL TREATISE
ON
DISEASES
OF THE
RESPIRATORY ORGANS:
IN
LARYNGITIS, BRONCHITIS, AND PNEUMONIA.

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1844

PREFACE
OF THE AMERICAN EDITOR.

THE popularity of the Essays on the Diseases of the Organs of Respiration, contributed by Dr. Williams to the "Library of Practical Medicine," edited by Dr. Tweedie, has induced the American publishers to present them in a separate form to the medical public. Written several years subsequently to the "Lectures on the Diseases of the Chest," they embody the more mature experience of the author, besides being presented in a more available form.

In issuing them as a separate publication, various additions became necessary. The whole work has been carefully revised from the Lectures of Professor Williams on these Diseases, which have just been completed in the London "Medical Times." Much new matter has been added to every section, and several new chapters introduced. In doing this the Editor has endeavoured to maintain as far as possible the practical and authoritative character of the work; and he has sought to add not so much that which was new, as that which was valuable, and had received the sanction of the profession. A constant familiarity with the hospitals of Europe and this country for many years, and his connection for some time with one of the largest medical institutions of this country—the Philadelphia Hospital—have given him a practical acquaintance with the subject matter, and enabled him to verify the truth of the statements of the various authorities in this department of internal pathology. His additions will be found inclosed in brackets, thus [].

The chief sources from which he has drawn his materials are the works of Louis,* Grisolles,† Piorry,‡ Rilliet and Barthez,§ Valleix,|| &c. The synoptical tabular statements have been modified from the admirable manual of Dr. Walshe.¶

The Editor ventures to hope that the present treatise will be found a safe practical guide to the student and practitioner.

M. C.

230 Spruce street,
December, 1844.

* Recherches, &c. sur la Phthisie, &c. Par P. C. A. Louis. 2e edition. Paris, 1843.

† Traité Pratique de la Pneumonie, &c. Par A. Grisolles, D. M. P. Paris, 1841.

‡ Traité de Médecine Pratique et de Pathologie Iatrique ou Médicale. Par P. A. Piorry. (T. iii. Angiairopathies.) Paris, 1843.

§ Traité Clinique et Pratique des Maladies des Enfants. Par MM. Barthez and Rilliet. Paris, 1841.

|| Guide du Médecin Praticien, &c. t. i. & ii. Maladies des Voies Respiratoires. Par F. L. J. Valleix. Paris, 1842.

¶ The Physical Diagnosis of Diseases of the Lungs. Phil., 1843.

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DISEASES
OF
THE RESPIRATORY ORGANS.

CHAPTER I.

ON THE DIAGNOSIS OF DISEASES OF THE LUNGS.

THE knowledge which we possess of the pathology and diagnosis of diseases of the respiratory organs, and consequently of a rational method of treating them, is so entirely of modern origin, that it would be useless in a practical work to refer to the writings of past ages for information on these subjects. The essential phenomena and the products of disease were, until lately, too little understood even to be described accurately; hence the descriptions and names of the older writers, however minutely given and dogmatically applied, are vague and equivocal to the modern reader.

The great improvement that has taken place of late years in our knowledge of diseases of the chest, and consequently in their treatment, has mainly arisen from the careful cultivation of pathological anatomy, and the successful application of physical means of diagnosis in connection with it; in both these departments, especially the latter, we must give the pre-eminence to Laennec, whose *Traité de l'Auscultation Médiate*, may be regarded as at once the *novum organum* and the *principia* of our knowledge of thoracic diseases. The results and the means of his discoveries have been so far extended and improved by subsequent investigators, as to have changed the subject from being one of the most obscure to be among the most intelligible in practical medicine. It was the defect of Laennec's practice to trust entirely to the physical signs, often to the exclusion of the general symptoms, which are always, especially in regard to the treatment, of the utmost importance. Both sets of signs have their value, and it will be our especial object to point out the modes of appreciating each in the study and treatment of the special diseases; to show, as far as

is possible, their relative value, by examining them more fundamentally than has generally been done; and, whilst we pay due respect to authentic records of experience, of whatever kind, to make them still more profitable and instructive by careful analysis and generalization. It is necessary, however, to study the structure of the pulmonary apparatus; the form, position, and connection of its several parts; their relation to physical laws, and the combinations of these laws in their statical and dynamical forces, that is, at rest and in motion. But in doing this it is soon discovered that the object of our study is more than a mere machine, and that it possesses properties, and is governed by laws which are not met with in inanimate matter. We have the *vital properties*, *sensibility*, *irritability*, *contractility*, added to the mechanism; we have a *vital chemistry* pervading the materials. Besides the chest, which is mechanically enlarged and diminished, and the lungs and their tubes, which are at the same time expanded and compressed, and the heart and its hydraulic pipes through which liquid is propelled, there are, also, in these several parts, the *vital* properties, which not only bind them together in special and complex relations, but connect them also with other organs and members of the body. Here, again, we see the sources of the two classes of signs of health or disease: the *physical*, confined to the organs and their physical or mechanical properties as exhibited in these organs; and the *vital* or *general* symptoms, the result of vital properties, which are not confined to the part, but may extend their operation and seat over the whole frame. Now, as in the maintenance of health, and in the production or removal of disease, each set of properties is concerned both as causes and as signs, so the necessity of duly appreciating both classes must be apparent.

It being presumed that the reader has studied the anatomy and physiology of the general structure, functions, and relations of the chest and its organs, the next object is to become acquainted with the signs or symptoms, through which, in the living body, we can judge of the condition of the various parts of the structure, and of the performance of their several functions, and thus, through which, we can distinguish health and disease. The condition of the chest and its organs may be examined through two classes of properties, the *physical* and the *vital*. The physical properties are studied, especially through vision, tact and hearing. The vital phenomena are studied in the condition of the functions, which are complex properties, or actions dependent on vitality operating in physical structure.*

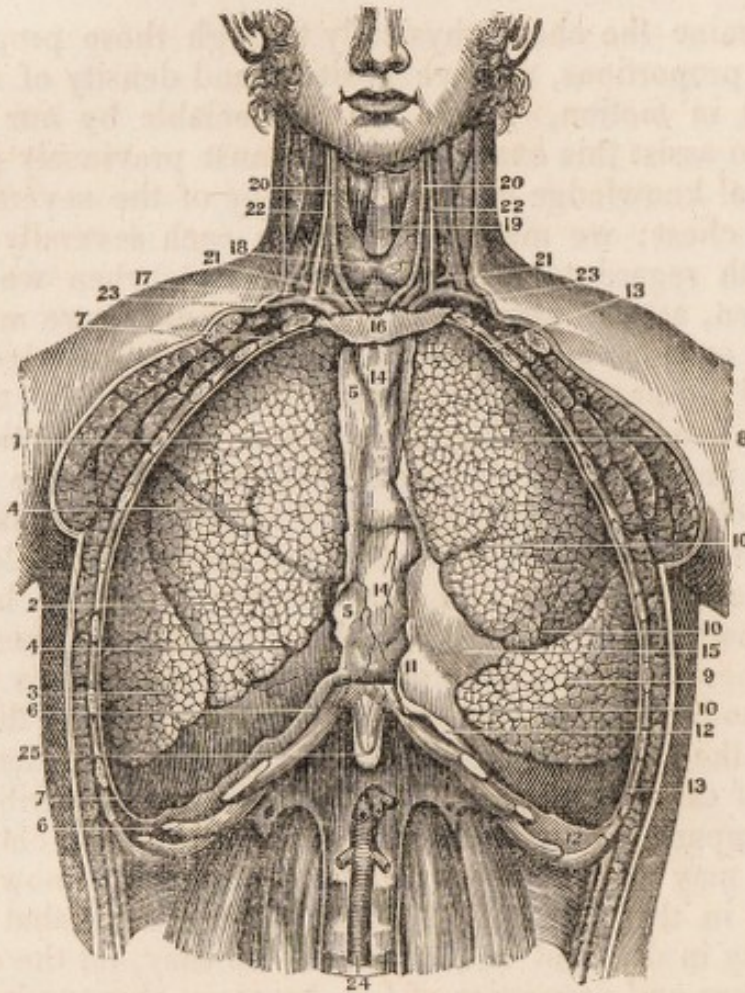
* [For further information on the distinction and proper application of these terms, consult Williams' Principles of Medicine, Am. ed., by Dr. Clymer, Phil., 1844, p. 344, et seq.]

SECTION I.

PHYSICAL EXAMINATION OF THE CHEST.

WE examine the chest physically through those properties of form, size, proportions, relative position and density of its parts, at rest and in motion, which are appreciable by our external senses. To assist this examination we must previously possess a good general knowledge of the topography of the several organs within the chest; we must know where each severally lies and reaches with regard to the exterior; so that, when we inspect, feel, or listen, at the different regions of the chest, we may define the general outlines of the organs within. This knowledge must be acquired by personal observation, which should be exercised both on the dead and on the living body. In examinations after death, the position of the organs with regard to the exterior should be observed. The moment the sternum is raised, and before the lungs collapse (which may be prevented by closing the nostrils), the extent to which these organs cover the heart and reach downwards, the position of the air and blood-vessels, the height of the diaphragm, and of the abdominal viscera beneath, should be noticed by the student; and he can transfer these various sites to the marks or lines of the exterior, such as the nipples, the edges of the pectoral muscles, the number of the ribs. This habit of comparing the outside with the inside of the chest in the dead body may not, however, furnish a perfect knowledge of what exists in the bodies of the living; for besides that there is much variety in different individuals, there may, on the cessation of the motions and properties of life, be some changes in the size and condition of the organs, and these changes may vary according to the mode of death. Thus it is probable that the diaphragm, relaxed by death, permits the abdominal viscera to encroach on the cavity of the chest further than during life; and the volume and position of the heart and lungs will be affected, not only by this circumstance, but by the condition of the circulation and respiration at the time of death, by the influence of time and temperature on the stiffening of the muscles, and by other changes which immediately succeed death, such as the disengagement or absorption of gases by which the intestines are distended, which vary much in different cases. It is well to be aware of these modifying circumstances, which can be appreciated only by the habit of personal observation: and it is by such individual experience, rather than from rules and descriptions, that a knowledge of the topography of the organs can be obtained in the study of the dead body. [See Figs. 1 & 2.]

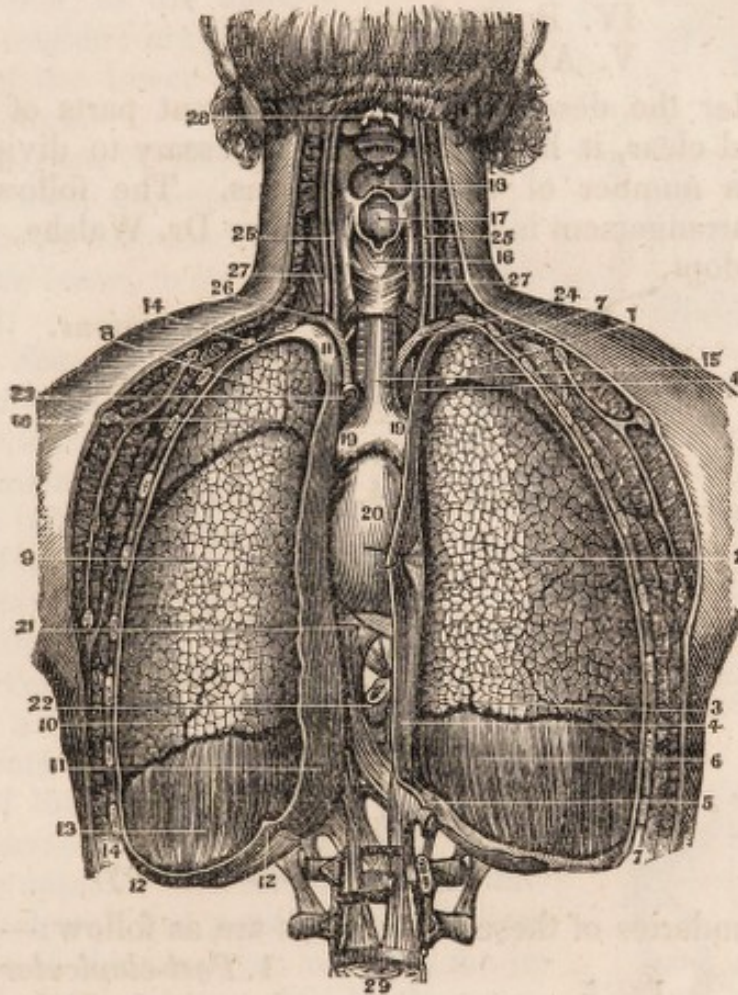
[FIG. 1.]



ANTERIOR VIEW OF THE THORACIC VISCERA IN SITU, AS SHOWN BY THE REMOVAL OF THEIR ANTERIOR PARIETES.

- | | |
|--|---|
| 1. Superior Lobe of the Right Lung. | 13. Left Pleura Costalis. |
| 2. Its Middle Lobe. | 14.14. The Middle Space between the Pleuræ,
known as the Anterior Mediastinum. |
| 3. Its Inferior Lobe. | 15. The Pericardium. |
| 4.4. Lobular Fissures. | 16. Fibrous Partition over which the Pleuræ
are reflected. |
| 5.5. Internal Layer of the Costal Pleura form-
ing the Right Side of the Anterior Me-
diastinum. | 17. The Trachea. |
| 6.6. The Right Diaphragmatic Portion of the
Pleura Costalis. | 18. Thyroid Gland. |
| 7.7. The Right Pleura Costalis on the Ribs. | 19. Anterior Portion of the Thyroid Carti-
lage. |
| 8. Superior Lobe of the Left Lung. | 20. Primitive Carotid Artery. |
| 9. Its Inferior Lobe. | 21. Subclavian Vein. |
| 10.10. Interlobular Fissures. | 22. Internal Jugular Vein. |
| 11. The Portion of the Pleura Costalis which
forms the Left Side of the Anterior
Mediastinum. | 23. Brachio-Cephalic Vein. |
| 12. The Left Diaphragmatic Portion of the
Pleura Costalis. | 24. Abdominal Aorta. |
| | 25. Xyphoid Cartilage.] |

[FIG. 2.



POSTERIOR VIEW OF THE THORACIC VISCERA, SHOWING THEIR RELATIVE POSITIONS BY THE REMOVAL OF THE POSTERIOR PORTION OF THEIR PARIETES.

- | | |
|--|---|
| 1.2. Upper and Lower Lobes of the Right Lung. | 14.14. The Left Pleura Costalis on the Parietes of the Chest. |
| 3. Interlobular Fissures. | 15. The Trachea. |
| 4. Internal Portion of the Pleura Costalis, forming one of the Sides of the Posterior Mediastinum. | 16. The Larynx. |
| 5. Twelfth Rib and Lesser Diaphragm. | 17. Opening of the Larynx and the Epiglottis Cartilage in Situ. |
| 6. Reflection of the Pleura over the Greater Muscle of the Diaphragm on the Right Side. | 18. Root and Top of the Tongue. |
| 7.7. Right Pleura Costalis adhering to the Ribs. | 19.19. Right and Left Bronchia. |
| 8.9. The two Lobes of the Left Lung. | 20. The Heart enclosed in the Pericardium. |
| 10.10. Interlobular Fissures. | 21. Upper Portion of the Diaphragm on which it rests. |
| 11.11. The Left Pleura, forming the Parietes of the Posterior Mediastinum. | 22. Section of the Oesophagus. |
| 12.13. Its Reflections over the Diaphragm on this side. | 23. Section of the Aorta. |
| | 24. Arteria Innominata. |
| | 25. Primitive Carotid Arteries. |
| | 26. The Subclavian Arteries. |
| | 27. Internal Jugular Veins. |
| | 28. Second Cervical Vertebra. |
| | 29. Fourth Lumbar.] |

[The methods employed in the physical examination of the chest are:—

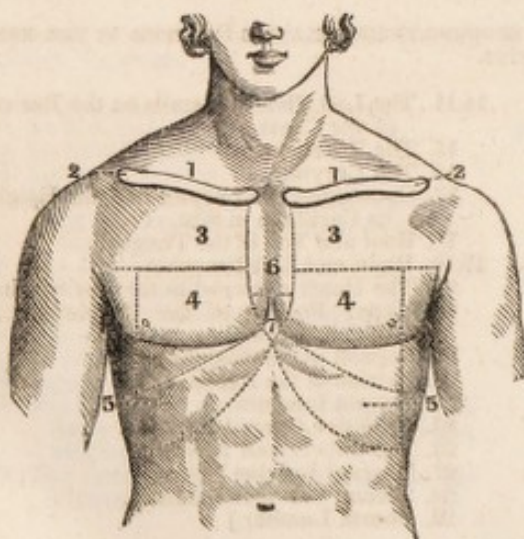
- I. INSPECTION;
- II. APPLICATION OF THE HAND;
- III. MENSURATION;
- IV. PERCUSSION;
- V. AUSCULTATION.

To render the description of the different parts of the chest precise and clear, it has been found necessary to divide its surface into a number of artificial regions. The following topographical arrangement is the one given by Dr. Walshe, and which we shall adopt.

<i>Regions.</i>	<i>Sub-regions.</i>
a. Anterior.	{ 1. Post-clavicular. { 2. Clavicular. { 3. Infra-clavicular. { 4. Mammary. { 5. Infra-mammary. { 6. Upper sternal. { 7. Lower sternal.
b. Posterior.	{ 8. Upper scapular. { 9. Lower scapular. { 10. Infra-scapular. { 11. Interscapular.
c. Lateral.	{ 12. Axillary. { 13. Infra-axillary.

The boundaries of these sub-regions are as follow:—

FIG. 3.



1. *Post-clavicular*.—Above, the edge of the trapezius muscle; below, the clavicle; outside, the head of the humerus; inside, the base of the neck.

2. *Clavicular*, corresponds precisely in its outline to the clavicle.

3. *Infra-clavicular*.—Above, the clavicle; below, the third or fourth rib; outside, the outer edge of the deltoid muscle; inside, the edge of the sternum.

4. *Mammary*.— Above, the third or fourth rib; below, the seventh or eighth; outside, a line vertically drawn about an inch and a half external to the nipple; inside, the edge of the sternum.

5. *Infra-mammary*.—Above, the seventh or eighth rib; below a curved line corresponding to the edges of the cartilages of the false ribs; outside, as the mammary sub-region; inside, the margin of the lower fourth of the sternum.

6, 7. *Sternal*, corresponds precisely to the sternum; the *upper*, to its superior two thirds; the *lower*, to its inferior third.

8, 9. *Scapular*, has the same limits as the scapula; the *upper*, corresponds to the supra-spinata fossa, the *lower*, to the infra-spinata fossa.

10. *Infra-scapular*.—Above, a line drawn transversely on the level of the angle of the scapula; below, a similar line on the level of the twelfth dorsal vertebra; outside, a line falling vertically downwards from the lower part of the outer border of the scapula; inside, the spine.

11. *Interscapular*.—Above, a line drawn from the spine of the scapula to the vertebræ; below, a line passing inwards from the angle of the scapula; outside, the inner border of that bone; inside, the spine.

12. *Axillary*.—Above, the angle of the axilla; below, a line drawn transversely about two inches below the level of the nipple; anteriorly, the line bounding the mammary sub-region outside; posteriorly, the external border of the scapula.

13. *Infra-axillary*.—Above, the lower edge of the axillary sub-region; below, a line corresponding to the edge of the false ribs; anteriorly, the external border of the mammary and infra-mammary sub-regions; posteriorly, the external border of the infra-scapular sub-region.

FIG. 4.

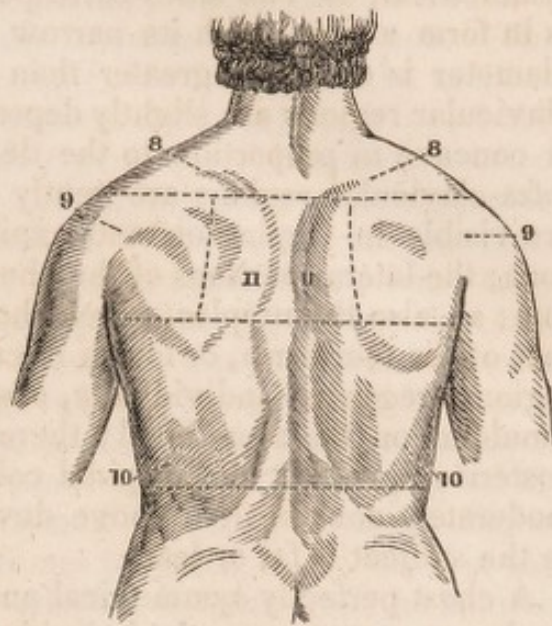
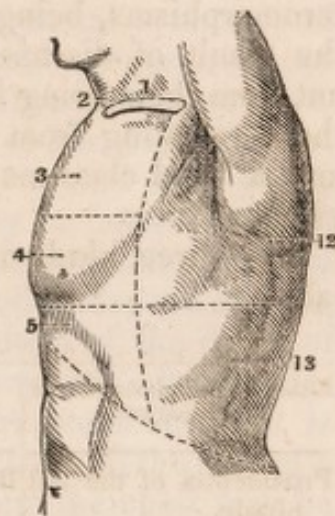


FIG. 5.



I. **INSPECTION**.—The patient, sitting or standing, [or lying, on a perfectly even plane,] with his arms, trunk and legs in symmetrical positions, and his chest, if possible, entirely uncovered, and exposed to a good light, we view it in front, behind, and from above, and carefully mark its form and proportions; and the corresponding prominences and depressions of the two sides [of

the chest must be closely *compared*.] A healthy chest is nearly symmetrical, the two sides corresponding in shape and size; [and is in form a cone, with its narrow end uppermost; its transverse diameter is evidently greater than its antero-posterior; the post-clavicular regions are slightly depressed; the lower sternal region is concave in proportion to the development of the subject; the infra-clavicular regions are gently convex; the intercostal spaces are visible in inspiration and expiration, except in very fat persons; the lateral portions of the chest equidistant from the median line; so, also the nipples, which should be both on the same level, that of the fourth rib, or fourth intercostal space; the various sub-regions, regarded individually, should be regularly shaped; the shoulders on the same level; there should be neither anterior nor posterior deviation of the spinal column; and the vertebral sulcus moderately convex from above downwards, is more or less deep, as the subject is fat or lean.

A chest perfectly symmetrical and regularly formed is comparatively very rare, even in individuals who have never laboured under pectoral disease, occurring only in about one in every five persons taken indiscriminately. These partial deformities or heteromorphisms, being compatible with health, and not necessarily the result of disease, are termed *physiological*, and are important from their being liable to be mistaken for and confounded with those resulting from disease, and which are termed *pathological*; and a third class may belong to either description, according to circumstances.

The three kinds of heteromorphism are shown in the annexed table.

HETEROMORPHISMS.

Either Non-Pathological or Pathological.	Non-Pathological only.	Pathological only.
Procidentia of the left nipple. General bulging of left side anteriorly. Bulging of left sterno-mammary regions. Lateral deviation of the spine.	Bulging of the infra-scapular regions, if limited to them posteriorly. Sternal depression. Prominence of right side posteriorly. Prominence of left side anteriorly. Sternal prominence.	Marked depression of infra-clavicular region. Infra-clavicular bulging. Procidentia of the right nipple. Antero-lateral depression. Considerable diminution of circumference superiorly as compared with inferiorly. Sterno-mammary prominence of left or right side. General anterior prominence of left side. Prominence of post-clavicular region. — <i>Except in the rarest instances, pathological.</i> General diminution of transverse diameter of chest; producing, as it increases, the cylindrical form.]

The right side is, however, almost always slightly larger than the left, especially at its lower portion, where the difference of measured circumference generally amounts to half an inch. This preponderance in favour of the right side is partly to be ascribed to the contents, the unyielding mass of the liver; but it is probably also connected with a law which pervades the animal creation, giving a superiority of strength and development to the right side. It is supposed by Dr. Stokes and M. Woillez, that the increased development of the right side is rather a consequence than a cause of the greater strength, and consequent use of its muscles; and they say that the proof of this is seen in the exceptional cases of left-handed persons, in which the left side has a superiority in size. We have observed, on the other hand, in most healthy chests, an advantage on the left side in point of height: the apex of the left lung, and corresponding portion of the chest, rise a trifle higher than those of the right. We are not prepared to say whether this be an original conformation, or whether it result from the habitual inflation of the stomach, and the unyielding mass of the heart on the left side giving the chest a greater tendency to upward expansion. When these slight exceptions are known, they will not mislead, and they scarcely detract from the general symmetry of the chest. Whenever there is any considerable departure from this degree of symmetry, or correspondence between the two sides, it becomes pretty certain that there either is, or has been disease.

It has been stated that the chest should be viewed from *above*, as well as from before and behind. This may be done when the patient is seated on a low seat, with the head a little inclined forward, the observer standing behind or on one side, and looking down on the shoulders. A view is thus obtained of the depth of the chest from front to back, and in this way may often be detected between the two sides a want of correspondence, that is not perceptible by the ordinary modes of inspection. If the patient's strength do not permit him to stand or sit up, the chest may be inspected when he is lying on his back, and this may be done by the observer taking his position, not only at the side, but also at the foot and at the head of the bed, from which the corresponding parts of the two sides can be better seen.

The inspection of the chest is to be applied not only to its statical condition, but also to its motions. Whilst, therefore, we are inspecting the chest, we desire the patient to breathe in various degrees; and with eyes directed to corresponding points of the two sides, we watch the amount and equality of the motions. If the chest is a healthy one, we see the motions as uniform as the chest is symmetrical: the clavicles, scapulæ and upper ribs rise; the lower ribs rise and spread; and the abdomen swells as the diaphragm descends at each inspiration. Attentively watching the chest will often also enable us to trace the limits of

some of these movements, so as to indicate the boundaries of the chest. Thus the lower ribs are pressed outwards by the displacement of the abdominal viscera at each descent of the diaphragm, and constitute a fulness below the limits to which the lungs descend, with a slight flatness or hollow above. These appearances have been pointed out by Dr. Edward Harrison, as visible indications of the height of the diaphragm and liver. The intercostal spaces and the hollow above the clavicles are also fit marks for this mode of comparison between the two sides. They are strongly marked during full inspiration; and are liable to be more so than usual where the entry of air into the lungs is difficult from obstruction of the tubes, and less so than usual when the obstruction is more in the tissue of the lung from internal effusion or external pressure. There are many other useful details which are soon learned by practice, when the principles of the examination are properly understood.

There are some general varieties of disordered respiration, which are determined by watching the motions of the chest. Healthy or perfect respiration is both diaphragmatic and costal; but under the influence of disease, the motions may be imperfect, and confined either to the ribs or to the diaphragm. Thus, when the diaphragm is prevented from descending by acute pain in it or below it, or by pressure from below, the respiration is wholly performed by the raising of the ribs; and is called *heaving*, *thoracic* or *costal* breathing. When, on the other hand, the ribs are immovable in consequence of pain, ossification of the cartilages and ligaments, or paralysis of the intercostal muscles, the breathing is wholly *diaphragmatic* or *abdominal*.

The movements of respiration may be *partial*, while one side of the chest is seen to move much less than the other, or when part of one side moves imperfectly; and this partiality of movement may have its cause in the walls, or, as more usually, it may proceed from impermeability of the corresponding portions of lung, in consequence of various diseases. Thus, when lymph or tuberculous matter in the tissue of the lung, an obstruction of the bronchi, an effusion into or a contracted adhesion of the pleura, prevent the inflation and collapse of a part of the lung, the corresponding walls of the chest will be resisted in their motions, and will be fixed in proportion. Thus in phthisical patients we often see the ribs below the clavicles scarcely moving in respiration, and often sunk on one side: in pneumonia and pleurisy, the lower ribs are more commonly fixed. It is proper to mark further how they are fixed; whether in a state of dilatation or in one of collapse; whether the affected part remains full after expiration, or is still sunk after inspiration, or whether it is fixed in an intermediate state: we may thus, in certain instances, go some way to distinguish between the different causes of pulmonary obstruction.

[The different morbid states of the chest discovered by inspection are as follows:—

A. Form.	B. Size.	C. Motions.
Expansion and Bulging. Retraction and Depression. Procidentia and Elevation. Curvature. Distortion.	The relative dimensions of the different portions of the thorax are altered by disease. These are more accurately ascertained by mensuration than inspection.	General. Partial.

SIGNS DISCOVERED BY INSPECTION.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Expansion.	Gradual and general detrusion of the walls of the chest, by a force acting from within outwards — the elasticity of the lung having been first destroyed.	The left side of the thorax; because its most usual cause (pleuritic effusion) is most common on that side.	Pleuritic effusion. Pleuro-pneumonia. Hydrothorax (extremely rare.) Pneumo-hydrothorax. Cancer of the pleura or lung. Hypertrophy of the lung. Pneumothorax. General hypertrophous emphysema. Extensive hæmothorax. Pneumonia.
Bulging.	The same cause acting locally.	<p>At either base; of- tenest the left.</p> <p>Infra-clavicular re- gion. Post-clavicular re- gion. Anterior surface generally. Mammary and cen- tral sternal re- gions. Seat, various. Infra-clavicular re- gion.</p> <p>Right hypochon- drium. Post-clavicular re- gion. Infra-clavicular re- gion.</p>	<p>{ Gravitating pleuritic effusion. Pleuro-pneumonia. Cancer of the pleura or lung.</p> <p>{ Hypertrophous em- physema.</p> <p>{ Circumscribed pleurisy. <i>Incipient</i> tuberculous dis- ease of apex of lung.</p> <p>{ Fatty liver.</p> <p>{ Pneumonia of upper lobe.</p>

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Retraction.	Long-continued pressure having reduced the lung to a very small size, the pleuritic fluid (the compressing material) is removed by absorption; the lung being unable to recover its previous bulk, the chest yields inwards under atmospheric pressure. The false membrane aids materially, through its characteristic force of contraction, in producing this result, by diminishing the bulk of the lung, not, as might be supposed, by actually dragging the wall of the chest inwards.	Most common on left side; for the same reason as expansion.	General pleuritic effusion, period of absorption. Pneumonia. Pleuro-pneumonia. Tuberculous disease. Infiltrated cancer of the lung.
Depression.	<p>1. The above causes acting locally.</p> <p>2. Contraction of pleuritic false membrane alone.</p> <p>3. Diminished volume of portion of lung consequent on changes occurring in its substance after tuberculization, or local suppuration.</p>	<p>Seat various.</p> <p>Anterior surface. Antero-lateral Posterior " Postero-lateral " Anterior and posterior surface.</p> <p>Infra-clavicular region. Post-clavicular region. Upper scapular region.</p>	<p>Circumscribed pleuritic effusion, period of absorption.</p> <p>General pleuritic effusion. Pleuro-pneumonia.</p> <p>Tuberculous disease. Evacuation of contents of an abscess. (Lanec.) Pneumonia. Chronic consolidation of the lung.</p>

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Procidencia.	The part lowered has been dragged downwards in consequence of retraction of the corresponding side of the thorax; increased, if lateral curvature of the spine occur.	The shoulder. The ribs, especially at their external aspect. The nipple.	Chronic pleurisy with retraction or considerable depression.
Elevation.		Shoulder of affected side.	Chronic pleurisy with retraction or considerable depression. (Very rare.)
Lateral Curvature.	Retraction of the side, and constant "leaning the body towards that side." (Lennec.)	Dorsal Spine; convexity more commonly to the right, because left pleurisy more common. The convexity of the curvature is always towards the healthy side.	Chronic pleurisy with retraction or considerable depression.
Distortion.	Retraction of the side; or local depression.	The ribs. The clavicle.	Chronic pleurisy with retraction or considerable depression. Tuberculous disease.
Diminished motions of expansion and elevation.	The instinctive avoidance of pain; paralysis of the muscles naturally producing the motions; a material obstacle in the condition of the pleura or lung.	More obvious at the lower than the upper parts of the chest; and most frequent on the left side.	Pleurisy at almost all its periods. Pleuro-pneumonia. Pneumonia. Extensive hypertrophous emphysema. Paralysis. Pleurodynia. Hydrothorax. Pneumothorax. Phthisis with extensive pleuritic false membrane.
Increased motions of expansion and elevation.	Muscular effort to overcome obstruction to the entry of air.	The chest generally.	Spasmodic asthma. Spasm of the glottis. Obstructive diseases of the larynx and trachea. Foreign bodies in air passages.
Jerking rhythm of motions of expansion and elevation.	Irregularity of muscular efforts.	The chest generally.	Spasmodic asthma. Spasm of the glottis. Obstructive diseases of the larynx and trachea. Foreign bodies in the air passages. Pleurodynia. Pleurisy in its earliest stage.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Altered rhythm of respiratory act; duration of expiratory movement notably exceeding that of the inspiratory.	Extreme difficulty in expulsion of air from pulmonary vesicles, in consequence of extensive and general dilatation of these, combined with decrease of the elastic contractility of the substance of the lung.	The chest generally.	Extensive emphysema.
Altered relation of movement of expansion to that of elevation; the former more or less proportionally diminished.		Either side of the chest.	Phthisis with abundant pleuritic false membrane. Pleurisy { Extensive effusion. Chronic, with retracted side. Emphysema. Pneumonia.
Extent and frequency of the general motions increased; duration and intensity of the respiratory murmurs much diminished.	Entry of air obstructed; violent muscular efforts made to overcome the impediment.	Chest generally.	Spasmodic asthma. Spasm of the glottis. Obstructive diseases of the larynx and trachea. Foreign bodies in air passages.
Diminution of partial or costal motions.	Mechanical obstruction originating either in the substance of the lung or in the pleura.	Most commonly observed in infra-clavicular and upper part of the mammary regions, on the right side, in phthisis; inferiorly, and on the left side, in pleuritic diseases.	Tubercles. Emphysema. Spasmodic asthma. Pleurisy, { plastic exudation; period of { effusion; retraction. Hydrothorax. Pneumothorax. Chronic consolidation of the lung.
Altered relation of costal to general motions; the former much diminished, the latter almost, or wholly unaffected.	Mechanical obstruction to costal motions; no notable cause of interference with the general motions existing.	Right side of the chest.	Tubercles. Chronic consolidation of the lung.
Fluctuation.	Movement of fluid contained in the pleura.	Lateral and inferior parts of the chest.	Pleuritic effusion, with considerable bulging of the intercostal spaces.]

[II. APPLICATION OF THE HAND.—By the gentle and even application of the palm of the hand to the surface of the chest, we ascertain the *form* of the various regions; the state of the *general*, and particularly the *partial motions* of the parietes; the amount of *vibration*, and the presence of *fluctuation* in the pleural cavities. The same precautions recommended for the performance of inspection are to be observed. To ascertain the amount of thoracic vibration, the patient should be placed in a horizontal position. Alterations of form and of motion are ascertained by the application of the hand. When the open hand is placed on a healthy chest, the impression of two sets of movements is conveyed; the one partial and the other general. To distinguish these accurately is very difficult, and no important information is to be obtained from it.

When a healthy person speaks, by applying the hand to the chest, a delicate vibratile tremor (*fremitus*) is perceived, and is marked in proportion to the gravity of the speaker's voice; it is stronger in the horizontal position; in thin than fat individuals; on the right than on the left side; anteriorly than posteriorly; behind than laterally; hardly perceptible in the infra-clavicular, and interscapular regions. It is almost invariably absent in children, and very frequently in women, and in all persons of weak and shrill voices. A similar vibration, (*tussive*,) though much less easily detected, occurs in the act of coughing.

The diagnostic signs furnished by *thoracic fremitus* or *vibration* depend on the modifications of the natural phenomena produced by speaking and coughing, and on its occurrence under other circumstances than those which physiologically cause it. Of the latter kinds are the vibrations attendant on the bubbling of air through fluid in the lung (*rhonchal*); by the rubbing together of plastic matter on the pleural surfaces (*rubbing*); and, lastly, by pulsation of the substance of the lung (*pulsatile*).

a. Vocal.—The natural fremitus caused by speaking may be either *increased* or *diminished*. By applying both hands, at the same time, one to each side of the chest, or upon each side successively, at short intervals, whilst the patient continues to speak uninterruptedly the same words in the same manner.

b. Tussive.—Affected in the same manner as the vocal.

c. Rhonchal.—The only rhonchus, according to Dr. Walshe, which is ever attended with a distinct sensation of fremitus, is the sonorous, when very intense.

d. Rubbing.—In the healthy state, the motions of the pulmonary and costal pleuræ are unattended with vibration. It is occasionally detected where loud sound friction exists; and the sensation conveyed is more rubbing than vibratile. Its intensity may be increased by making the patient breathe deeply.

e. Pulsatile.—A pulsatile movement of the lung, isochronous

with the pulsation of the heart, attended with a vibration of the surface, occasionally occurs.

Fluctuation.—The fluctuation of fluids in the cavity of the pleura, or in the lungs, may sometimes be perceived by the hands applied to the surface. The sensation is that of ordinary fluctuation, occasionally accompanied with fremitus. Its presence may be ascertained by the same means that we employ to detect fluid in an external abscess; or we may resort to succussion; or we may percuss the surface, by giving a quick sharp fillip in an intercostal space, perpendicular to the surface, and a sensation of fluctuation will be detected by a finger of the opposite hand applied firmly to the surface on the same space, at a short distance from the percussed point; or it may spontaneously occur, as an accompaniment to certain rhonchi, and it is in this case that the vibration is most marked.

SIGNS DISCOVERED BY APPLICATION OF THE HAND.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Increased vocal and tussive vibration.	Unnatural density of the pulmonary substance between the bronchi and the part examined.	Infra-clavicular and latero-inferior regions.	Tubercles. Pneumonia. Dilatation of Bronchi. Chronic consolidation of the lung. Pulmonary apoplexy. Pulmonary œdema (very slight.)
Diminished vocal and tussive vibration.	Decreased density of the pulmonary substance between the bronchi and the part examined, and hence decreased power of transmitting vibration from those tubes; or presence of a non-conducting material (air or liquid) in the pleura.	Latero-inferior regions; also infra-clavicular and mammary.	Pleuritic effusion. Pleuro-pneumonia, with some amount of effusion. Pneumothorax. Emphysema. Hydro-pneumothorax. $\left\{ \begin{array}{l} \text{simple;} \\ \text{fistulous.} \end{array} \right.$ Cancerous infiltration of the lung, with tumour.
Rhonchal vibration.	Strong vibratile motion of bronchial tubes communicated by pulmonary substance to the thoracic walls.	Central part of chest.	Bronchitis, with intense sonorous rhonchus.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Rubbing vibration.	Walls of chest set in vibration by friction of pleural false membrane.	Latero-inferior part of chest.	Pleurisy, periods of { Plastic exudation; Absorption, with or without retraction.
Pulsatile vibration.	Propagation of pulsations of heart through the lung in a semi-fluid condition of the lungs.	Anterior surface of either side.	Pneumonia. Cancerous tumour of the lung or pleura.
Simple fluctuation.	Motion given to fluid by alternate pressure with hands.	Intercostal spaces infero-laterally.	Pleuritic effusion, attended with considerable bulging of the intercostal spaces.
Peripheric fluctuation.	Wavy motion of fluid in pleura communicated to the fingers by quick sharp percussion of surface.	Intercostal spaces, infero-laterally or about middle height of chest.	Pleurisy, periods of { Gravitating effusion; Effusion with dilatation.
Fluctuation by succussion.	Rapid motion of fluid contained in pleura or pulmonary cavity.	Latero-inferior or antero-superior part of chest.	Hydro-pneumothorax. Tuberculous cavity of very large size.
Rhonchal fluctuation.	Undulation of fluid in cavity close to surface, produced by air passing through it.	Antero-superior part of chest.	Tuberculous cavity.

III. MENSURATION.—This is a more exact method of detecting inequalities between the two sides. It is generally practised by fixing with the finger a piece of tape by one end at the mesial line of the sternum, and passing it horizontally around the chest to the same point; then, by taking it off at the point where it crosses the spinous process of the dorsal vertebra, the length of two sides may be at once compared. Great care must be taken to pass the tape horizontally around corresponding parts; and attention should also be paid to the degrees of the respiratory act. The most accurate mode is to compare the measurements of the two sides, on a full inspiration and expiration as well as in the intermediate state; [or, the patient may be desired to hold his breath, so that any inaccuracy from motion of the chest will be obviated. In full-chested persons, a full inspiration produces an enlargement in the measured width of the chest of about one inch. Calm respiration does not sensibly affect it.] Dr. Stokes recommends the use of graduated

callipers to measure the depth and height of the chest, as well as its circumference, which alone is given by the tape. Such an instrument would doubtless afford more exact results; but it is not likely to be introduced into general use. We may mention that we have been in the habit of using the tape for the height also, by measuring from the bottom of the sternum to the hollow under the humeral end of the clavicles, and from the latter spot to the spinous process of one of the lower dorsal vertebræ. The measurement may also be practised from the top of the sternum downwards and outwards, to the margin of the ribs at either side. These expedients, together with the practice of inspection downwards on the shoulders for the antero-posterior diameter of the two sides, are generally sufficient to furnish the comparative dimensions of the sides of the chest. [With the following admeasurements the physician should be familiar, and in all doubtful cases should practice.

A. GENERAL.

- a. Circular. 1. Opposite ensiform cartilage.
- b. Antero-posterior. 2. Under the clavicles.
- c. Vertical. 3. From the clavicle to the most dependant point of the ribs.

B. PARTIAL.

- a. Horizontal. 1. From nipple to median line of sternum.
- b. Vertical. 2. From sternoclavicular articulation to nipple.

A. GENERAL MEASUREMENTS. a. *Circular*.—The mean circular capacity of the chest is about thirty-three inches in the healthy adult; the extremes being forty-three inches, and twenty-eight inches. The average width gradually increases from sixteen to sixty. The two sides of the chest are of unequal dimensions in about five-sixths of healthy individuals; a mean excess of about half an inch existing on the right side in right-handed individuals. In left-handed persons the left side generally measures the same, and sometimes more, than the right.

By circular measurement we ascertain the relative dimensions of the two sides of the chest to each other; whether there be increase or diminution of bulk; and also defective expansion during inspiration. To ascertain this latter condition, we compare the width of the two sides of the chest at the end of inspiration and expiration; whilst no difference is detected at the latter, a very marked excess on the sound side is seen at the former period when this state exists.

A pair of steel callipers is the best instrument for determining the antero-posterior diameter of the chest. That which Dr. Walshe recommends consists of two arched blades terminating at one end in a button, at the other in a straight blade of about eight inches in length, which serves for a handle; a graduated

arc, fixed to one of the straight blades, passes through a hole in the other, and the graduation is so managed as to correspond to distances of inches and eighths of inches between the buttons. By applying these buttons to any two points, the distance between them is at once ascertained: the only difficulty, in comparing the diameters of the two sides of the chest, being to apply the callipers with exactly the same force, and to exactly corresponding points on both sides.

b. *Antero-posterior*.—In measuring the antero-posterior diameter of the summit of the chest on either side, one button of the instrument should be placed immediately under the centre of the clavicle, the other upon the corresponding point of the spine of the scapula, the distance from both buttons to the middle line being precisely the same.

Diminution, and perhaps *increase*, of the antero-posterior diameter, are the morbid conditions discovered by this measurement.

The same states may be detected at the base of the chest.

c. *Vertical*.—The distance between the centre of the clavicles and the most dependant point of the corresponding ribs, measured by the tape, is found to be the same on both sides. In certain morbid states, this distance may be increased or diminished.

B. PARTIAL MEASUREMENTS. a. *Horizontal*.—This extends from the nipple to the middle of the sternum. In health the distance between the median line and either nipple is precisely the same. In disease this distance may be diminished or increased.

b. *Vertical*.—In chests of regular conformation the distance from the nipple to the sterno-clavicular articulation is identical on both sides. Occasionally the left nipple is placed a half an inch to an inch lower, constituting a non-pathological deviation. The only morbid state is *increase*, and is a sign of more value on the right than the left side.

SIGNS DISCOVERED BY MENSURATION.

A. General Measurements.

CIRCULAR.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Increased bulk of either side.	Gradual detrusion of the walls of the chest by a force acting from within outwards—the elasticity of the lung having been first destroyed by pressure.	The left side of the thorax.	Pleurisy, period of effusion with dilatation. Hydro-pneumothorax. Pneumothorax. Cancerous tumour of the lung or pleura. Hypertrophy of the lung. Pneumonia. Emphysema.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Diminished bulk of either side.	Same as in case of <i>visible</i> retraction. [INSPECTION.]	The left side of the thorax.	Pleurisy, period of absorption with retraction. Pleuro-pneumonia. Pneumonia. Chronic consolidation of the lung. (Rare.) Tubercle, generally first manifested in second stage. Infiltrated cancer of the lung.
Defective expansion of chest in inspiration, either of one or both sides.	The instinctive avoidance of pain; paralysis of the muscles producing expansion; or the presence of a material obstacle.	More common on left than right side.	Pleurisy, } Effusion; } Absorption. Pleuro-pneumonia. Pneumonia. Emphysema. Tuberculous disease; second and third stages. Paralysis. Cancer of the lung or pleura. Pleurodynia. Hydrothorax. Pneumothorax. Hydro-pneumothorax.
ANTERO-POSTERIOR.			
Diameter diminished.	Diminished bulk of the lung, and consequent falling in of the parietes.	Infra-clavicular region. Base of chest.	Tuberculous disease of the apex, especially with abundant false membrane investing the part. Chronic consolidation of the lung. Pleurisy, period of absorption with retraction.
Diameter increased.	Increased bulk of the corresponding part of the lung from presence of various morbid matters.	Infra-clavicular region. Base of chest.	Tuberculous disease of the apex at its very earliest stage. Pleurisy with considerable effusion. Cancerous accumulation of considerable amount in lungs or pleura. Extensive hypertrophy of lung.
VERTICAL.			
Vertical measurement increased.	Extensive liquid or solid accumulation in chest.	Front of chest.	Pleurisy, with very abundant effusion. Cancerous masses of large size in lungs or pleura.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Vertical measurement decreased.	Retraction of side. Although elevation of the diaphragm, and consequently diminished vertical height of the thoracic cavity on either side, is common in cases of absorbed effusion, decrease of this measure on the surface is rare.	Front of chest.	Pleurisy, period of absorption with retraction.
<i>B. Partial Measurements.</i>			
HORIZONTAL.			
Distance between nipple and middle line diminished.	External parts of the chest brought nearer its central axis by the process of retraction.	Most common on left side.	Pleurisy, period of absorption with retraction.]

Besides external measurement, which is essentially comparative between the two sides, there have been various attempts to measure the internal capacity of the chest by noting the quantity of air that can be exhaled or inhaled. The late Mr. Abernethy proposed to judge of the capacity, and thereby of the soundness of the lungs of a patient, by measuring how much air he could throw at a breath after a full inspiration into a jar inverted over water. Other contrivances have been made to measure how much air can be inspired at a breath from a jar of air inverted over water. The chief objection to these means of measurement is, that their indications are affected not only by the capacity of the lungs, but also by the strength of the respiratory efforts. They are dynamometers for the muscles of respiration as well as pulmometers; and a weak, delicate, or nervous person, with sound lungs tested by them, would be placed below a pleuritic or phthisical patient whose muscular energies are still considerable.

So much for examination of the form, shape and size of the chest by sight, touch and measurement. [Although easily explained and comprehended, its practice is by no means easy, requiring, as it does, care and patience on the part of the physician, and good will and intelligence on that of the subject. The position of the patient's head, the fall of his arms, the degree of tension of his muscles, the evenness of the plane on which he is placed, will all materially affect the results of the exploration.]

It may often give us important indications; but it will seldom inform us of the nature of the obstructions or changes which it discovers; and it cannot detect many obstructions and changes in their smaller degrees. The chest may be immobile, distended, or contracted in parts, but whether from impervious air-tubes, diseased lung, liquid or air in the pleura, or any other of the various causes, sight and touch will rarely inform us.

EXAMINATION OF THE CHEST BY HEARING.

We are led, then, to try another sense which may reach beyond the surface, the sense of *hearing*. The acoustic phenomena of the chest should be studied, not only by mere experience, like that by which the infant studies objects by sight and touch, and in time becomes acquainted with them; but also, more rationally, by a generalization of such experience in the laws according to which the phenomena occur. We must accustom our ears to the sounds in all their varieties, that we may be able by experience to know and distinguish them; but to understand their import, and to read the interpretation which they give to the condition of the parts that produce them, we should study them through the laws under which they occur. We must consider what sound is, how it may be produced, transmitted, and modified; how the contents of the chest may produce it, and, when produced, can change it: and by comparing its general properties with the mechanism of the chest and its organs, we shall be prepared to understand and arrange the phenomena that experience has discovered, or may hereafter reveal to us. By thus learning the acoustic relations of the chest, not merely as isolated facts, but as parts of an applied science, we may be enabled to escape, in great measure, the errors into which unintelligible matters of memory might continually lead us, and we shall be acquiring a rational pathology, instead of resting on an empirical diagnosis.

The character of the present work precluding the introduction of more than a few of the leading principles with regard to sound in general, we must refer for further details to the various treatises on natural philosophy.

Sound is a certain velocity of motion of a body, or of the particles of a body, resisted with a certain force. The moving and the resisting forces acting alternately in opposite directions, constitute the vibrations of sound, which may be seen in a vibrating cord, and illustrated by the slower motions of a vibrating pendulum. The transmission or conduction of sound is the communication of the sonorous motion from one body to another, as one ball striking another ball moves it. The reflection of sound is the refusal or rejection backwards of this motion by bodies which cannot receive it, as a wall throws back the motion of a ball. Sound is most readily produced and sustained in bodies of uniform

density and elasticity, the particles of which transmit and continue, and do not reject or choke each other's motions. Hence tense and rigid bodies produce and conduct sound better than those which are flaccid and soft. Bodies of very different density and elasticity do not readily receive sound from each other; because their powers of motion differ in force and extent, and must cause them to reflect or choke the motions which they receive from each other. Thus a sound produced by air is intercepted by a solid; and that produced by a solid is far better transmitted by a solid of the same density and elasticity, than by air. The sound of a body much more dense than air, such as metal, may be communicated with greater freedom to air by the medium of a third body of intermediate density, such as wood, and this effect may be increased by extending the surface, and lightening the mass of the third body, as it is done in the sounding boards of musical instruments. The note or pitch of a sound depends on the frequency of the vibrations, those of the highest or shrillest notes being the quickest. The duration of a sound depends on the continuance of the vibrations. The sources of sound are such impulses as those which affect bodies suddenly, or with some force. Thus the percussion, collision, friction, tightening and breaking of solids cause sound. Sounds are not often produced in air or in liquids but by the aid of solids, which either communicate the motion or offer the resistance: thus we hear the wind only when it whistles in a key-hole, in the rigging of a ship, the leaves of a tree, or the like; and the sound of wind instruments depends on the motion or on the resistance of a solid. But liquids and air together readily generate sound without the aid of solids, by their impulses on each other; and thus are caused all the bubbling and rushing noises of liquids, from the frothing of beer to the roar of a cataract.

IV. PERCUSSION.—As the nature of metal, wood, and other bodies is tested by the sound which they yield on being struck, so we strike or percuss the chest to judge of the nature and condition of its materials. The practice of percussion as a mode of diagnosis, we owe to Avenbrugger; it has been applied and improved by Corvisart, Laennec, Piorry, and others, and now constitutes an important means of diagnosis in diseases of the chest and abdomen. When the principles on which its indications depend are well understood, the practice becomes easier as well as more instructive; and as we believe that no preceding writers have exposed these principles correctly, it will be well, after stating the general phenomena of percussion, to explain them by a few familiar illustrations.

[When a healthy chest is percussed, one is sensible of a slight yielding of the thoracic parietes, accompanied with a sensation of

elasticity. By percussing comparatively the anterior portion of the chest and the thigh, this sensation will be readily comprehended. Laennec alludes to it, and Piorry and other late French writers, have studied it with care, but we agree with Dr. Walshe that its importance is still not fully recognized. He says, "there are cases of not very rare occurrence, in which erroneous inferences would almost inevitably be drawn from the sound elicited by percussion, were those not corrected by the information derived from the *degree of resistance felt by the fingers*. Take the case of a cavity seated close to the surface; the unnatural clearness of sound which sometimes distinctly exists over such cavities, quite independently of the amphoric *character* in that sound, might not only lead to an incorrect estimate of the state of the subjacent part, but also to the inference that the lung in reality least affected was the most diseased. The sensation of hardness and firm resistance experienced by the fingers at once discloses the true cause of the unusual clearness. Besides, the cases are extremely numerous in which it is satisfactory to have the corroborating evidence furnished by the state of resistance in favour of the inference drawn from the sound. That doubt often exists as to the state of the sound on the two sides, is unquestionable; and in these cases the condition of the subjacent parts may frequently be settled by taking into consideration the amount of resistance."

The changes detected by percussion are as follows:—

1. Decrease of clearness, and of duration of the sound, with increased resistance.
2. Increase of clearness and of duration, with decrease of resistance.
3. Increase of clearness and of duration, with increase of resistance.
4. Alterations of special character.]

The chest, when struck abruptly with the ends of the fingers, yields a rather deep and not very short sound; which implies that the vibrations are not quick, and that they do not instantly cease. If we strike in the same manner on the thigh, a very different sound results, a short dull tap, implying that the vibrations have no continuance. The same dead tap is obtained on striking the lower part of the chest on the right side, where the liver lies; but all those parts under which the lungs are, yield more or less of the deep hollow sound. Is the seat of this sound in the air, or in the solids of the chest? If it be in the air, like that of hollow bodies, it ought to be changed by the same circumstances which modify the sounds in them. Thus, if we take an India-rubber bottle, and strike it, we find that its note is quite different when its mouth is open, from that which it yields when it is closed. But closing the glottis, or aperture into the chest, does not materially change

the sound of pectoral percussion. Again, the sound of hollow bodies is deep in proportion to their size. Thus a large India-rubber bottle gives a much deeper tone than a small one; and its note is raised on diminishing its cavity by compression. It is not so with the chest; for enlarging or diminishing its hollow does not in this way change its sound on percussion: the extremes of inspiration and expiration only slightly raise it.

As the sound of percussion of the chest does not follow the law which regulates sounds produced in the air of hollow bodies, we must conclude that it is seated in the solid: and if we study the construction of the chest, we shall see how well adapted its solids are to vibrate. Composed of layers of membrane, thin muscles, and integument stretched on an elastic frame of bone and cartilage, the walls of the chest are free to vibrate so long as the organs within do not check their motions: were there nothing but air within, these motions would be perfectly unembarrassed, and the sound would be more prolonged and hollow in consequence, deriving also an additional tone from the note of the cavity within, as in pneumothorax, or over an inflated stomach. The light, soft, spongy tissue of the lung scarcely interferes with the free vibrations of the walls, whilst the slight sound of its own which it yields, is equally deep with that of the walls with which it becomes combined. Hence, where healthy lungs lie in contact with them, the walls of the chest give a deep clear sound. But below the sixth or seventh rib on the right side, which is over the liver, and to the left of the lower part of the sternum, which is over the heart, the sound is dull and short, the vibrations being checked by these solid organs beneath; so it is obvious that morbid changes of the organs, such as a condensation of the lung, or the pouring out of serum into the pleural sac, would, in a similar way, arrest the vibrations, and render the sound of the chest dull in those parts where these changes occur. On the other hand, changes of an opposite kind, such as dilatation of the air-cells of the lungs, or an effusion of air into the pleural sac, may make the vibration of the walls more free than usual, and thus increase the sound obtained on percussion.

These illustrations are enough to show the general principles of the acoustic examination of the chest by percussion. It is a test of the density and elasticity of the materials within the chest: as diseases alter these qualities, so will they alter the sound on percussion which may thus announce their presence. A few more considerations will suggest some practical application of these principles. As we have seen that the walls of the chest give the sound which we hear on striking the chest, so it is plain that they must be sufficiently tense and elastic to vibrate on being struck. The chests of some persons are so loosely put together, and so flaccid, that they give but little sound, although the organs within

are quite healthy. In others, again, there is such a mass of fat and loose integument on the chest, that the walls are completely muffled by it, and they sound but little on percussion. The same difficulty occurs, in other cases, in certain regions where muscles of considerable thickness, or the mammæ in females, lie on the walls. In other instances, again, the walls of the chest are so drawn in by contracted adhesions of the pleura, that they are too tight to vibrate, and give a hard or dull sound, although the lungs within them may be comparatively healthy. In all these cases we must give to the part struck the equal tension which is wanting, by pressing on it a small piece of some firmly elastic body, such as wood, ivory, stiff India-rubber, or some such substance. This, when struck, gives sound enough; and if it be firmly applied to the chest, the density of the contents within will modify this sound, just as it modifies that of percussion on the naked walls of the chest. The sound obtained by striking a little plate of ivory or wood thus pressed on the chest, is the same in character as that of striking the chest itself; but it is louder, and as percussion on it gives no pain, the stroke can be applied with such force as to make the vibrations reach the interior through any thickness of fat or muscle. By these means we can test the sonorous qualities of the thoracic viscera through the scapulæ and muscles of the back, and through fat or œdematous integuments of any thickness. In this way, too, we can try the resonance or sonorous quality of any part of the abdomen.

We owe this method of mediate percussion to M. Piorry, who calls this percussion-plate a *pleximeter*. Mediate percussion is so much better than the immediate kind that it is now generally preferred. There is, however, an improvement on it which was, we believe, first proposed by Dr. Skerret; it is to substitute for a pleximeter the fingers of the left hand. This mode of percussion has the advantage of convenience as well as of yielding distinct results. Its adaptations are soon found out by a little experience—in fitting the fingers to the inequalities of the chest, sometimes singly, sometimes together, sometimes with their palmar surface outwards, but generally with this applied to the chest and the back to strike on, with other varieties of manipulation to be hereafter noticed.

To understand the varieties of sound on percussion, and their situations in the chest, it is necessary to bear in mind how the contents of the chest lie in relation to the surface. This varies considerably in different healthy individuals, but the following may be given as an average statement of the position of the thoracic organs after an ordinary expiration. The lungs are in contact with all the upper and middle portions of the walls of the chest. On the right side they reach down to about the sixth rib in front, and the eighth rib at the side, below which the liver comes in contact with the walls, and still lower in the back. On the left side

they reach to about the seventh rib in front, except within two or three inches of the sternum, where they seldom reach lower than the fifth rib, there being a space of from one to two superficial inches under and to the left of the sternum, where the heart lies in contact with the walls; at the side they reach to the eighth rib, whereabout they are bounded by the stomach and spleen, which, with the colon, also bounds them behind, where they reach a little lower. Inspiration greatly alters these limits, both by raising the ribs and expanding downwards the lungs, which then reach a rib lower, and a full inspiration may bring them in contact with nearly the whole of the thoracic walls, while expiration has the converse effect. [Figs. 1 & 2.]

The sound on percussion corresponds with this description, and by it we may therefore know the position of the organs in a living subject. Thus, in all the upper parts of the chest, before, behind, and at the sides, the sound is clear, and equal on both sides. There is also some clear pulmonary sound in the inferior parts of the chest down to the limits to which the lungs reach. But below the fourth rib in front on either side, although the lungs are in contact with the walls of the chest, their lobes are not thick, and beneath them lie the liver on the right side and in front, and the heart and stomach in front and to the left. The vicinity of these organs modifies the sound on percussion, and the more so the nearer they approach to the surface, where the lungs become thin towards their margins, until they quite give place to the peculiar sounds of these respective viscera about the limits before named. There is, therefore, a very slight deadening of the pulmonary sound below the fourth rib on the right side, below the middle of the sternum, and below the third rib near the sternum on the left; and this deadening increases down to the margin of the lungs, where the sound has the perfect dulness of the solids of the liver and heart. Further to the left the sound takes more or less of the hollow tympanitic character of the air-filled stomach. It appears, then, that the stroke of percussion reaches to a considerable depth, to organs an inch or more from the walls; and whatever it reaches may modify the sound. This suggests to us, that, by varying the force of the stroke, we may make the impulse of percussion reach to different depths, and derive the character of its sound from the superficial, or from the deep-seated organs, as we will. Thus, where the lung overlaps the liver, *strong* percussion will give a shorter deader sound than gentle percussion. Strong percussion receives the character of its stroke from the liver, as well as from the lung; whilst gentle percussion, such as by filliping with the finger and thumb, does not pass through the thin layer of lung, and gives still the pulmonary sound. The same mode of percussion may distinguish the utmost limits of the lungs over the heart. It is more difficult to determine by percussion the precise limits

of the lung on the left side; for, in consequence of the loudness of the hollow stomach sound, and the facility with which it may be elicited, it is apt to disguise the pulmonary sound, even with the most gentle percussion. In this case more may be done by observing the amount of expansion of these parts by a full inspiration. The extent of this stomach sound varies according to the state of gaseous distension of the stomach; it not unfrequently reaches, in a slight degree, above the mamilla. There is sometimes a slight dulness on the left side behind, corresponding with the position of the spleen; and in case of enlargement of this organ, the dulness may become extensive.

[The sound elicited by percussing the larynx, which is best obtained by filliping one of the fingers of the left hand applied firmly to the surface, the patient's head being thrown back, and the tissues thus rendered tense, is very clear, of considerable duration, and distinctly hollow. The resistance is greater under the fingers, relatively to the clearness of the sound, than it would be in the chest.]

It must not be forgotten, that the motions of respiration may produce changes in the character and position of some of these sounds. Inspiration, as it enlarges the lung, renders the pulmonary sound clearer, and extends it over every part of the heart, and over a considerable portion of the liver. As the complete and equal enlargement and contraction of the chest, as seen and felt, are signs of the free conditions of the respiratory organs, so the sound on percussion becomes an additional sign of the healthy action, in proportion as the clear pulmonary sound is extended at each expansion of the chest. Percussion is a test, therefore, not only of the statical condition of the lungs, but of their dynamical state also. This point is not enough attended to by auscultators; yet the neglect of it not only would deprive us of additional signs, but would tend to render deceptive the results of statical percussion. For example, in judging of the goodness of sound on percussion, we generally compare the sounds on the two sides of the chest, where in health the structures and sounds are the same; but if we do not attend to the movements of respiration, we may strike one part when the chest is contracted, and the other when it is full, and obtain results which differ from this cause only, and not from any internal change. In practising comparative percussion, therefore, in cases requiring delicacy, it is proper to desire the patient to hold his breath for an instant while the comparison is made; and it is often useful to try the sound when the chest is expanded to the utmost, when it is contracted, and in the intermediate states.

[In certain diseased states of the lungs, the sounds produced by percussing the chest are peculiar and special. These are: 1.

Wooden ; 2. Tympanitic ; 3. Tubular ; 4. Amphoric ; 5. Cracked Metal.

1. The Wooden character conveys the idea of hardness, and resembles the sound elicited by the mediate percussion of a table. The duration is diminished, and the resistance greatly increased. When well marked, Dr. Walshe considers it as the conclusive sign of a thick and dense stratum of fibrous substance in the pleura, binding the lung and parietes together. No amount of fluid in the pleural cavity, or of parenchymatous consolidation will produce it to any great degree ; but it is present in all consolidations where there is false membrane in abundance.

2. The Tympanitic character resembles the sounds of a drum. The note is clear ; the duration considerable ; the resistance slight.

3. The Tubular character is the same as that obtained by percussing mediately the trachea. Duration and resistance moderate.

4. The Amphoric character may be imitated by filliping the cheek, with the mouth closed and fully inflated ; or by striking the backs of the hands, hollow and closed, against the knee, provided that no air be allowed to escape.

5. The Cracked-metal character is obtained by permitting the air to escape from the cavity formed by the hands in the above experiment. It is produced in the chest by driving out the contained air of a large anfractuous cavity, which communicates freely with the bronchi, by a slow and heavy blow. If the mouth and nose be closed tightly in a patient furnishing the cracked-metal sound when open, an amphoric note is substituted for it.]

The varieties in the sound of percussion from special diseases will be considered when those diseases are described ; but a few examples will be useful here to illustrate the subject. The indurations of the upper lobes of the lung are often small, and so scattered through its substance, that they scarcely affect the sound on percussion ; but by a full expiration, they are brought closer together, and if more on one side than on the other, they may then sensibly deaden the sound on that side, especially if gentle percussion be used below the clavicles, and not on a very small surface. Again, the indurations, especially if of some standing, tend to restrain the lung from its full expansion ; and if there be a difference on the two sides, it thus may be detected only on a full inspiration. In the disease called emphysema of the lungs, the air-cells are permanently dilated : they contain an unusual quantity of air, which expiration cannot expel : this may be detected by percussion used as a dynamical test ; the regions of the heart and middle part of the liver being covered by the permanently distended lung, give, even after expiration, a clear sound. There is one more point to be noticed respecting percussion at the ex-

tremes of the respiratory act. Full inspiration makes the sound clearer: full expiration has the contrary effect; but they both raise the note a little; they make its pitch higher. This is in consequence of forcible inspiration or expiration, which are muscular actions, straining the walls of the chest, and thus rendering their vibrations quicker, and therefore the sound higher, as in tightening a drum.

It is unnecessary to add more on the principles of percussion; but it will be useful to give some directions with regard to the practice. In this, as in every other art requiring some manual dexterity, and the exercise of the senses, practice is necessary to familiarize the beginner with the phenomena and the mode of obtaining them.

In obtaining the sounds of percussion, he soon finds that some dexterity is necessary even in mediate percussion, which is the easiest mode. The fingers or pleximeter should be closely pressed on the walls of the chest: and if the object be comparison between the two sides, they should be placed on corresponding parts, whether between the ribs, along them, or across them. Care should also be taken that the mode of striking be the same, whether it be with one or several fingers, with their tops (in which case the nails should be kept short) or the flat of the last phalanx, or with the knuckles, each of which modes is sometimes preferable.

[The index and median fingers, with their points on exactly the same level, and supported by the thumb, with its ball laid firmly on the outer surface of the former, opposite to the articulation of the second with the third phalanx, are the best percussing instrument. The movement should spring from the wrist only, the forearm and arm being perfectly motionless; this is a rule of the first importance; by its observance both pain and variation in the result to be obtained are prevented.]

Filliping with the middle finger and thumb often gives more uniform and delicate results, especially when the patient is in an inconvenient position, or suffers from tenderness of the walls of the chest. This is also the best mode for abdominal percussion. When striking the clavicle, attention should be paid to what part is struck; for the sternal portion of this bone always sounds much clearer than the humeral end: so also in percussing this or any other part, the direction of the stroke should be perpendicular towards the lungs, and not sideways, or the sound will be modified, not by the lungs, but by the adjacent muscles or other parts towards which the impulse is directed. It is from neglecting this precaution, that beginners sometimes get nothing but dull sounds all over the chest. It is not generally necessary to use much force in percussion: in fact, many of the most valuable results are obtained by gentle mediate percussion; but the mode must be

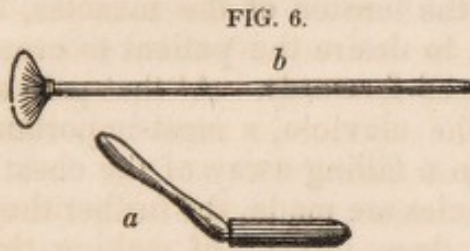
varied in different cases. When it is desired to test the density of a small spot, percussion with a single finger is best; whilst for trying a surface of greater extent, flat percussion with several fingers answers better. In doubtful cases it is proper to try both. In percussing the regions of the back and shoulders, the bony prominences of the scapulæ and ribs should be sought, for these transmit the impulse to the interior far better than the thick layers of muscle. But as the scapulæ are movable bones, it is necessary to see that they are in corresponding places on both sides; and to insure this, and to increase the tension of the muscles, it is well, in examining these regions, to desire the patient to cross his arms in front, and to bend his head forwards. At that part of the chest near the humeral end of the clavicle, a most important region for examination, there is often a falling away of the chest; and the more tense the pectoral muscles are made, the further they are removed from the walls: here, then, instead of making the muscles tense, they must be relaxed, by letting the elbow hang close to the side, whilst mediate percussion is practised in this region.

The best posture of the patient for percussion is erect or sitting; and in comparing the two sides, both before and behind, the observer should be directly opposite the front or the back. When the patient is lying down, the sound is modified by the matter on which he is lying: if it be a soft feather-bed, the sound is more dull; if a mattress, or any thing hard, the sound will often be increased, because the elasticity of the contents of the chest is increased by the unyielding matter behind it. So also the vicinity of a wall or other hard surface causes a reverberation which gives to the side nearest to it too loud a sound. On the other hand, the vicinity of curtains or other drapery deadens the sound. As most of the effects of percussion are judged by comparison, the chief object of the cautions given is to take care any of the external causes of modification may not act unequally on the different parts of the chest. The patient may sometimes be removed from the influence of these to the middle of the room; and when this cannot be done, these modifying causes must be equalized as much as possible.

Little needs to be said about pleximeters, for they are not generally necessary: M. Piorry much exaggerates the advantages derived from them. A thin circular plate of wood or ivory, with two projections or a raised rim by which it may be held firmly to the chest, is one of the best forms: [see fig. 8, E.] the surface to be struck should be covered with soft leather, to prevent the clack of the fingers on it. We give the preference to a little oval piece of boxwood, about an inch long, three-quarters of an inch wide, and one-eighth of an inch thick, with a strong handle two inches long rising from its outer margin, at an angle of about forty-five degrees. The handle

is convenient for holding it firm to the chest without interfering with the percussing fingers. The chief precaution necessary in using it, is to take care that it be applied flat and not tilted.

[In a communication made by Dr. Williams to the Medical Section of the British Association at Manchester, in June, 1842, "on the Construction and Application of Instruments used in Auscultation," he has described and figured an instrument for percussion, which he considers to be very efficient as well as very simple. The pleximeter is a stout narrow piece of whalebone, about four inches



long, (fig. 6, *a*,) slightly bent by heat, so that one end forms a handle, whilst the other is applied to the chest; the latter part may be covered with buff leather and velvet, to deaden the clack of the surface. The hammer (fig. 6, *b*) is made of an oblate

spheroid of lead, three-quarters of an inch long in diameter, is also covered with leather and velvet, with a small rod of whalebone, four or five inches long, for its handle. The pleximeter fits like a finger on or between the ribs, and is firmly and conveniently applied to any part. The hammer head being circular, like that used by geologists, can scarcely vary in the direction of its stroke, and has weight enough to elicit deep-seated, as well as superficial sounds with very little force of stroke. The elasticity of the handles of both greatly facilitates their operation.

A flat piece of India rubber is recommended and used by Dr. Louis. It saves pain both to the operator and patient; it deadens somewhat the sound, but this objection is of no weight in a comparative examination.]

V. AUSCULTATION.—Let us now inquire into other modes of producing sounds in the chest, which may prove signs of the condition of the organs within. The contractions and relaxations of the muscles of respiration are in general too gentle to cause sound; but when forcible or sudden, they sometimes produce a sound of tightening, a kind of muscular sound. This is often evident when there is an abrupt catch in the breathing, and during the act of coughing, though it does not furnish any sign of importance. But the internal motions and passage of air to and from the lungs produce sounds; and inasmuch as this passage of air is the great object of respiration, we may expect to find in these sounds signs of the manner in which this object is accomplished. These and most of the other acoustic motions of the chest were first discovered and described by Laennec, who may well be regarded as the father of the art of auscultation. We shall endeavour so to illustrate and extend this art by the aid of physical and physiological

science, that we may be enabled to deduce respectively from the phenomena the condition of the organs, and from any known condition of the organs the phenomena which it would produce.

The air enters the lungs by atmospheric pressure, to fill the increased space made in the chest by the action of the muscles of inspiration. On its way to the most expansible parts of the lungs, the fine tubes and cells, it strikes against the sides and angles of the larynx, trachea, and its ramifications, with force sufficient to produce a particular hollow blowing sound. We may hear this on applying the ear to the fore part of the neck, or at the top of the sternum. As the current of air becomes subdivided and spread in the small bronchi, it loses a part of its velocity, and the sound becomes of a more diffused and less hollow character: it is more like the sighing of a gentle breeze among the leaves of trees; and in passing into the cellular terminations, all of the hollow tubular sound is lost, as may be perceived on applying the ear to most parts of the chest where the lungs lie. This sound seems to depend here chiefly on the impulse of the air against the angles and sides of the minute tubes and cells, but partly also on the opening and stretching of these cells, and perhaps partly on a propagation of the louder sound of the passage of air in the larger tubes. Where inspiration ceases, expiration begins; and a portion of air is pressed out of the cells and small tubes by the collapse of the walls of the chest, and by the contracting properties of the pulmonary tissues. There is a remarkable difference between inspiration and expiration; in inspiration air is the moving body, and rushing through the tubes distends the passive lung: in expiration the lung is the moving body, and by its contraction (backed by external pressure) drives before it the passive air. In either case there is a pressure exerted between the air and the interior of the cells, and doubtless this proves the means of assisting the chemical changes that take place. But it is plain that there must be a difference between the sounds of inspiration and expiration. In inspiration air moving with some velocity meets with the resistance of the angles and sides of the tubes and cells which it has to dilate. Here must be sound in the whole passage of the air, from the nostrils down to the pulmonary cells. In expiration the motion begins with the lungs; and the air passively yielding to it, there is not motion or resistance enough to produce sound, until, by the converging together of the small tubes, the impelled air is gathered into a current in the larger tubes, where, impinging against their sides with its now acquired velocity, it at length produces sound. These remarks explain why in natural inspiration there are three kinds of sound produced by the motion of the air through different parts, and hence called *tracheal*, *bronchial* and *vesicular*.

[By auscultation we detect : 1. The natural respiratory murmur—inspiration and expiration. 2. Modifications of this. 3. Abnormal sounds, superseding it, termed rhonchi. 4. Adventitious sounds exterior to the lungs, but dependent on respiration, and heard only during disease. 6. The resonance of the voice. 7. The resonance of the cough. 8. Phenomena common to the sounds of respiration, of the voice, and of the cough. 9. The sounds of the heart and vessels as transmitted through the tissue of the lungs.

The sounds of respiration can be heard on applying the ear to different parts of the chest, being transmitted through the parietes to the parts beneath with sufficient distinctness; and as the healthy sounds vary in these different parts, we may judge of the natural distribution of the tubes, by listening to these sounds. Thus we find in any part of the neck, and at the upper part of the sternum, there is the hollow blowing sound which results from the passage of air to and fro in the trachea, which is therefore called *tracheal* respiration. A little lower down than this, over the space of two or three inches on each side of the top of the sternum, between the scapulæ, and sometimes in the axillæ, there is the sound called *bronchial* respiration, its whiffing or tubular character denoting that it is produced by the passage of air in the bronchial tubes. [Dr. Walshe states that natural bronchial respiration is limited to the surface corresponding to the upper portion of the sternum. According to M. Fournet, the interscapular region is the only region where it is commonly found. Natural bronchial respiration is less soft and breezy than pulmonary respiration, and a more appreciable interval exists between the two sounds.

In most other parts of the chest is heard the *vesicular* respiration, which is a diffused murmur caused by the air penetrating through the minutest tubes, and into their numerous vesicles or cells, which is a gentle sighing sound, soft, neither dry nor liquid, gradually developed, composed of two sounds, the inspiratory and expiratory, inappreciably separated.

The character of the expiratory murmur is identical with that of the inspiratory, and differs from it only in intensity and duration. The seat of their production is no doubt the same—the ultimate portions of the minute tubes and air-cells. In healthy respiration the two murmurs so closely follow one another, that they may be said to be continuous. In health the expiratory murmur may be said to be from three to five times less intense and shorter than that of inspiration. It is sometimes wholly wanting. Dr. Walshe considers this as natural and in no instance the result of disease. It is best heard at the summit of the chest. Laennec was fully aware of this phenomenon, and of its pathological value;* Andral also.† To the late Dr. J. Jackson, jr., of Boston, great credit is due for the careful study of the expiratory murmur, and of its semeiotic value. Since then M. Fournet has studied

* Laennec, t. i. p. 20 and 64, éd. Andral. † Clinique Médicale, 3e éd. t. iv. p. 69.

it, and added much important information. The duration of expiration is increased in old persons, whilst its intensity is decreased. According to Dr. Gerhard, the respiration is always somewhat blowing at the apex of the right lung, and consequently prolonged expiration is a natural phenomenon in the right clavicular region. This arises, according to Dr. Gerhard, from the greater diameter and straighter course of the tubes at the summit of the right lung, which are not lengthened and curved as on the left side by the arch of the aorta. The anatomical fact has been denied by M. Fournet, who took much pains in investigating the subject; and the difference of respiration in the two sides is not admitted by Barth and Roger, Fournet, Walshe and others. Dr. Louis, in order to ascertain the accuracy of Dr. Gerhard's statement, studied, with Dr. Picard, the manner in which respiration is performed at the apexes of both lungs, as well as the resonance of the voice in the same places, in twenty-two young females, aged from fifteen to twenty, who had never suffered with any affection of the thoracic organs. The sound of expiration was nearly inaudible under the left clavicle in the majority of cases,—thirteen times out of twenty-two; whereas the contrary was the case on the right side, where the sound of expiration was inaudible in five cases only. In the others expiration was distinct and sometimes very much prolonged. Posteriorly, expiration was not heard in the left side in fourteen cases; it was wanting on the right side, five times only. When expiration was audible on both sides, it was more marked and prolonged, sometimes to a considerable degree, on the right than on the left side. In one young girl expiration was not only harsh, but bronchial in that situation. (Louis on Phthisis, 2d ed., p. 441.)]

The question naturally occurs, why is the bronchial respiration heard in comparatively few parts of the chest, when bronchial tubes of considerable size are distributed in so many parts of the lungs, within an inch or less of the surface? Why is not the sound a mixture of the tubular and vesicular sounds? The answer and explanation is, that in consequence of its softness and inequality of density, the healthy tissue of the lung is a bad conductor of sound, and does not transmit the sound of bronchial respiration to the surface, except in points where the tubes are large, and approach quite close to the walls of the chest. The flaccid tissue, composed of the different materials, membrane and air, effectually arrests all the slighter sounds produced in the tubes within it. An important corollary from this is, that, as this arrest of the sounds of the interior depends on the light spongy structure of the lung, so any disease increasing the density of that structure augments its conducting power, and enables it to transmit the sounds. Hence we find that a great increment of solid or liquid in the lung, as in pneumonia or tuberculous disease, or the compression of its superficial parts by a moderate quantity of liquid in the

pleura, as in a recent pleurisy, often not only diminishes the vesicular murmur in consequence of the obstructed state of the cells, but also adds a bronchial or tubular sound of breathing in those parts where naturally the respiration is purely vesicular.

As the several sounds of respiration depend on the resisted motion of the air, so they vary according to the velocity of that motion, and the degree and nature of the resistance to it; they are loud when the air passes in and out forcibly and quickly, and low when it passes gently and slowly. So, on listening to a person's breathing, it may be scarcely audible at its ordinary rate; but if he breathe quick and short, it will be distinct enough. Taking a long breath may not answer the same purpose; for although much air is thus taken in, it may not enter with sufficient rapidity to cause the increased sound. Coughing answers better, for the full inspiration which succeeds coughing is generally quick also; and it is often useful, where the sounds are obscure, to magnify them by this more forcible act. But there is a limit to this power of increasing the sound of respiration by increased effort. If an individual tries to breathe very hard and quick, as after violent exertion, the movements of the lungs cannot keep pace with those of the external muscles of respiration, and the air does not freely enter, the sound will be diminished or altered rather than increased.

As we can vary the sound of respiration by varying the act in the same individual, so we find that a difference exists naturally in different individuals; in some, as in many robust adults, the ordinary respiratory sound is very low and faint; in others, as in children, in nervous females, and in slight irritable persons, it is loud and distinct. In the last-mentioned cases, the respiratory movements are more brisk; and although air may not be taken in more frequently or in such great quantity as in other cases, yet it enters more suddenly, and meets with greater resistance in its passage, so that it must cause more sound. As this loud respiration is commonly met with in children, Laennec called it *puerile* respiration. So, also, by rendering the respiration quicker and more energetic, it may be made to sound loud in those cases in which it is naturally faint, as by the quick short breathing just mentioned, or, better still, by desiring the person to hold his breath for a while; the quick strong inspiration which follows is noisy enough. Disease sometimes brings about this same change; thus, if a considerable portion of the lungs be obstructed, the force of the act of breathing will be concentrated on the remaining portions, and the air will be carried in and out of them with unusual energy and noise. Hence Andral terms this partially increased respiration *supplementary*. [It is called also *exaggerated* respiration, from the natural properties of the respiratory murmurs being exaggerated.] So, also, under some circumstances, without any obstruction, the want of breath may be increased, as it happens during

moderate exercise, in some degree during digestion, and on exposure to cold; here the whole respiration is more energetic and its sound louder. Further, as the act of breathing depends on a particular impression of the nervous system, so it may be supposed when this system is preternaturally sensitive, the ordinary impression produces an increased effect; here, again, the respiration becomes more energetic and noisy. This appears to be the chief cause of the increased sound of respiration in fevers and other diseases where the nervous sensibility is exalted. Lastly, it is possible, by an external restraint of some parts of the chest, to render the sound of respiration louder in other parts. Thus, by inclosing the abdomen and lower part of the chest in a tight belt (and the experiment is already prepared in the persons of tight-laced females), the sound of respiration is made unusually loud in the upper parts; and it may be seen by the heaving of these parts how their motions are augmented. Acute pain or tenderness of some of the parts moved in respiration would have somewhat of the same effect as a ligature, for it would cause an instinctive restraint of these parts, which would throw on others supplementary labour.

It appears, then, that there may be much variety in the sound of respiration without disease of the lungs; and except in the case last mentioned, it is where there is a comparative discrepancy in the several parts of the lungs rather than any absolute difference, that disease of these organs is indicated. Thus, if we find the respiration loud on one side and obscure on the other, or clear in the lower part of the chest, indistinct in the upper, we may well suspect some obstruction to exist in those parts where the sound is obscure; and the nature of that obstruction is then to be tested by percussion and other means.

[We have now to treat of the modifications the respiratory murmur undergoes in diseased conditions of the lungs. The changes which take place are in its duration, intensity, rhythm and character.

SPECIES OF UNHEALTHY RESPIRATION, DISTINGUISHED BY CHANGES OF

- | | | | |
|---|---|---|--|
| a. Duration and intensity. | } | a. Exaggerated respiration.
b. Weak "
c. Suppressed " | |
| β. Rhythm, either solely or in conjunction with other properties. | } | d. Incomplete respiration.
e. Jerking "
f. Divided " | |
| γ. Character, and in addition other properties. | } | g. Harsh respiration.
h. Bronchial or Blowing " | } 1. Diffused.
2. Tubular.
3. Cavernous.
4. Amphoric. |

1. In *Exaggerated respiration* the vesicular murmur is more intense than naturally, but still soft and breezy in character. In morbid puerile respiration the excess of duration and intensity exists, according to Walshe and Fournet, on the side of expiration; whilst, in healthy puerile respiration, if any difference exists in the two sounds, it is on the side of inspiration. (Laennec.) In the absence of the physiological causes mentioned before (p. 52), in the adult its presence announces disease, but does not locate it, or give its nature.

2. *Weak respiration* consists in real or apparent diminished intensity and duration without change in the other properties. It may be close to the ear, *superficial*, or removed to a greater or less distance, *deep-seated*. It is generally persistent, but occasionally intermittent. Two causes produce it; either the murmur is actually diminished in intensity, or it reaches the ear less readily owing to the interposition of a solid or liquid between the surface of the lung and the thoracic parietes. A reference to the table will show the diseases in which it occurs.

3. *Suppressed respiration* is an entire absence of the respiratory sounds; nothing replaces them; there is absolute silence. Its seat is variable, and it may be permanent or intermittent.]

4. *Incomplete respiration*.—There is another kind of variation in the respiratory sound that has not been attended to—that which affects its duration. In this, as in other varieties, there are absolute differences in different individuals, and in the same individual under different circumstances; but we shall only notice the comparative discrepancies in the same subject and at the same time, which alone constitute signs of disease. We may hear the sound of inspiration on one side distinct and prolonged during the whole inspiratory act, whilst on the other side it is loud enough at first, but is abruptly arrested before the act is complete, and it is stopped with a sort of hitch. Hepatization or compression of the lower portions of the lungs will do this; so will a movable plug of tough mucus in the bronchial tubes. In other cases, again, we find the circumstances reversed: there is in a part of the lung no sound during the first part of inspiration; but towards its end, when the chest is most expanded, there is a short wheeze. This happens where the bronchial tubes are so far obstructed that air will not pass through them, until they are distended by a full inspiration, as in bronchitis. It appears also in extensive pleuritic effusions which distend the parietes of the chest beyond the medium state of respiration; it is only the *acmé* of inspiration that can then introduce air into the compressed lung, and it is at this period alone that the respiratory sound is heard.

5. [*Jerking respiration* is where the respiratory murmur, instead of being continuous (thus *vvv*) is interrupted and divided, (thus

mm | mm | mm .) It is heard in inspiration. It is partial or general. Its physical cause is sometimes due to a sudden arrest in the dilatation of the chest, from pain or deficient innervation; or from the incomplete dilatation of the air-cells from some cause or other.

6. *Divided respiration* is where a distinct interval elapses between the inspiratory and expiratory murmurs; it is caused by the permanent dilatation of the air cells preventing the expulsion of the contained air, is found in the middle of the chest, and occurs in emphysema.

7. *Harsh respiration* is characterized by harshness and dryness in the respiratory murmurs, and by increase in the intensity and duration of the expiratory sound. Prolonged expiration, of which so much has been said lately as an early diagnostic sign of tubercles, according to Dr. Walshe never exists as an isolated phenomenon; there is always a change in the character of the murmurs.

8. *Bronchial or Blowing respiration*.—In this variety both murmurs are blowing, harsh, dry; both sounds are increased in intensity, and the relative duration of expiration notably. It resembles natural bronchial respiration as heard at the top of the sternum and root of the lung. Quickness in production and progress are peculiar characteristics. It is continuous. There are four varieties: 1. the *diffused*, where the degree is slight, and the murmurs are produced over considerable space, and sometimes at a distance from the ear; 2. the *tubular* variety seems limited to a small space, is distinctly metallic, and may be compared to the sounds produced by blowing through a clear tube. Its intensity is great, and its production rapid. The sensation as if the air were drawn from and puffed back into the ear is sometimes experienced. 3. *Cavernous respiration*, which resembles the sound produced by blowing into a hollow vessel, and may be imitated by breathing forcibly into the hollow of the two hands with the mouth wide open. It is distinctly metallic, and its duration nearly natural. 4. *Amphoric respiration* gives the sensation of air passing into a large empty cavity with thick walls, and is imitated by blowing into a jug two thirds empty, or into a narrow-necked glass bottle or phial. It accompanies both sounds, but particularly the inspiratory. There is a strong metallic sound. It may sometimes be necessary to make the patient breathe forcibly in order that the amphoric character be detected.

SIGNS DISCOVERED BY AUSCULTATION.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Exaggerated respiration.	More rapid circulation of air through the lung, together with an increase in its quantity and the force of its impulse against the walls of the vesicles; all this being the result (except in very rare cases) of the inaction of some part of the same or of the other lung.	Very variable; frequently the entire of either side of the chest.	<p>Obstructed by Bronchitis. Foreign body in the principal bronchus. Condensed by Tubercle. Apoplectic effusion. Pneumonia. Pleuritic effusion. Intra-thoracic tumours. Chronic consolidation. Rarefied by Vesicular emphysema.</p> <p>1. In healthy tissue adjoining parts</p> <p>2. In healthy tissue suddenly released from spasm. } Spasmodic asthma.</p> <p>3. In tissue affected with } Hypertrophy. Earliest stage of pneumonia.</p>
Weak respiration.	Existence of an obstruction to the entry of air into the part in which it exists.	Variable; limited to a spot in one lung, or apparent over entire of both lungs.	<p>1. SUPERFICIAL VARIETY.</p> <p>a. Persistent.</p> <p>Obstructive diseases of the larynx and some of the pharynx.</p> <p>Narrowing or obliteration of bronchus by Contraction. Thickening of mucous membrane. Accumulated mucus. Hypertrophy of longitudinal fibres. Pressure of tumours, cancerous or other. Bronchitis.</p>

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Weak respiration.	Existence of an obstruction to the entry of air into the part in which it exists.	Variable; limited to a spot in one lung, or apparent over entire of both lungs.	<p>Chronic consolidation of the lung, or infiltration with tubercle or other morbid product in a limited space.</p> <p>Vesicular emphysema.</p> <p>Pneumonia.</p> <p> Previous to engorgement.</p> <p> After resolution.</p> <p>Pulmonary œdema.</p> <p>Pulmonary apoplexy.</p> <p>Imperfect respiratory movements from paralysis.</p> <p> b. Intermittent.</p> <p>Pleurodynia.</p> <p>Pleurisy.</p> <p> Dry stage.</p> <p> Stage of plastic exudation.</p> <p>Spasm of the glottis.</p> <p>Spasmodic asthma.</p> <p>Foreign bodies in the air passages.</p> <p>2. DEEP-SEATED VARIETY.</p> <p>Pleurisy, period of laminar effusion.</p> <p>Hydrothorax to a moderate extent.</p> <p>Pneumothorax to a moderate extent.</p>
Suppressed respiration.	Existence of a complete obstruction to the entry of air into the part in which it exists.	Variable; the whole or part only of a lung.	<p>Complete obliteration of a bronchus by any of the causes above enumerated. (Plug of hardened mucus in large bronchus; Andral.)</p> <p>In very rare cases, infiltration of the lung with tubercle, "matter of induration," or other morbid productions.*</p> <p>In rare cases of vesicular emphysema.</p> <p>Extremely thick plastic matter in pleura.</p> <p>Pleurisy, with abundant effusion.</p> <p>* [It is probable that the respiratory murmurs are actually more or less extensively suppressed in almost all cases of this class; but it is, for obvious reasons, in rare instances only that the suppression can be detected.]</p>

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Suppressed respiration.	Existence of a complete obstruction to the entry of air into the part in which it exists.	Variable; the whole or part only of a lung.	Hydrothorax. Pneumothorax, when considerable. Bronchitis. Spasmodic asthma; during very intense paroxysms. Pulmonary apoplexy, if extensive.
Incomplete respiration.	Some mode of partial obstruction to the entry of air, not accurately defined.	Lower parts of the chest; infra-mammary, infra-axillary and infra-scapular regions.	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: small; margin-right: 5px;">1. Inspiration deficient at close.</div> <div style="font-size: 2em; margin-right: 5px;">{</div> <div style="font-size: small;">Spasmodic asthma. Hepatization of the lower portion of the lung. Movable plug of tough mucus in bronchi. Certain cases of incipient pleurisy.</div> </div> <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: small; margin-right: 5px;">2. Inspiration deficient at outset.</div> <div style="font-size: 2em; margin-right: 5px;">{</div> <div style="font-size: small;">Bronchitis with much obstruction of tubes. Pleuritic effusion with dilatation of side.</div> </div> </div>
Jerking respiration.	Interference with continuous expansion of chest, either from pain or, under certain circumstances, from the presence of pleuritic adhesion.	Entire of one side or infra-clavicular region only.	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="font-size: 2em; margin-right: 5px;">{</div> <div style="font-size: small;">Incipient pleurisy. Pleurodynia. Spasmodic asthma.</div> </div> <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: small; margin-right: 5px;">Partial</div> <div style="font-size: 2em; margin-right: 5px;">{</div> <div style="font-size: small;">Certain cases of tuberculous infiltration [with corresponding pleuritic adhesion.] Certain cases of chronic pleurisy with adhesion.</div> </div> </div>
Divided respiration.	Permanently distended state of the air cells interfering with expulsion of air in expiration.	Central parts of lung.	Very extensive emphysema.
Harsh respiration.	Condensation or rarefaction of pulmonary substance, and dryness of the mucous membrane of the bronchi.	Infra-clavicular regions in tuberculous cases; variable in others.	Incipient tuberculization of lung. Dry bronchitis. Vesicular emphysema. Chronic pulmonary consolidation. Dilatation of bronchi. Incipient cancerous infiltration of lung. Lungs slightly compressed by plastic or

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Harsh respiration.	Condensation or rarefaction of pulmonary substance, and dryness of the mucous membrane of the bronchi.	Infra-clavicular regions in tuberculous cases; variable in others.	tuberculous matter in the pleura. Pneumonia, period of resolution. Pleurisy, in parts of lung { Underneath laminar effusion. Above gravitating effusion. Beside effusion with dilatation. Compressed during absorption. Pulmonary apoplexy.
Bronchial respiration.	Condensation of the pulmonary substance.	Same as harsh respiration.	Chronic pulmonary consolidation. Incipient tuberculization of lung. Dilatation of bronchi. Pulmonary apoplexy. Incipient cancerous infiltration of lung. Pleuritic effusion; while unadvanced, opposite the seat of the effusion; when advanced, opposite the parts not surrounded with fluid. Hepatization of moderate density and extent.
Blowing respiration: diffused variety.	Considerable condensation of pulmonary substance (acting principally upon the smaller bronchi.)	Upper and middle parts of the chest.	Pneumonia; stages of hepatization. Tubercles. Pleuritic effusion, rare. Dilatation of bronchi. Chronic pulmonary consolidation. Cancerous disease of lung or pleura.
Blowing respiration: tubular variety.	Extremely dense solidification, by which minute bronchi obliterated and sound transmitted directly from large ones.	Middle and rarely upper parts of the chest.	Pneumonia, stages of hepatization. Pulmonary abscess; pus retained. Solid adventitious mass in pleura, pressing down tissue of lung towards bronchi.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Cavernous respiration.	Passage of air through an unnatural hollow space in the interior of the lung.	Summit of one or both lungs. Central part of lung most commonly. Indifferently in any part of the lung.	Tuberculous excavation. Extensive dilatation of bronchi. Abscess. Sphacelus. Communication of pus contained in pleura or elsewhere with bronchi; some destruction of substance attending. Softening of cancer. Pulmonary apoplexy.
Amphoric respiration.	A very large space empty or nearly so, within the chest, and communicating by a moderately wide opening with the air passages,—that communication existing above the level of any fluid present in the space referred to.	Latero-posterior part at central height on either side most commonly; rare at the upper part of the chest; extremely rare at the base of the lung.	1. Broncho-pleural fistula, produced by— a. Rupture from lung into pleura of— Tubercle. Sphacelated tissue. Emphysematous vesicles. (Very rare.) b. Passage from pleura into bronchi of— Pus, formed in pleura (empyema). Pus, conveyed from other parts. 2. Excavation of large size in the lung, from Tuberculous disease. Sphacelus. Abscess. It is possible that evacuation of cancerous matter from the lung might occur to a sufficient amount to give rise to amphoric respiration, but this has never been observed.]

RHONCHI.

We have hitherto considered the sounds produced by the passage of the air to and fro in the lungs, and we found that the varieties of these sounds depend on the size of the tubes, and on the force with which the air strikes against their sides and angles, and that they may be shortened or stopped by various kinds of obstruction. We have now to describe a class of novel sounds

which arise from partial obstructions to the passage of the air ; obstructions which permit the air to pass, but not without such a resistance as causes an increased and modified sound. Thus, if a bronchial tube be narrowed by the swelling of its membrane, or by mucus secreted by it, the air will pass through the narrowed portion with increased velocity and increased resistance ; and hence the sound is changed from a simple breathing or blowing to a louder wheezing, bubbling, whistling or snoring, according to the nature of the obstruction. These new sounds Laennec called *râles* or *rattles*. We prefer the Latin term *rhonchus*, (which is from the Greek *ρογχος*;) as more expressive ; and it has been adopted by most English writers. If there were one, it would be desirable to use an English word, for nothing injures the purity of a language more than the introduction of foreign terms.

The rhonchi may be divided into the *dry* and the *humid*, according as the impediments that produce them are solid or liquid.

Of the *dry* rhonchi there is the *sibilant* or *whistling rhonchus*, which is sufficiently described by its name, and may generally be imitated by whistling between the teeth. It is produced by the passage of air through a small and somewhat circular aperture ; and this aperture may be formed by a slight obstruction of a small tube, or by a greater obstruction in tubes of larger size. It generally occurs in tubes narrowed by swelling of their mucous and submucous coats, such as occurs in the early stage of acute bronchitis ; but it is heard also in asthma, where the tubes are congested and constricted by the spasmodic contraction of their circular fibres ; and it may happen, also, when viscid mucus clings to and diminishes the calibre of the tubes.

The *sonorous rhonchus* is a snoring, humming or droning sound, and may vary in loudness or key, from an acute note, like that of a gnat, down to the grave tone of a violoncello or bassoon. It must be produced by an obstruction leaving a flattened aperture, the lips of which, or the moisture on them, yield to the passing air with a vibrating resistance. Partial swelling of the sides of a tube, particularly at its bifurcation, a pellet of tough mucus in it, or external pressure on it, may cause such a flattened opening within the tube ; and the sound in question, therefore, occurs in various forms of bronchitis, and often accompanies tumours which press on the bronchial tubes. When caused by tough phlegm, coughing generally changes or removes it ; when from the other causes, it is generally more permanent. When quite permanent, it usually depends on the pressure of a tumour, or some deposit outside the tube. The key or note depends chiefly on the size of the aperture left : when this is small, the note is high ; when large, it is more of a bass : from this may be inferred, that the latter can have its seat only in the large tubes ; but as a more considerable obstruction may flatten their calibre to the smallest size, these may

also be the seat of the acute notes. Almost every variety of this rhonchus may be imitated by blowing between the lips moistened with saliva, and almost closed.

There is another rhonchus, which may be called the *dry mucous*, because it is produced by a pellet of tough mucus obstructing a tube, and yielding to the air only in successive jerks, which cause a ticking sound like that of a click-wheel. When the air is driven very fast, these click-sounds pass into a continuous note, and constitute the sonorous rhonchus. Sometimes, again, particularly in inspiration, the click-sound suddenly stops, the tough mucus being forced into a smaller tube, which it completely closes, and may not be dislodged again, but by dint of forcible coughing.

[*Dry crackling* rhonchus is composed of a succession of minute, dry, short, sharp, crackling sounds, few in number, rarely exceeding three or four in a respiration, limited to inspiration, persistent, when fully developed, conveys to the ear the impression of being evolved at a distance from the ear, and passes, at a variable period, into the humid crackling. It is met with in the earliest stages of phthisis, in about nine-tenths of the cases, according to Fournet. It has been investigated with great care by Fournet. It is generally heard at the summit of the lungs, but when heard lower down indicates that the summit is already considerably diseased.]

Now, as any of these rhonchi may be produced in only one tube and yet be very loud, it is not to be supposed that they are important in proportion to the noise they make. It is rather when they are permanent, or when several of them are heard at once in different parts of the lungs, that they bespeak disorder that may be serious, either from its continuance or from its extent.

The *humid rhonchi* depend on the passage of air in bubbles through a liquid in the lungs, and their varieties are produced by differences in the size of the tubes, and in the nature and quantity of the liquid, which cause varieties in the bubbling sound. A bubble is a portion of air contained and slightly compressed, by a thin film of liquid, which preserves its integrity by its molecular or aggregative attraction; when this attraction is overcome by the gravitation of the liquid, the motion of the air, or any other disturbing cause, the bubble bursts; as it bursts, the air from it, slightly expanding, gives to the adjacent air an impulse which, if forcible enough, produces sound. In the bubbling passage of air through a liquid, the air is the moving body, the liquid gives the resistance; and in proportion as these are strongly and suddenly opposed to each other, the louder will be the sound produced. If the air pass with force, it makes most noise in a liquid of some tenacity, which offers it most resistance; but if it move slowly, such tenacity may retard the breaking of the bubbles, and therefore diminishes the sound. Again, air passing through a liquid in large tubes, gives most sound when the liquid is thin, because

the bubbles form and burst quickly; but in passing through very small tubes, air causes more sound with a rather viscid liquid, which, adhering to the tubes, is not carried before the air so readily as one of a thinner nature. This rule is applicable to bubbling sounds or rhonchi heard in the chest.

The *mucous* rhonchus may be heard in the large and smaller bronchi down to the size of a crow's quill; and in these tubes its gurgling or crackling presents different degrees of coarseness. It is an irregular and varying sound, composed of unequal bubbles, and often interspersed with some whistling, chirping, or hissing notes. Its most common cause is acute bronchitis, which, after its onset, is attended with a secretion of liquid mucus into the bronchial tubes; and the passing of the sibilant and sonorous rhonchi of the first or dry stage into the bubbling of the second or secreting stage, is often marked by a curious combination of chirping and cooing notes, like those of birds in a bush.

When there is a little liquid in the smaller bronchi, the bubbling or crackling is more regular, although the sound is weak, and is sometimes only a roughness added to the ordinary respiratory murmur. This is the *submucous* rhonchus, [which is a variety of the mucous.] It may result from slight degrees of bronchitis, and owes its importance only to its being permanently present when such slight inflammation is constantly kept up by the irritation of adjacent tubercles in an incipient state.

When there is more liquid, not viscid, in the smallest tubes and terminal cells, the rhonchus has a still more crepitating character, and resembles that heard on applying the ear near the surface of a liquid slightly effervescing, such as champagne or bottled cider. This is the *subcrepitant* rhonchus, which is heard in œdema of the lungs, humid bronchitis, and other affections in which liquid and air occupy the extreme tubes, and are forced through each other in the motions of breathing.

But the most perfect and equal crackling is that of peripneumony, and is therefore called the *crepitant* rhonchus; it exactly resembles the sound produced by rubbing slowly and firmly between the finger and thumb a lock of one's hair near the ear. We believe that this sound depends on the forcible passage of air through a little viscid mucus in the finest tubes, narrowed by congestion and deposit around them, but we shall have occasion to investigate this subject under the head of PNEUMONIA.

[Crepitant rhonchus, is of two kinds, *primary* and *redux*,—the one accompanying the development, the other the resolution of hepatization. Primary crepitation is composed of an immense number of dry, small, sharp, crackling sounds, very similar, evolved with great rapidity, and in puffs, co-existent with inspiration and persistent. *Redux* crepitation is somewhat more moist

and bubbling, never occurs in sudden puffs, irregular and dissimilar.

Humid crackling, is a rhonchus composed of a series of crepitations having a humid character, few in number, of moderate size, occurring with both respiratory murmurs; passes into the mucous; it is most distinct and regular in inspiration.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Sibilant rhonchus.	<ol style="list-style-type: none"> 1. Presence of viscid mucus in, and modifying the form and caliber of, the bronchi temporarily, and itself becoming the seat of vibration, which is transmitted to the tubes. 2. Permanent alteration of caliber of bronchi from external pressure. 	Commonly general over both sides of the chest, or in other cases limited to some spot in particular, the site of which is variable	<p>Bronchitis.</p> <p>a. Primary. { Emphysema Pulmonary caverns. Dilated bronchi. Pneumonia.</p> <p>b. Inter-current, or Secondary to</p> <p>c. Acute. d. Chronic. e. Simple. f. Plastic.</p> <p>Pulmonary emphysema. Tumours pressing on bronchi.</p>
Sonorous rhonchus.	<ol style="list-style-type: none"> 1. Presence of viscid mucus in, and modifying the form and caliber of, the bronchi and itself becoming the seat of vibration. 2. Permanent alteration of caliber of bronchi from external pressure. 	Same as the sibilant.	Same as the sibilant; the precise conditions of the diseases vary commonly in the two cases however.
Dry crackling rhonchus.		Wherever tubercle exists in the first stage; hence, in the great majority of cases the summit of the chest anteriorly and posteriorly, —that is, primarily; it may appear secondarily, however, in a lower situation, when the disease has advanced to the second stage su-	Unsoftened tubercles in moderate quantity.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Dry crackling rhonchus.		periorly. It has not yet been detected as a primary condition in those rare cases in which tuberculization commences inferiorly.	Unsoftened tubercle, &c.
Crepitant rhonchus: a. Primary.		Varies with that of the pneumonia, according as this is idiopathic or symptomatic. In the former case one base posteriorly is its most common seat.	Pneumonia; stage of engorgement, both in idiopathic and symptomatic species.
Crepitant rhonchus: b. Redux.		The same as the primary variety.	Pneumonia; period of resolution.
Sub-crepitant rhonchus. True sub-crepitant variety.	Bubbling of air through liquid of variable consistence in minute bronchial tubes.	Bases of both lungs posteriorly. Summit of either lung. Basis of one lung posteriorly most commonly.	{ Idiopathic capillary bronchitis. { Tuberculous capillary bronchitis. { Pneumonia, at period of resolution.
Sub-crepitant rhonchus. Liquid subcrepitant variety.		Circumscribed points of the chest of variable seat. Bases of both lungs posteriorly. Bases of one lung posteriorly most commonly.	{ Pulmonary apoplexy. { Pulmonary } Idiopathic. { œdema. } Following pneumonia. { Chronic consolidation of the lung, in its very earliest period of transition from acute.
Humid crackling rhonchus.		Summit of either lung.	Tubercles commencing to soften.
Mucous rhonchus.	Bubbling of air through liquid (mucus, blood, pus) contained in tubes of moderate or considerable caliber.	Middle height of both, or more rarely of one lung.	Bronchitis { Acute. { Chronic. Bronchorrhœa. Dilatation of bronchi. Bronchial hæmorrhage. Pulmonary apoplexy (with hæmoptysis.) Evacuation of pus from pleura or elsewhere through bronchi. Third stage of pneumonia.]

[When the bronchial tubes become enlarged by disease, or when morbid cavities are formed by the destruction of portions of the lung, the bubbling of air through liquid in them is of the coarsest kind; it is quite gurgling, and, if the liquid be scanty, has a hollow character; it is called *cavernous rhonchus*.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Cavernous rhonchus.	Bubbling of air through fluid contained in a hollow space in the interior of the lung, or, in very rare cases, motion of fluid so contained, produced by the action of the heart.	Summit of one or both lungs. Central part of lung most commonly. Indifferently in any part of the lung.	Tuberculous excavation. Extensive dilatation of bronchi. Excavation from Abscess. Sphacelus. Communication of pus contained in pleura or elsewhere with bronchi; some destruction of substance attending. Softening of cancer. Pulmonary apoplexy.]

Of all these different rhonchi, we may repeat what we said of the morbid sounds of respiration, that they may occupy the whole of the respiratory movements, or be confined to part of them. Thus, an obstruction which is sufficient, at the commencement of inspiration, to cause a rhonchus, may be insufficient when the tubes are dilated by the distension of a full breath, or there may be the converse; an obstruction which is total in low degrees of respiration, and stops all sound, in forced or extensive efforts, as in coughing, occasions a rhonchus. This suggests to us the propriety of using these different degrees of respiration to test the nature and extent of bronchial obstructions. It may also be inferred from what has been said, that the different stages and degrees of force in respiration may change the note of the different rhonchi, and thus produce such a variety as that which we hear in the chests of some catarrhal and asthmatic patients. Laennec used to call this combination of piping sounds rhonchus *canorus*. It may be readily conceived, too, that these several rhonchi may be variously combined, or exist at the same time in different parts of the lung, and give rise to numerous combinations which it is needless to dwell on. It has been stated that the loudness of a sonorous or sibilant rhonchus is no proof of the severity of the disease; nor is the fact of its being audible over the whole chest, unless the respiratory murmur be at the same time absent or very

feeble in parts. But the presence of the bubbling or crepitant rhonchi does imply mischief proportioned to its extent; and if they are heard over a large space, and accompanying the whole act of respiration, diminishing or destroying the natural murmur, they denote disease of a very serious character, because, as our hearing informs us, there is an obstructing liquid in the tubes where there ought to be only air, and the function of respiration must be injured in proportion.

AUSCULTATION OF THE VOICE. We now proceed to examine another class of sounds—those of the *voice* as transmitted through the chest. We have found that the sounds of respiration, which are chiefly produced by air passing in the lungs, are transmitted to the air on the surface of the chest. In like manner the sounds of the voice, which are strongly communicated to the same air, are transmitted modified by the size of the tubes, and the nature of the substance through which they pass; and thus these sounds also become signs of the condition of the organs that transmit them.

On applying the ear to the throat or upper part of the sternum of an individual whilst he is speaking, the voice is heard so loud that it seems as if he were speaking into the ear, only the articulation is not so distinct. The reason of this is obvious: the sound of the voice, although originating in the vibration of the glottis, is propagated to the air above and below it; that below being pent up, is not heard without bringing the ear into contact with the parts where the tubes run, and it there resounds with all its force. This is called *tracheophony*, or the natural tracheal voice.

But when the trachea divides and subdivides, there is not only a division of the sound into smaller tubes, and a consequent diffusion of it and reduction of its strength, but at this division the tubes plunge into the spongy tissue of the lung, which, as we have before found, is a bad conductor, and tends to stop the sound. Hence over the chief bronchial ramifications, on each side of the upper part of the sternum, at and between the scapulæ and in the axillæ, the voice is still heard, but more diffused and distant than at the throat and sternum, and the articulation is still less distinct. This is natural *bronchophony*, or bronchial resonance.

In other parts of the chest, as the voice gets into the finer tubes with their more flaccid coats and minute cells, its vibrations are either choked and destroyed, or in some parts they may be transmitted across the tissue to the parietes in merely an obscure diffused fremitus. This may be called the *pectoral fremitus*, or *vibration*. It may also be felt by the hand applied to the chest. Before describing the modifications of these sounds by disease, we must notice some natural varieties and their physical causes.

Natural bronchophony, or the vocal resonance in the bronchial

tubes, is most distinct in thin persons with a high or treble voice, as in females and children: shrill or treble notes penetrate further into the small tubes, because their vibrations are less extensive, and need less room than those of deeper tone. This may be understood on observing the different vibrations of the cords of a musical instrument: the motions of the treble cords are short and quick, so as to be scarcely visible, whilst those of the bass are long and quite distinct. So in a person with a bass voice, the sound will hardly pass into the subdivisions of the tubes, and there will be little or no bronchophony: but if the voice be strong, it will not be entirely lost, for it will pass across the whole spongy tissue, and throw it all, more or less, into a diffused vibration, which may be heard and felt in many parts of the chest in the character of pectoral fremitus. We find, then, that treble tones give more of bronchophony, and bass ones more of the pectoral fremitus. The same occurs with the morbid sounds; and if we can get our patients sometimes to change their tone of voice, we may thereby more effectually test the condition of their pectoral organs.

Now, as with corresponding varieties of respiratory sound, so with these sounds of the voice, they become signs of disease when they are heard out of their proper places. To know what these proper places generally are, it is necessary to study the anatomical disposition of the tubes, and tissue of the lungs in the different regions. But there is another standard more applicable to individuals, viz., comparison between the two sides of the chest. As there is an approach to symmetry in the structure of the two sides, so there is, in health, a general correspondence between their sounds; and as disease scarcely ever affects both sides at the same time in the same degree, it will make the phenomena of one side to differ from those of the other. For example, if under one clavicle the voice resound loudly, whilst it is scarcely heard under the other, it is certain that there is some physical difference between the two sides that does not exist naturally; or if below the third rib in front there be heard the tubular or bronchial voice, which is generally confined to the immediate neighbourhood of the large bronchi, it may be inferred that there is an altered condition of the parts. Let us inquire what alterations will change the natural disposition of the sounds.

An increase in the density of the pulmonary tissue by a solid or liquid effusion, or even extensive sanguineous congestion in it, will improve its conducting power, and enable it to transmit from the bronchial tubes the vocal sounds which they receive from the trachea. This is *morbid* bronchophony, and it is usually accompanied with bronchial respiration: If, then, the voice be heard resounding in a part of the chest where it is not usually heard, it

may be suspected that the lung is in some way increased in density; but this is not certain until it be tested by further means, for there is another change which may also increase the vocal resonance of a part. If, instead of the sound being better conducted from within, it is increased in strength and extent by an enlargement of the bronchial tubes, it may then be heard in situations where it does not naturally reach the walls of the chest. In both cases it may more or less resemble the natural bronchophony heard near the top of the sternum, and between the scapulæ; but it often presents considerable modifications. Thus, when transmitted from the middle-sized bronchi, it comes rather as *diminutived bits of voice* than as articulate words; and for reasons before mentioned, low tones are not transmitted; so that if the patient varies his cadence, some words are heard and others not. When arising from dilated air-tubes, or when transmitted from the larger tubes, the resonance is more noisy and continued, varying less with the tone of the voice. If the air-cells over the resonant tubes be still open, the sound will be diminished when they are dilated by a full inspiration, because they then tend to intercept it more. The loudest bronchophony is caused where the middle and upper lobes of the lung are pressed against some part of the walls of the chest by a liquid effusion in the pleura, which cannot displace the lung from that part, because it is bound to it by old adhesions.

But what modifies the transmitted voice in the most remarkable manner, is a thin layer of liquid between the lung and the walls of the chest. The liquid is thrown by the vocal resonance of the lung into a state of irregular vibration, which causes it to transmit the voice in a broken tremulous manner, so that it sounds to the ear outside like the bleating of a goat. Hence Laennec called it *ægophony* (*αἴγος φωνή*). It may be produced simply by liquid in the pleural sac, without disease of the lung; for the compression of the pulmonary tissue caused by the liquid is enough to enable the lung to transmit the voice from the bronchial tubes within it. When the lung is consolidated also by disease, the vocal resonance is stronger, and there is a loud bronchophony mixed with the bleating voice, constituting a kind of double or buzzing voice, which Laennec compared to that performed in the exhibition of *Punch*.

There is yet another kind, which may be called the perfection of vocal resonance in the chest. When a cavity is formed in the lung by the emptying of a vomica or abscess through the air-tubes, the voice passes from these tubes into it; and if the communication be free, the voice may, by the ear applied outside, be heard in the cavity as distinct as it is in the trachea. This is *pecto-riloquy*—not only voice, but speaking in the chest. When the cavity is near the surface, of moderate size, and opens freely into

a large air-tube, the phenomenon is most perfect, and then sounds exactly as if a patient spoke into the ear: this is limited to the spot where the cavity lies, which is thus, as it were, a little island of voice, and is a sure sign of a cavity. The sound of bronchophony is often louder, but then it is more diffused, and there is less distinctness in the words. We shall enter further into these distinctions when we treat of the lesions of which they are signs.

When the cavity is large, and the opening into it small, the voice may not fully enter it; but there may be a tinkling or hollow reverberation in it, like that in a phial. This is an echo modified by repeated reflection, and constituting a separate note. It is called *amphoric resonance*, or *metallic tinkling*, according to the character of the sound. It may be produced in the cavity left by a large vomica or abscess, or by several of these running together; but its more common seat is the sac of the pleura, into which the air has entered through a fistulous opening from the lung. This being the resonant or echoing cavity, it is plain that not the voice only, but the breathing and cough also, especially if they be accompanied by a bubbling through the fistula, will have more or less of this tinkling or bottle sound.

Besides these various positive phenomena of the voice, the absence of the *vocal fremitus* is sometimes a valuable sign. It has been stated that this pectoral fremitus can be felt as well as heard. On applying the hands, one on each side of a healthy chest, the vibrations may be felt nearly alike on both sides. Liquid in the pleura will generally more or less destroy this fremitus; and the difference which it produces between the two sides is often a very valuable sign of the presence of liquid. Consolidation of the lung, again, will increase the vibrations, or make them even stronger over the bronchial tubes. In cases where one side is quite dull on percussion, we may often thus easily distinguish whether the dulness is caused by consolidated lung or liquid in the pleura, which is a point of great importance.

[Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Weak vocal resonance.	Diminished conducting power of substance of lung, or presence of non-conducting medium between the lung and the walls of the chest.	Anterior surface of either side (especially the left;) also the bases posteriorly.	Atrophous vesicular emphysema. Pneumothorax.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Suppressed vocal resonance.	Presence, in the cavity of the pleura, of a material incapable of conducting sonorous vibrations (air.)	Middle height of chest.	Extensive pneumothorax.
Bronchophony.	1. Unnatural density of the pulmonary tissue surrounding the bronchi, and forming the medium of transmission between those tubes and the surface, in consequence of which density, the substance is rendered a better conductor of sound; 2. presence of an indurated adventitious mass in the same situation; 3. Enlarged caliber of the bronchi.	Summit. Base posteriorly commonly; sometimes the summit. Central height usually. Variable.	Tuberculous accumulation. Pneumonia, periods of hepatization. Pleurisy, { { Period of effusion, laminar and gravitating. { Period of absorption without contraction of chest. (Rare.) { Period of absorption with contraction of chest. (Frequent.) Pleuro-pneumonia. Dilatation of bronchi. Cancerous disease of lung or pleura. Tuberculous masses in pleura. Pulmonary apoplexy. rare. Chronic consolidation of lung. Pulmonary œdema.
Ægophony.	A thin stratum of liquid compressing the lung, and commonly (but not necessarily) contained in the pleura.	The neighbourhood of the inferior angle of either scapula (rarely of both) and a few inches on the side in a line with that point; in very rare cases extending towards the nipple in front.	Pleurisy, pe- } laminar } effusion } riod of } gravitating, ab- } sion } } sorption. (Re- } } dux.) } Hydrothorax. Hydropericardium (extremely rare.) Pleuro-pneumonia. Pneumonia.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Pectoriloquy.	The existence of a hollow space in the lung, presenting certain conditions conducive to free vibration.	Summit of one or both lungs. Central part of lung most commonly. Indifferently in any part of the lung.	{ Tubercular excavation. { Dilatation of bronchi. { Excavation from { Abscess. Sphacelus. Pulmonary apoplexy. Cancer.
Amphoric resonance.	The existence of a large cavity in the lung, filled chiefly with air, and communicating with the bronchi.	Same as amphoric respiration. (p. 60.)	
Metallic tinkling and echo.		Central height laterally or posteriorly, whence it may be propagated with gradually diminishing intensity to the surrounding parts; may be heard in every part of the chest.	Pneumo-hydrothorax, with bronchial fistula. Excavation in the lung, with indurated walls, of extremely large size; especially if multilocular, and containing about equal proportions of air and fluid; of tuberculous origin. (Rare.) Pneumo-hydrothorax without bronchial fistula. (Extremely rare.) Pneumothorax.

PLEURAL FRICTION SOUND.—Besides the sounds produced by air and the voice, there is sometimes one produced by the motion of the lung against the ribs. The lungs, although they nearly follow the motions of the chest, do not move quite with it, especially in the lower parts, where the descent of the diaphragm draws the lungs downwards whilst the ribs are rising. But in the natural condition, the surfaces of the pulmonary and costal pleura are so smooth, and so well lubricated with serum, that although there is motion, there is not resistance enough to that motion to cause sound. But if these surfaces become uneven by the deposit of rough matter on them, or by an irregular distension of the tissue by solids or air under them, there may then be a rubbing sound with the motions of respiration; this occurs in pleurisy and emphysema of the lung. This rubbing sound is often the more evident in these cases, because the same disease, by preventing the proper expansion of the lung, causes less harmony than usual between its motions and those of the chest.

Pleural friction sound consists of superficial jerks, audible over a limited space generally; varying in intensity; of variable

duration; depending on the freedom of the surfaces and the dilatability of the lungs, ordinarily dry, heard during inspiration and expiration, never heard during expiration alone. The varieties into which it has been divided are *grazing*, *rubbing*, *grating*, and *creaking*—they are but different degrees of intensity of the same sound. The latter is said to exist by Dr. Walsh at the apex of tuberculous lungs.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Grazing friction sound.	Collision of the pleural surfaces, which have lost their natural polished smoothness and slight humidity, and become more or less rough from the deposition of new matter. The collision is commonly produced by the movements of respiration; in very rare instances, by the action of the heart.	Variable not only in different cases, but from day to day in the same subject.	Pleurisy; period of simple dryness of the pleural surfaces; generally tuberculous.
Rubbing friction sound.		When the cause is idiopathic pleurisy, the central height and inferior part of the chest posteriorly and laterally; when the cause is tuberculous pleurisy, sometimes the summit. In cases of advanced emphysema at the postero-inferior part of the chest.	Pleurisy, { <ol style="list-style-type: none"> 1. Period of plastic exudation. 2. Period of effusion. 3. Period of absorption, with or without contraction of the chest. (Redux.) Superficial pneumonia with plastic exudation. Pulmonary emphysema with sub-pleural vesicles. Sub-pleural tubercles.
Grating friction sound.			Pleurisy, { <ol style="list-style-type: none"> Period of plastic exudation. Period of absorption with or without contraction of the chest. (Redux.)
Creaking friction sound.			Pleurisy; period of absorption with or without contraction of chest. (Redux.)]

[HEART'S SOUNDS.—When the lungs are healthy, the intensity of the heart's sounds is directly as the distance of the point at which they are examined from their centre of production. In some diseases of the lungs the conducting power of the intermediate media being altered, increased or diminished, the intensity of the heart's sounds will be increased or diminished.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Intensity of heart's sounds as transmitted through the lung increased.	Increase of conducting power of pulmonary substance, or deposition of good conducting material in the cavity of the pleura.	Always more readily ascertainable on the right side; the part of that side variable.	Pneumonia. Chronic consolidation of lung. Tuberculous disease in first and second stage; occasionally in third. Extensive pulmonary apoplexy. Pleurisy, { Period of effusion; laminar; gravitating. { Period of absorption with retraction. Dilatation of bronchi. Cancerous disease of the lung. Pulmonary œdema, if producing much induration. Tuberculous masses in pleura.
Intensity, as above, diminished.	Diminished conducting power of contents of chest, dependent on rarefaction of lung or presence of air in pleura.	More readily ascertainable on the left side; the part of that side variable.	Pulmonary emphysema. Pulmonary atrophy. Pneumothorax.
Transmission of vascular murmur through the lung.	The existence of the murmur, and of an unnaturally good conducting medium to transmit it.	Under the clavicle, and originating in the subclavian artery.	Tuberculous disease of apex. Chronic induration of apex.]

The foregoing description of the acoustic phenomena of the chest connected with respiration may perhaps be considered rather minute, and it is hardly expected that the student will be able easily to master all the details; but if sufficient attention be paid to the principles that have been explained, the various phenomena which are illustrations of these principles will become familiar and intelligible when they present themselves in clinical experience. In the descriptions of individual diseases we shall again meet with these phenomena; and by the principles which have now been explained, we shall be prepared for them wherever they may occur.

[AUSCULTATION OF THE LARYNX.—Neither Laennec nor his commentator, Dr. Andral, makes any mention of the application of auscultation to the diagnosis of the diseases of the larynx and trachea. Dr. Stokes, of Dublin, was the first to direct attention to this subject, and subsequently, Dr. Barth, of Paris, published a valuable memoir on laryngeal auscultation, (*Arch. Gén. de Méd.*, Juillet, 1838, and Juin, 1839), which was afterwards incorporated into his admirable manual on auscultation—(*Traité Prat. d'Auscultation, &c. par M. Barth et M. H. Roger. Paris, 1841.*) Our knowledge on this subject is yet very deficient and uncertain; still, when its results are compared with those of pulmonary auscultation, they often serve as useful auxiliaries.

The morbid phenomena discovered in the larynx by auscultation are :

A.—Changes of character.

a. Harsh Respiration.

B.—Rhonchi.

- a. Sibilant.
 b. Sonorous.
 c. Valvular.
 d. Gurgling.
 e. Flapping.

Harsh laryngeal respiration.—Is cavernous in character; both murmurs are increased in intensity and duration, and are harsher and dryer than naturally.

Sibilant laryngeal rhonchus.—Resembles ordinary bronchial sibilus in character, though it is generally much more intense; it accompanies both murmurs; is more marked in inspiration, and is sometimes wanting in expiration.

Sonorous laryngeal rhonchus.—Precisely the same as the bronchial sonorous rhonchus.

Valvular laryngeal rhonchus.—This is described by Dr. Stokes as resembling the noise produced by the rapid action of a small valve, combined with a deep thrumming sound.

Gurgling laryngeal rhonchus.—Resembles pulmonary cavernous rhonchus.

Flapping laryngeal rhonchus.—First discovered by Dr. Barth, is described as a vibrating tremulous murmur, such as might be produced by the agitation of a thin movable membrane by the air.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Harsh laryngeal respiration.	Passage of air along the surface of rough or ulcerated mucous membrane; also through a larynx the form of which is altered by external pressure.	Opposite the larynx, extending into the trachea to a certain distance.	Acute and chronic laryngitis, with or without ulceration or diminution of caliber tube. Tumours pressing upon the larynx or trachea from without. Croup.
Sibilant laryngeal rhonchus.	Passage of air through a larynx of diminished caliber.	Over the larynx and lateral parts of the neck; sometimes audible at the upper part of the chest, and even without applying the ear or stethoscope to that cavity.	Spasm of glottis. Laryngismus stridulus. Hooping-cough. Edema of the glottis. Foreign bodies in the air passages. Tumours compressing the larynx or trachea.
Sonorous laryngeal rhonchus.	Passage of air through a larynx of diminished caliber.	Same as the sibilant.	Laryngeal ulcerations with thickened edges. Laryngeal vegetations. Croup. Tumours either connected with the larynx itself, or pressing upon it from adjoining parts.
Valvular laryngeal rhonchus.		Most evident immediately above the <i>alæ</i> of the thyroid cartilage; disappears below in the bronchial tubes, and may even exist on one side only of the larynx. (Stokes.)	Chronic laryngitis with ulceration.
Gurgling laryngeal rhonchus.	Passage of air through fluids contained in the larynx.	The larynx and trachea; audible sometimes at a distance.	Hæmoptysis. Laryngeal ulcerations. Foreign bodies in larynx or trachea. Close of life in various diseases (death rattle.)
Flapping laryngeal rhonchus.	Tremulous movement of false membrane, produced by the air passing to and from the lungs.	Opposite the larynx or along the trachea, and audible even in the larger bronchi also.	Croup, with floating false membrane, partially attached.]

We shall now describe shortly the methods of auscultation or the means which we use to obtain a cognizance of those acoustic phenomena which we have found to be signs of the condition of the organs within the chest. We have already described the methods of percussion; and we have now to study the best mode of listening to the signs of the motions of the chest. All these signs can be heard by the direct application of the ear to the chest, and this *immediate* method of auscultation is so easy and simple, that it commends itself strongly to us, and in many cases is used with advantage. The sounds proceeding from the walls of the chest are communicated to the ear, and especially to the air contained in the external meatus, and are thus propagated in the most direct and unmodified manner to the organ of hearing. *Immediate* auscultation is exclusively practised by some, both at home and abroad; and as it is much more easily learnt than the *mediate* method, it will probably always have its advocates among those who prefer ease to exactness. But if we can hear the signs so well by the unassisted ear, it may be asked, what is the use of the *stethoscope*? We shall first mention some positive objections to immediate auscultation; and on examining the principles of the stethoscope, we shall find that it has, in many cases, considerable positive advantages. To apply one's ear, and therefore the nose, face, and so forth, to the chest of a patient who is dirty, blistered, or wet with perspiration, would be disgusting. To apply it to the chest of a patient labouring under an infectious disorder would be unsafe. To apply it to the person of a young female would scarcely be delicate. Moreover, it is difficult to apply the ear well to some parts of the chest, such as the arm-pit, and below the clavicles or between the scapulæ in thin persons. Besides this, disturbing noises sometimes arise from the contact of one's hair or clothes with the patient's chest; and unless the practitioner's neck be pretty long and flexible, this easy method will be found, after all, more fatiguing than the mediate method; still, in a great many instances, it may be used with advantage, especially in examining the regions of the back, and in children where the stethoscope might cause alarm, and could not be so steadily or quickly applied.

[The advantages of mediate over immediate auscultation are here rather exaggerated. The chest can be more quickly, and, in most cases, as accurately explored without as with the stethoscope. By placing a towel over the chest the objection on the score of uncleanness is removed. In France, where auscultation is used as a daily means of exploration, the stethoscope is but little employed. The distinctness and precision with which the sounds are heard depend on the habits of the auscultator. Children are frightened by the production of the instrument, and for them the

naked ear is preferable. As, however, the anterior portions of the chest in females, and the clavicular and axillary regions in both sexes are better explored by the stethoscope, the auscultator should habituate himself to its use.]

We want an instrument, then, to transfer the sounds from the chest to our ear, which must be a good conductor of sound; and as the power of bodies to conduct sound depends on the strength and uniformity of their elasticity, and their capacity to vibrate like the body that produces the sound, we must have an elastic material, of density resembling that of the sources of sound within the chest, and of the walls of the chest through which they are transmitted. But the sources of the pectoral sounds vary: some, as the voice and respiration, or at least the hollower sounds of respiration, are produced in air; whilst in others, such as the sonorous rhonchus, the rubbing sound, and the sounds of the heart, the solids are chiefly concerned: we shall therefore need a varied capacity in our instrument to receive these sounds. It should be a uniform solid, and the lighter it is the better, provided it be thoroughly rigid. Now nothing answers to this description so well as wood; and in the light kinds of wood, with a stiff longitudinal fibre, such as pine-wood, deal, cedar and the like, we find these qualities in perfection: through a cylinder of such wood, about eight inches long, and an inch and a half in diameter, adapted to the ear at one end, most of the pectoral sounds may be heard; but those best which originate in solids, such as the sounds of the heart, of friction and sonorous rhonchi. The sounds of respiration and of the voice are also heard through it, but not nearly so distinctly as with the naked ear.

We need, therefore, an aërial conductor for these sounds, because they originate in air, and can best be transferred through air. By perforating the cylinder with a bore a quarter of an inch in diameter, it becomes a tube through the column of air in which the respiration and voice may be heard with increased distinctness. But as this column of air is in contact with only a small spot of the chest, it can transmit only the sounds produced under or very near that spot, and the instrument thus prepared is well adapted for the exploration of small parts of the chest. But we want the instrument also to transfer the sounds of larger spaces: the sounds of so limited a space are often too weak to be heard alone; and besides, it would be very tedious to go over the whole chest, *dotting* in this way a quarter of an inch at a time. Now, if the column of air be enlarged at the base where it is in contact with the chest, by hollowing out the wooden cylinder into a funnel shape, it will conduct the sounds produced on this greater extent of surface, which are reflected by the funnel into this central bore, and conveyed concentrated to the ear. This also gives

the instrument the power of concentrating or magnifying the sounds; they are thus heard as strong at the distance of several inches or even a foot or two from the chest as they are to the ear in close contact with it; nay, in some cases, they are even stronger. The best shape for the excavated end is that of a long funnel or cone, with its apex terminating in the central bore; for this directs the sound at once in the right direction without repeated reflections, which may modify it. As we still sometimes want to explore small spots of the chest, by means of a perforated plug, the excavated end can be filled and the instrument reconverted into a simply perforated cylinder. To make the instrument more portable, the upper part of the cylinder may be reduced to a stem half an inch or less in diameter, leaving only at the top a sufficient width for the ear; or this top may be made of a harder wood, or of ivory. Wood is so excellent a conductor of sound, that when once the vibrations are in it, they can be conveyed by a very small body of fibres.

[In the communication of Dr. Williams to the British Association, before referred to (p. 48), the author has entered at some length into the principles and mode of construction of the stethoscope. An abstract of his paper is here presented to the reader.

“Twenty years’ attention to the principles and practice of auscultation may perhaps warrant me in offering to the section a few remarks on the acoustic principles of means used in auscultation, and on the best mode of applying them with efficacy and convenience.

“Laennec, the inventor of the stethoscope, had no accurate views of the principles of its construction. He declared that the instruments which he found the best were not made according to the commonly received laws of physics. Yet experience taught him that the solid cylinder does not convey breath sounds or voice sounds so well as a cylinder perforated and hollowed at its pectoral end. Many years ago I pointed out that this fact, which is unquestionable, is in perfect conformity with a law of acoustics, that sounds are best conducted by bodies of an elastic tension resembling that of the sonorous body. On the other hand, bodies differing in elasticity are bad recipients of each other’s vibrations. Thus wood, although an excellent conductor of sounds generated in itself, or in other solids, receives but imperfectly those produced in air. But by thinning wood, and extending its surface in contact with air, it is much more readily affected by the vibrations of air, and becomes the best medium for transferring to air the sounds of denser solids; and this is the principle of sounding-boards.

“The view which I originally gave of the principle of the stethoscope, represented its operation as varying with the source of sound: sounds produced in air (vocal and breath-sounds) being

best transmitted by an enclosed column of air; those produced in solids (rhonchi, heart and friction sounds) being most effectually communicated by rigid solids of the least density. This view I still hold; and I proceed to remark on the best mode in which the principle may be brought into operation. It has been lately questioned that the conducting power of the stethoscope depends at all on the air contained in the central canal and excavation. This doubt has arisen chiefly from an observation first made by Dr. Cowan, that plugging the central canal does not much impair the power of the instrument. Professor Forbes has repeated the same remark. I have made many experiments on this point, and the following are some of the results:

“Stopping with a cork the pectoral end of the instrument greatly impairs its conducting power; stopping the ear end does so in a much slighter degree. But in any way stopping the tube impairs the transmission of sound; and to be assured of this, it is not sufficient to judge by general impressions as to whether a sound is louder in one way than in another: we must resort to what may be called a *test sound* (as opticians use a test object); a sound just within the limits of audibility, such as the sound of expiration in a healthy subject, or a very faint cardiac murmur. When tried by such a test, the superior conducting power of the open tube becomes obvious. But the impeding effect of a stoppage in the tube becomes most evident in the flexible stethoscope, a cork inserted into the pectoral end of which altogether shuts out faint sounds, and very perceptibly impairs those that are louder. That the common stethoscope really conducts by its closed column of air as well as by its solid walls, is further proved by the following facts: Loud pectoral sounds, as that of the voice, heart, or a murmur, may be heard by bringing the ear end near the ear, without actual contact: the sound is then exclusively conveyed by the air, and may be totally intercepted by a plug. If a large hole be made in the side of a stethoscope, its conducting power is greatly impaired, especially for aërial sounds; but it is at once restored by closing the hole with the finger. The difference depends not only on the exclusion of extraneous sounds by the latter expedient, but also, and chiefly, on the superior power of conduction which a close column of air possesses. That the addition of a solid conductor, by that which stops the hole, is not concerned in the improvement, is clear from the fact, that solid tubes of the most slender walls avail as well as thick ones, so long as they preserve a close column of air within them.

“The closed state of the column of air is the chief condition necessary to give air a high conducting power. Following the assertions of acoustic writers, that the pulses of sound pass through the air in straight lines, like rays of light, I formerly suggested

that the pectoral end of the stethoscope should be hollowed into a very tapering cone, and that the whole interior should be made as smooth as possible, to promote the most direct reflection of sound. But this principle is more applicable to ear trumpets which receive sounds from the open air, than to the stethoscope, which receives vibrations from a solid enclosed surface. Air confined in a close tube vibrates as a whole, and its vibrations pass over angles, and through bends (as in a flexible tube), with a freedom which supercedes the idea of mere reflection, and although they must be transferred through a straight smooth tube more freely than through a crooked and rugged one, the difference is less than might be expected without a knowledge of the properties of close tubes. The chief object in the formation of the hollow end of the instrument is to bring into close contact with the walls of the chest as large a surface of air as possible, and to convey the pulses of this air as directly as possible to the ear. It is at the same time desirable to avoid a large hollow within the instrument; because such a hollow causes such a conch-like or tinkling echo, from the repeated transverse reflection of the vibrations. A conical cavity answers very well for the sounds best transmitted by the air; but a trumpet end does not appear to be inferior, and it answers better for the communication of vibrations to the solid part of the instrument. I have before noticed the inferior power of a solid stethoscope. Some writers, who consider the stethoscope to conduct only by its solid walls, ascribe this inferiority to the weight of its mass, and suggest that if this be reduced by hollowing, the closed solid is still the best instrument. To test this principle I had a thin stethoscope made of light deal, and closed at its pectoral end by a very thin plate of the same material: this proved to be decidedly inferior to instruments with an open bore. Yet this instrument reversed, with its closed end applied to the ear, and its open end on the chest, communicated all diffused sounds uncommonly well; this can be explained only on the principle of the large surface of the hollow of the instrument enabling the solid part to receive the vibrations. But finding the considerable share which the solid walls of stethoscopes have in communicating sounds, and finding, by experiment, that their efficacy depends chiefly on the formation of their pectoral end, by which they receive the vibrations, I have devised a form of instrument which qualifies them for this purpose better than any instrument now in use. It is the bugle or trumpet end, (as seen in fig. 7, A,) the edges of which being made very thin, and applied flat on the walls of the chest, are most readily affected by their vibrations. The instrument thus constructed, of a light rigid wood, such as sycamore, if tried with a test sound, will be found for most purposes superior to the stethoscopes hitherto used.

Fig. 7.

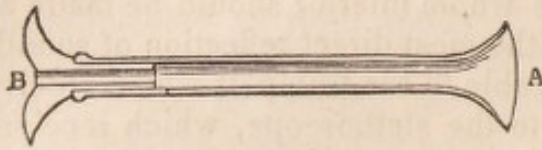
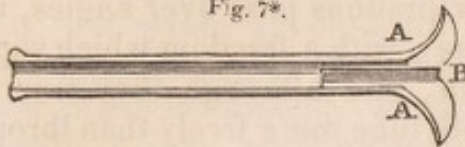


Fig. 7*.



“But most stethoscopes are provided with a perforated stopper, the chief use of which is to shut out diffused sounds, and to transmit by the central canal aerial sounds, from a limited spot; it is thus of great use in distinguishing pectoriloquy from diffused bronchophony. I find that the same object can be pretty well attained

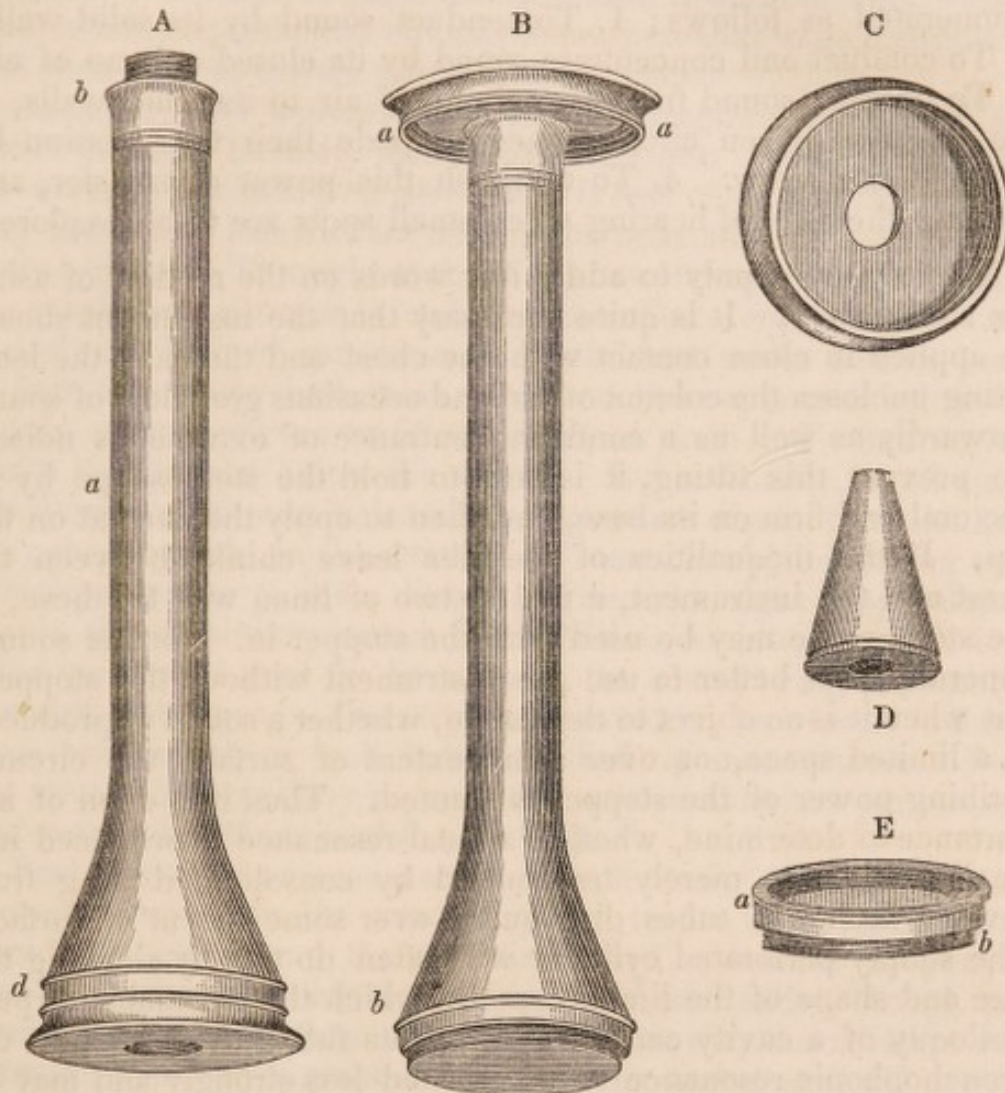
by reversing the new stethoscope, applying the ear end (B) to the chest, and the hollow end (A) to the ear; this end having some extent of flat surface, fits the ear very well, and is not hollow enough to produce much conchal sound.

“An inconvenience at first experienced with this instrument was its fragility, being easily cracked or crushed in the pocket. This evil is readily obviated by making the ear end (B, as seen in fig. 7*) to take off and fit into the hollow end (A); which, thus, not only strengthens the thin part, but also renders the instrument more portable. For this purpose, and for that of shutting out diffused sounds, the ear end should be made stout, and of a tough material, as box or yew wood.

“The stethoscope, in its packed or portable state, (fig. 7*), is well adapted to render visible the extent and direction of the pulsations of the heart or arteries, and of the motions of respiration. Held by its broad end as a base firmly applied to the chest, its small end exhibits, in an exaggerated degree, the movements of its base. Laennec used to exhibit the impulse of the heart by the lifting of his stethoscope; but this instrument does this much more exactly, and likewise shows the direction of the impulse.”

The stethoscopes at present most extensively used in France are those of Dr. Louis and Dr. Piorry. The annexed cuts represent the instrument of Dr. Piorry. This stethoscope is constructed exactly on the same principles as that of Laennec, but with several modifications, intended to render it lighter, smaller, and more portable. In it the central bore and conical cavity of the pectoral extremity, are preserved of the original dimensions, but the body of the instrument is greatly reduced in size, and the proper width is given to the auricular extremity by screwing a thin ivory cap to the slender body of the instrument. The *pleximeter* is attached to the stethoscope merely with a view to render the former conveniently portable.

Fig. 8.



- A. The whole stethoscope with the plug included, and the pleximeter attached, as carried in the pocket.
- a. The body of the instrument, of one-fourth the actual size.
- b. Its auricular extremity of ivory, and with a screw for attaching it to the auricular cap D.
- c. Its pectoral extremity.
- d. The pleximeter, of ivory, screwed upon the body of the stethoscope, and shutting in the plug E.
- e. The auricular cap D, screwed upon the pleximeter.
- B. The stethoscope fitted for use, the pleximeter being removed and the auricular cap (D) applied. a. Auricular cap screwed upon the cylinder. b. The pectoral extremity freed from pleximeter and cap.
- C. The auricular cap removed, interior view.
- D. The plug or stopper removed.

E.—*Piorry's Pleximeter (connected with the Stethoscope.)*

- a. Internal screw for attaching it to the end of the stethoscope. b. External screw, on which the auricular cap is fixed.]

Thus the stethoscope, although a simple instrument, performs several offices in relation to sound, the chief of which may be enumerated as follows: 1. To conduct sound by its solid walls. 2. To conduct and concentrate sound by its closed column of air. 3. To transfer sound from its column of air to its solid walls, or the converse, when circumstances impede their transmission by one of these ways. 4. To diminish this power of transfer, and contract the field of hearing when small spots are to be explored.

We have now only to add a few words on the method of using the stethoscope. It is quite necessary that the instrument should be applied in close contact with the chest and the ear; the least tilting uncloses the column of air, and occasions great loss of sound outwardly as well as a confusing entrance of extraneous noises. To prevent this tilting, it is best to hold the stethoscope by its pectoral end firm on its base, and then to apply the ear flat on the top. If the inequalities of the ribs leave chinks between the chest and the instrument, a fold or two of linen will fill these, or the stethoscope may be used with the stopper in. For the sounds generally, it is better to use the instrument without the stopper; but when it is an object to determine, whether a sound is produced in a limited space, or over some extent of surface, the circumscribing power of the stopper is wanted. Thus it is often of importance to determine, whether a local resonance is produced in a small cavity, or merely transmitted by consolidated lung from several bronchial tubes distributed over some extent of surface. The simply perforated cylinder will often do this by showing the size and shape of the limited spot in which the resonance or pectoriloquy of a cavity can be heard in its full strength, while the bronchophonic resonance is transmitted less strongly and may be traced over some extent of surface, generally in the known direction of these tubes. The stopper is also useful in shutting out the sound of respiration, when it is an object to listen to the sounds of the heart or arteries, and in many other circumstances which will be noticed in the history of special diseases.

In conducting physical examination, due care should be taken to avoid fatigue or annoyance to the patient. There are cases in which a complete physical examination will do more harm than the information which it may bring can do good; but they are few, and it must be left to the discretion of the practitioner to hold the balance between too much and too little examination. Experience soon points out that the observer must also consult his own ease in the act of auscultation; for a constrained or painful posture impedes the hearing and disturbs the attention. For this reason, it is sometimes easier to hear with a flexible ear-tube than with the straight stethoscope, although the latter is by far the best instrument for general purposes.

[PERCUSSION AND AUSCULTATION OF CHILDREN.—The thorax in children is much more sonorous on percussion than in adults; the respiratory murmur is more intense, and is audible only during inspiration, except under circumstances hereafter to be mentioned, and then only in certain portions of the chest.

Anteriorly the sonorousness and the respiratory murmur are not of the same intensity throughout the chest. Immediately over the clavicle the sound on percussion is less clear and the respiratory murmur is less distinct than in the infra-clavicular and mammary regions. Throughout these regions, except over the heart, the respiratory murmur is loud, and the chest very resonant. Anteriorly the limit of sonorousness in children under twelve years is from about one inch to an inch and three-quarters below the nipple. From eleven to fifteen years an inch and a half to two and a half inches below the nipple. But ordinarily, at all ages, the liver is about one inch and three-quarters distant from the nipple; the stomach, on the contrary, is somewhat higher, being only three-quarters or an inch distant. From the right nipple downwards the respiratory murmur diminishes in intensity, but it is often perceived over the liver itself, the sound being transmitted through that organ. The respiratory murmur, moreover, is heard from one half to an inch below the limit of sonorousness. Both the sternal and axillary regions are very resonant on percussion, and respiration there is also very loud.

Posteriorly the sonorousness and the intensity of the respiratory murmur vary. In the supra-scapular region the respiration is decidedly feeble, and there is diminished resonance on percussion. In the infra-scapular region, both are louder, though to a much less degree than anteriorly. However, auscultation and percussion of the supra and infra-scapular and præcordial regions give often in children very variable results. Sometimes they are quite resonant, and the respiratory murmur is distinctly heard, and at other times, they are quite dull, and respiration is very feeble. These differences, no doubt, depend upon the degree of thickness of the osseous and fleshy parts which separate the lungs from the ear. The inter-scapular region is very resonant, and respiration there is loud and even exaggerated. Over a portion of this region is the origin of the bronchi. In very young children the sonorousness of this region is the same throughout, except, perhaps, at the very superior part; after six months, however, the inferior half is usually more sonorous than the superior. It is over this region that not unfrequently the expiration is as distinct, and as long, or even longer than inspiration. Sometimes the character of the respiration is decidedly bronchial. This is generally over the superior portion of the interscapular region, or over its middle portion. That part of the thorax immediately beneath the angle of the scapula, is generally somewhat less sonorous, and the respi-

ration more feeble, than in the interscapular region, though still much more marked than over the same region in the adult. Both the resonance and the respiratory murmur diminish in intensity gradually from above downwards, until both disappear. The inferior posterior boundary it is important to establish, on account of the frequency of those affections which impair or destroy these phenomena above the point where they naturally cease to be heard. MM. Rilliet and Barthez first ascertained with great care the exact spot where sonorousness naturally ceased at the posterior inferior portion of the chest in children of various ages; they then measured, following the vertebral column, the distance between this spot and the seventh cervical vertebra. They found that, in children from three to five and a half years, the height for the sonorousness was from six to eight inches, and an inch or an inch and a quarter more for the extent of respiration. From six to ten the sonorousness extended from six and a half to nine inches; respiration had the same limit usually, and rarely half an inch more. Finally, from eleven to fifteen years, from eight to ten, or eleven inches for both. These measurements are less than those of the dorsal spinal column, because the thorax is rarely sonorous posteriorly below the eleventh dorsal vertebra. On the left side sometimes the chest is resonant, and the respiratory murmur is heard from one to two inches lower down. It occasionally happens that the sonorousness of the thorax is continuous with the tympanitic resonance of the intestines, and is confounded with it, and it is difficult to say where the one commences, and the other ceases.

In some rare cases a false bronchial respiration is heard in some of the regions, which is caused by the sounds in the pharynx and nose; this phenomenon is temporary, and ceases when the child breathes less violently. If from fright, or during a fit of crying, the child makes a deep inspiration, and retains the expiration, false bronchial respiration is heard during inspiration. At other times, on the contrary, inspiration is performed gently, but expiration is noisy and jerking, the child coughing or spitting it out, as it were; false bronchial respiration, in such cases, accompanies the second sound. These phenomena are particularly frequent in rachitic children.

From what has been said, it will be seen that the maximum of intensity of sonorousness and of the respiratory murmur, anteriorly is from the clavicle to a little below the nipple on the right side, the space being rather more limited on the left side. Its minimum is the præcordial region.

Posteriorly, its maximum is the inferior part of the interscapular region; its minimum the supra-scapular region.

Finally, in general terms, the sonorousness is equal anteriorly and posteriorly, but in some instances an evident difference exists.

Age does not produce any great alteration in these results.

In ausculting very young children it is better that they should be held in the nurse's arms who will place the portion of the chest to be examined against the auscultator's ear, as may be required. The same end may be attained by the physician's placing his hand beneath the chest of the child and raising it, so that the head and pelvis not being supported, the chest will become prominent, and the ear may be applied conveniently. The manner in which the child breathes should be carefully noticed, so that errors may be avoided, and the sounds which take place in the pharynx and nose may be distinguished. Sometimes it is useful to examine the chest whilst the child is crying, or even to cause it to cry, in order to ascertain the amount of resonance, the cry replacing in children the voice of the adult. Percussion should be practised with great lightness; a hard blow does not give a more satisfactory result, and often causes intense pain.]

SECT. II.

EXAMINATION OF THE CHEST THROUGH THE VITAL PROPERTIES OF THE ORGANS.

We have been hitherto occupied in considering the *physical* properties of the chest and its organs, and the manner in which these properties may become signs of the condition of these parts. We have now to examine them through their *vital* properties, which, combined with certain physical and chemical powers, constitute *function*. Physiology teaches us that the elementary vital properties immediately concerned in the function of respiration, are sensibility and contractility, to which may be added, the power of secretion. These properties are closely linked together with the chemistry and mechanism of the organs of respiration, so as to constitute their healthy function. Any excess, defect or disorder of any of these properties, will be more or less felt throughout the links of this chain, and hence may arise not only derangement of the function of respiration or *dyspnœa*, but also new phenomena proceeding from a loss of due balance of the same properties, such as *cough*, *expectoration* and *pain*; and linked as the vital properties are with those of other organs, there may be added disorders of these in the form of disturbance of the circulation, and its sign the arterial pulse, general fever, disorder of the secretions of the kidneys, liver and intestines, and of the digestive, nutritive and sensorial functions. The phenomena arising from these several disordered properties are what are called the *vital* or *general symptoms* of disease, which we now have to consider in relation to the organs of respiration.

It may be inferred, and will be more apparent as we proceed, that these general symptoms, dependent as they are on such a linking together of many properties, the laws of which are but imperfectly understood, must be far less simple and intelligible than the physical signs; and the variable measure of the vital properties also renders general symptoms far more uncertain than these signs, in their degree, and even in their presence. We cannot, with any certainty, as with the physical signs, from a knowledge of the phenomena, and the laws which regulate those phenomena, deduce the condition of the parts which produced them, nor, from knowing the condition of parts and physical laws, deduce what phenomena the parts ought to develop. For example, the solids of the body have sensibility, which varies not only in different parts, but in the same parts at different times, and this for reasons which we cannot discover; therefore we cannot calculate on it. The contractility of moving parts also varies in a similar manner; and we can by no means gain, from the character of their motions, a criterion of their true condition. Instead, therefore, of pursuing the synthetic as well as the analytic method, which we have done with regard to the *physical* examination of the chest, we shall shortly analyze the chief *general symptoms* of diseases of the chest, and by that examination, endeavour to determine their nature and varieties, and their value in teaching us to discover, to measure, and to treat these diseases.

Dyspnœa, difficult or disordered breathing, is the most important general symptom of disease of the chest, inasmuch as it implies some interruption to the due performance of some part of the great function of the chest—respiration. Dyspnœa may be caused by circumstances affecting any one or more of the several elements concerned in the function of respiration, viz., the blood in the lungs, the air, the machinery of respiration by which these are brought together, and the nervous system through which the impression which prompts the respiratory act is conveyed from the lungs to the medulla oblongata, and thence to the muscles which move the machinery; in fact, all the causes which, in excess, produce asphyxia, in slighter degrees occasion dyspnœa. Subjoined is a table which exemplifies these causes of dyspnœa; but the character of the symptom itself must first be described.

When any thing interferes with the sufficient action of the air on the blood, the impression which prompts the acts of breathing not being relieved, causes a quicker and fuller repetition of this act, and if the interference still remain, the breathing will continue to be more or less hurried and forced, until the sensation or impression is reduced to the ordinary standard of almost unconsciousness. An individual in whom the breathing is hurried may not be sensible that it is accelerated; whilst in another who feels the oppression, there may be little appearance of shortness of

breath. Again, the feeling of dyspnœa must greatly depend on the condition of the sensorium; for whilst some patients are conscious of the slightest infringement on their respiration, others, particularly in congestive fevers, are brought to the verge of asphyxia without complaining of any oppression. So, too, we are sometimes astonished to find, on opening the bodies of the dead, a whole lung diseased, or one side of the chest full of serum, where the patient had not complained at all of dyspnœa; while, in other cases, a much smaller lesion of the organs has been attended with the most distressing orthopnœa. It is, however, rather to the sensation of breathlessness than to merely accelerated breathing, that the word dyspnœa is generally attached, for, translating it as difficult breathing, this expression can be hardly applied when the difficulty is overcome by accelerated movements of which the patient may not be conscious. But we shall here advert to frequency of breathing, as well as the feeling of dyspnœa.

The number of respirations in a healthy adult male at rest, generally ranges about twenty in a minute. It is more in children and in females, and it becomes increased in all cases, not merely from affections of the lungs or connected organs, but also from general weakness or depressing causes, which, diminishing the strength of the muscles of respiration, oblige them to make up by the frequency of their contractions what is wanting in their energy. Probably there are some nervous conditions of the system, also, in which the breathing becomes accelerated, from what Cullen called *mobility*, a greater readiness to move than power to complete the motions. We have seen the breathing hurried in some cases of hysteria, without the patient being conscious of it, and without either real weakness or pectoral disease to account for it. These cases are of no consequence in themselves, but should be known, that they may be separated from those of true dyspnœa. In many other cases, especially those, we believe, where the nervous system is affected, the breathing is not accelerated, but suspirious, a sigh or deep breath being taken from time to time; yet the patient is often not conscious of any oppression or unusual effort. This may be called irregular breathing, and there are several other varieties which we have not time to consider in detail. The rhythm in breathing probably depends entirely on the chain of influences which we before described as concerned in the act, and not on any peculiar periodicity, such as that which seems to reside in the heart; and therefore irregular breathing must depend on a change in one or more of the links in that chain.

The feeling of dyspnœa is one of a very peculiar and distressing character. Even when slight in degree, its permanent oppressive influence is very wearing; and when severe, it causes

the most indescribable suffering, with such a feeling of impending death, that the most courageous are often unmanned by it. The constrained postures of the patient, the anxious or even desperate expression of his countenance, the painful straining of all the muscles that can in any way, however distantly, assist in the respiratory movements, bespeak the intensity of the feeling, which is far worse than the most acute pain. It is worthy of remark, however, that this feeling is experienced in its severest degrees only by those in whom the dyspnœa comes on rather suddenly, especially when the sensibility is entire, and the lungs are not diseased, as in obstructions in the trachea or large bronchi, spasm or swelling of the glottis, and spasmodic asthma. In these cases the sensibility is not gradually blunted by the circulation of imperfectly oxygenated blood; nor has the activity of the functions, which require arterial blood, been lowered by previous depressing causes. Opium, belladonna, camphor, and other narcotics, will sometimes relieve the symptoms of dyspnœa not only by deadening the sensibility, but also by diminishing the activity of those functions and secretions which require oxygenated blood, and therefore a free supply of air. If we could temporarily produce a state approaching to the torpor of hibernating animals, we might diminish the bad effects, as well as the painful feeling of dyspnœa; and we believe that such a state is actually induced in those who are habitually asthmatic, in whom all the functions are brought to a lower standard, and who thus suffer with impunity such an encroachment on the function of respiration as would be fatal to an individual of a common standard.

The feeling of want of breath has been used as a means of testing the condition of the respiratory organs. A person whose respiration is free and unembarrassed, can hold his breath longer than one whose lungs are diseased. Dr. Lyons has proposed to measure the condition of the lungs by the time which he can *hold the breath*, after a full inspiration; and to insure accuracy, the patient is desired to count numbers during this time. A healthy person with a good chest can continue counting for forty-five seconds without taking breath, whilst those with diseased lungs often cannot keep on for twenty seconds. The same objection may be made to this test that we made to the measuring of the exhaled air proposed by Mr. Abernethy, that it is a test as much for the strength of the muscles of respiration as for the condition of the lungs. Besides, both the feeling of want of breath, and the power of augmenting the respiratory movements, vary considerably in different healthy subjects. It is well known that divers acquire the power of remaining under water for two or three minutes (it has been said more) without taking breath. In diving animals there is a structural provision to enable them to continue some time without air. The chief venous trunks are very tor-

tuous, and admit of dilatation, so that the venous blood can accumulate in them, instead of distending and embarrassing the right cavities of the heart and the lungs. Perhaps some change of this kind may be somewhat produced in divers by the often-repeated practice of holding the breath. Professor Faraday has described another mode by which a person may be enabled to hold his breath for a minute and a half, which is double the time usually practicable. This is by making in succession five or six full and forcible inspirations, which seem to so completely change the air in the lungs, that there is left in them a stock of pure air capable of lasting during that time. The knowledge of this fact may be useful, if ever it is wanted to hold one's breath for a time in going into the suffocating atmosphere of a sewer, a mine, a house on fire, or the like, or in diving.

Dyspnœa is often a symptom demanding great attention in diseases of the lungs; but it must be studied in conjunction with the other general symptoms and the physical signs, for in itself it is most vague and inconclusive. This may be perceived on inspecting the subjoined tabular view of the causes of dyspnœa, which is founded on the physiology of respiration. This table deserves attention, not only in showing the varied nature and origin of the symptom, but also in contrast with the tables of the physical signs, the causes of which are much less varied, and far more appreciable. But when, through the means of the physical and other general symptoms, it has been made out on what cause the dyspnœa depends, then this symptom often becomes a valuable measure of the increase or diminution of the disease, and a useful guide of practice.

PROXIMATE CAUSES OF DYSPNŒA, OR DIFFICULT BREATHING.

1. BY IMPEDING THE ACCESS OF PURE AIR TO THE LUNGS.

a. *Mechanical.*

Rigidity of parts of the respiratory machine	} e.g.	} Ossification of cartilages; induration of the pleura; rickety distortions.
Pressure on ditto.	- e.g.	
Obstructions of the air-tubes	} e.g.	} Effusions in, swellings of, tumours pressing on, the air-tubes. } Spasm of the glottis; spasm of the bronchi.
	- - - - }	
Compression of the lungs	e.g.	} Effusions or tumours in pleural sac - - } Pleurisy, } Hydrothorax, } Pneumothorax, } Aneurism, &c.
Alterations in the tissue of the lungs	} e.g.	} Engorgement of the vessels. } Effusions - - - - } Œdema, } Tubercle, &c. } Altered structure - } Emphysema, } Dilated bronchi, } Vomicae, &c.

- b. *Chemical*.
 Deficiency of oxygen in the air - - - - } *e.g.* Mephitic gases; rarefied air.
- c. *Vital*.
 Pain of parts moved in respiration - - - } *e.g.* Pleurodyne; pleuritis; peritonitis, &c.
 Paralysis of muscles of ditto. - - - - } *e.g.* { Injuries of the spinal marrow in the neck, &c.
 { Paralysis of the bronchi (?).
 Weakness of ditto - - *e.g.* { Excessive prostration from ataxic fevers, &c.
 Spasm of ditto - - - *e.g.* Tetanus; spasmodic asthma, &c.
2. BY THE STATE OF THE BLOOD.
- a. *Mechanical*.
 Obstruction to the passage of the blood - } *e.g.* { Diseases of the heart and great vessels; tumours pressing on them.
- b. *Chemical*.
 An excessively venous state - - - - } *e.g.* Violent exertion; idiopathic dyspnoea (?).
 Deficiency of red particles *e.g.* Anæmia; chlorosis.
3. BY THE NERVOUS RELATIONS OF RESPIRATION.
- Excessive sensibility of the par vagum - } *e.g.* { Hysteric dyspnoea; cerebral fevers; neuralgia (?).
 Defective ditto - - *e.g.* Coma; narcotism, &c. (breathing slow).

Cough. Another symptom, which is even more common in diseases of the chest than dyspnoea, is *cough*. The act of coughing consists in one or more abrupt and forcible expirations, accompanied by a contraction of the glottis, trachea and upper bronchial tubes. The expirations being more complete than usual, especially when there are several of them, are followed by a deep forcible inspiration, the force of which is shown by the loud respiratory murmur, which, by the ear applied to the chest, may be heard to accompany it. The muscles chiefly concerned in the act of coughing are the abdominal muscles and intercostals, the combined contraction of which effects a strong pressure on the contents of the chest.

The common cause of cough is phlegm, or some other matter irritating the air-passages, and the object or final cause of the cough is to expel or expectorate this matter. The proximate cause of cough may be said always to be some irritation, either direct or by sympathy, of the sentient parts of the air-tube, or of the nerves which render them sentient. Some parts of the bronchial membrane are much more sensitive than others; that lining the glottis and larynx is excessively so, and the least irritation of it is enough to excite coughing. That of the trachea and large bronchi is less, for foreign bodies have been known to lodge in them for some time without causing any coughing, so that some have supposed that they have nothing to do with the production of this symptom; but when the sensibility of these parts is increased by inflammation or nervous excitement, any thing irritating them will also excite coughing. It is easy to see why the

sensibility of the air-tubes should be greatest at their entrance; it is the *door-keeper*, placed there to exclude, or, by calling other forces to its aid, to expel any thing improper which may intrude. But the other parts of the tubes have also a preserving sensibility, which may bear a little, but is soon roused into activity by continued irritation. We find the parallel of this in the alimentary canal in the natural state. The sensibility that excites the action of vomiting is peculiar to the fauces at one end of the tube; and that which induces the striving of defecation resides chiefly in the termination of the rectum at the other end: but uncommon degrees of irritation, or an exalted sensibility, will occasion the same actions to be excited by impressions on other parts that are usually insensible: hence arise the vomiting caused by an over-irritated or inflamed stomach or duodenum, and the tenesmus and purging excited by a similar state of the colon. We shall see this more fully on considering the various causes of cough.

As other irritations, cough may be excited either by an unusual irritant acting on the tubes in their natural state, or by the ordinary circumstances, which, although not usually irritating, yet become so by the exalted irritability of the tubes, or, as is the more common case, by a combination of these causes. We have an example of cough excited simply by an unusual irritant, when a portion of food or of bronchial mucus lodges on the membranes of the glottis; and an irritant may act by sympathy as well as by direct application, as when we excite coughing by introducing a probe pretty far into the ear. The cause, by increased irritability, is exemplified in the cough of early bronchitis and nervous asthma, which the mere inhalation of air is sufficient to excite. There are both an unusual irritant and increased irritability, in the secreting stages of bronchitis and other affections, where an unusual quantity, and sometimes an irritating kind, of mucus is poured out on an over-sensitive membrane. This more complex cause of cough is frequently induced by the continuance of the other causes; thus, the continued application of an irritant will develop an increased sensibility; an increased sensibility and irritation will be followed by inflammatory excitement and the secretion of matter, the quantity and quality of which add to the irritation. Thus we see how the physiological causes of cough become identified with the pathology of bronchitis, or inflammation of the membrane of the air-tubes; and, in common parlance, a bronchial inflammation is called a *cough*, this being the most prominent symptom. But although this inflammatory condition is often developed by the continuance of causes which produce cough, yet it is not necessarily so, and there may be irritation or increased sensibility, or both, enough to cause cough, and which may yet be short of the degree or the conditions requisite to produce inflammation.

It has been stated that the irritation which causes cough may not be applied to the bronchial membrane itself, but may be exerted from a part more or less distant. Thus cough may be excited by tubercles in the parenchyma of the lungs, by inflammations or irritations of the pleura, peritoneum, stomach, liver, and so forth; and although we may conjecture that these irritations are conveyed through the nervous branches which connect these several organs and the air-tubes with one common sensitive centre, yet we cannot explain why they should be sometimes conveyed, and at others not; for although cough does frequently accompany the pathological conditions to which we have just adverted, yet irritations and inflammations of the stomach, liver, peritoneum, nay, sometimes even of the pleura and pulmonary parenchyma, often arise without any cough whatever. It has been attempted to explain these discrepancies by assuming that there must be bronchitis present to produce cough, and that, when these several distant irritations do not excite bronchitis, they are unaccompanied by cough; but this view increases instead of diminishing the difficulty, for it leaves unexplained the reason why this supposed bronchitis should occur in some cases and not in others; and bronchitis, although including cough, is more than cough, and needs something more to produce it. We may conjecture about local weaknesses, constitutional peculiarities, and irregular sensibilities, as causes of these differences, and this is all that we can do towards explaining them: but this is not what an explanation ought to be; this is referring phenomena not to known general properties, and the laws which govern them, but to individual peculiarities and undefined influences, the laws of which are not known. These considerations furnish another proof of the uncertainty of general symptoms as means of diagnosis. Still, when cough does occur, and its cause has been made out by the aid of other signs, it deserves attention, not only as a symptom, but as a morbid action of a distressing and hurtful kind, which sometimes may require remedies expressly to relieve it. This illustrates what has been said before, that general symptoms, although much less constant and instructive than physical signs with regard to the diagnosis of organic lesions, yet, when positive, often tell us more of those general conditions of the system which become our guides in the employment of remedies.

Under this impression we shall examine some of the varieties of cough which present themselves in different cases, and trace the connection between their characters and variations in the elements that constitute them. Of course the study of a symptom in any individual case must be conjoined with a proper survey of its functional or organic cause; but as we have also (sometimes only) to treat the symptom, it is highly useful to study its varieties, and thus to render it more practically instructive.

The cough may vary according to, 1. The irritant exciting it; 2. The sensibility feeling the irritation; 3. The movements thereby excited, which consist of (*a*) the contraction of the muscles of respiration, and (*b*) the contraction of the air-tubes; 4. The condition of the bronchial membrane and its secretion.

Under these heads, we shall meet with the varieties of cough with which every practitioner is familiar.

1. The violence of a cough will, *cæteris paribus*, be in proportion to the degree of irritation that excites it. For example, a healthy person whilst eating or drinking incautiously, suffers some food to enter the glottis; the cough thereby excited will be more severe with wine or any thing peppered, than with water or any bland food. So in the early stages of catarrh, although the sensibility of the membrane is increased, yet the thin saline-tasted secretion also acts as unusual irritant upon it, and keeps up a short teasing tickling cough, with continued attempts to clear the throat. When the irritation is more moderate, but irremovable, like that occasioned by incipient tubercles in the pulmonary tissue, the cough will generally be of that slight *hacking* kind, with little or no expectoration, that is so well known as one of the first symptoms of pulmonary consumption. The irritant here remaining the same, the circumstances which increase this cough are those that augment the sensibility of the lung and air-tubes, such as a quickened state of the circulation from exertion, heated rooms, or during the assimilation of stimulating food.

2. We have already adverted to increased sensibility as being concerned in the cough of recent bronchitis or bronchial irritation. It becomes, however, more developed when the cough has lasted several hours, and instead of being short and tickling only, it comes on in more violent and prolonged fits, which are quite irresistible and often accompanied by a feeling of soreness. The heightened sensibility of the air-tubes is further manifested by the readiness with which breathing air at all cold, or swallowing any thing at all irritating, will excite cough. We have before remarked how this increased irritability of the inflamed air-tubes is commonly joined with the augmented irritation of their secretion; but we do sometimes meet with cases in which the increased sensibility is purely nervous, unaccompanied by any secretion: and the cough is brought on by the slightest cold or irritating matter in the air. Even strong odours will sometimes cause it. These nervous coughs are to be treated chiefly by various remedies which diminish the sensibility of the nervous system, such as narcotics, or sometimes by those which excite stronger impressions in other parts, such as epispastics and the application of heat.

3. Besides the sensibility of the bronchial membrane, another property connected with the nerves, muscular mobility, may be the source of some varieties of cough. We cannot here examine

the circumstances under which a change of proportionate relation takes place between the action of the motory nerves in general, and the impressions which excite them. It is sufficient for us that the fact is well known, that in certain conditions or states of the system, an ordinary impression will excite inordinate motions; while in others the motions resulting from similar impressions will be imperfect, and below the natural amount. It is thus also with the motions of muscles concerned in coughing: they may be excessively mobile, so that the least irritation will set them agoing; and, like a clock without its pendulum, they continue their impetuous motions until their strength has fairly run out. This is the *convulsive* cough which we meet with in some hysterical and nervous subjects, and its convulsive character is the more evident from the fact, that it sometimes alternates with chorea, or convulsive affections of other sets of muscles. The same uncontrollable character is, however, often communicated, by a nervous temperament or peculiar nervous affections, to coughs arising from common causes, which thus shake and exhaust the patient in an unusual degree, and require appropriate modifications of treatment to subdue them. Hooping-cough in its after stages is of this kind, and from our experience we should say, that the shaking, uncontrollable nature of the cough is more characteristic of pertussis, than the hooping, which is not always present, especially in adults. This leads us to consider on what hooping depends; and here again we shall find the use of our physiological divisions, which explain some other varieties of cough that are sometimes met with.

In considering the physiology of respiration, we are led to believe that the act of expiration is aided by the contraction of the circular fibres of the air-tubes. In the forcible expirations which constitute ordinary coughing, there is also a simultaneous contraction of the air-tubes, and especially of the aperture of the glottis, through which the air is driven with the greatest force, in order to expel any irritating matter. Now the contraction of these tubes may be excessive, defective, or irregular, and this will occasion other varieties of cough. When their contraction is excessive, being also generally irregular, they give the *wheezing* character to the cough, so remarkable in asthmatic subjects. A wheezing cough does not always depend on contraction of the circular fibres, for other constrictions of the bronchi will also cause it; but if we listen to the chest of a nervous asthmatic, we may often hear, in the forcible expirations of a fit of coughing, sibilant and sonorous rhonchi, which are too transient to be produced by the thickening or secretion of the tubes. Where the irritability of the bronchi is great, their contraction may not, as usual, cease during the act of inspiration; and it is this spasmodic constriction affecting particularly the upper part of the air-tube

during the forcible inspiration which succeeds to coughing, that causes the *hooping* sound. This state of things happens chiefly in the irritable frames of children when affected with convulsive cough; and the violence and repetition of the expiratory efforts of this cough occasion the back draught to be the more forcible, sonorous, and prolonged. If we apply our ears to the chest of a child during a fit of hooping-cough, we are surprised to find how little sound we can hear there with all these noisy external efforts: in fact, the continued constriction of the bronchial tubes permits very little motion of air into and out of the tissue of the lungs: in the convulsive cough of adults, again, in which there is seldom hooping, the respiratory murmur of the long inspiration, or back draught, is pretty loud, whilst the succession of coughs here also consists more of external than of internal movement. In all these kinds of cough, antispasmodics will often give more relief than any other class of remedies.

But we may have an opposite condition of the circular fibres of the bronchi, a weakness or deficiency of action, a paralysis, so that they do not contract as usual during the expiratory efforts of coughing. This constitutes the *hollow* or *barking* cough which we sometimes hear in chronic bronchitis, and now and then in febrile and nervous affections. This cough is, as we shall presently find, accompanied with a difficulty of expectoration; hence it is sometimes very distressing, and particularly so when, as it occasionally happens, it is combined with a mobility of the external muscles of respiration, rendering the cough convulsive and paroxysmal. The tearing and exhausting fits of this kind of cough are sometimes quite agonizing; and we may judge from the bloated, congested appearance of the lips and face, how much these fits impede the respiration and circulation, and how much they may thus tend to increase and perpetuate the diseased condition of the bronchial tubes. In some such cases we have seen the terebinthinaceous medicines, with external counter-irritation and occasional emetics, give most relief; but the treatment will depend on various circumstances, which cannot be entered into at present.

4. Besides the sensitive and motory apparatus concerned in the act of coughing, we have the secretion of the air-tubes, which may also by its qualities modify the character of the cough. According to whether this secretion is present or not, the cough may be humid or dry; and according to the relation of the qualities of this secretion to the powers of expectoration, the cough may be loose or tight; and these varieties may be combined with the other species of cough, as those may with each other; and thus are produced the endless host of different kinds of cough that we meet with in practice. Without pretending to affirm,

that it is always possible to classify these by the division now pointed out, we may state that we have often found this analysis useful in drawing attention to the predominant changes of vital property, as manifested by symptom, and in thus distinguishing cases which require different modes of treatment.

Expectoration. The expectoration is another symptom of thoracic disease, which must be considered as the result of vital as well as physical properties, and therefore it is included under the head of general diagnosis, although it sometimes approaches in character to a physical sign. The word expectoration strictly means the act of expelling any thing from the chest; but by a figure of speech it is also applied to the matter so expelled. We shall find that both the act and the matter of expectoration may present us signs of the condition of the pectoral organs.

If we consider the structure of the bronchial tree, we shall perceive that natural breathing tends to prevent the accumulation of matters in its tubes, in spite of gravitation. The area of the smaller divisions of the bronchi is considerably greater than that of their trunks; and it may be represented as the divided base of a hollow cone or funnel, which is concentrated gradually in the trunks, and completely in the windpipe. The air, in the more sudden act of expiration, passes with greater rapidity and force as it converges into these trunks, and therefore tends to carry through them any superfluous matter that may be present on the bronchial surface. This will explain how the finer bronchial tubes of the most dependent parts of the lung are, in health, kept clear of any accumulation. Possibly the ciliary motions of the mucous membrane may, as MM. Purkinjie and Valentin have surmised, tend to the same effect.

But it is the forcible acts of special expectoration, *hawking*, and coughing, that tend most effectually to clear the air-passages; and they do this by both increasing the force and fulness of the expiratory effort, and at the same time contracting the upper tubes and trachea, so that the air acts with greater force on any superfluous matter in them. The repeated closure of the glottis in coughing increases the expulsive effort by letting out the air in successive sudden jerks, which are more forcible than any continued act of expiration would be. We see this exemplified in cases where the operation of bronchotomy has been performed. The patient often cannot expectorate effectually so long as air can pass out from the artificial opening, and he is in danger of suffocation in consequence; but on closing this during the act of coughing, the force of the air can be directed in the natural way against the accumulated matter. By attention to this particular, suffocation has been averted in more than one instance after this ope-

ration. In certain diseased conditions of the larynx, the patient cannot close the glottis; and hence also expectoration may be difficult, while the cough assumes a continuous uncontrollable character, which we might have added as another variety to those before enumerated. This is what M. Trousseau calls a belching cough.

There is another element essential to the proper performance of the act of expectoration—the capacity to make such a full inspiration as shall carry the air in beyond the accumulating matter, so that it may on its forcible passage out again, carry this matter before it. Hence we see why weakness, which prevents a sufficient inspiratory effort, or obstruction of the terminal and most expansible parts of the air-tubes, which renders this effort ineffectual, may stop the act of expectoration, and by permitting the accumulation of matter in the air-tubes may speedily conduce to a fatal result. Inability to expectorate is the immediate cause of death in many cases of various diseases; in fact, it is a part of the article of death itself; and when we hear the rattle in the throat of the dying, we hear the sign of the accumulating barrier which is shutting out the breath of life. Sometimes, even at this stage, there are sensibilities enough in the system to feel the force of a stimulant which may excite the sinking powers to another struggle; expectoration is once more accomplished, and breath once more renewed; and where there is no irrecoverable alteration of structure, this act of expectoration may in some few instances turn the balance in favour of recovery. It is unnecessary to say, then, how important it is to study the act of expectoration, and to acquaint ourselves with those means that may excite or promote it. Most practitioners have seen instances in which a patient has been snatched from the jaws of death by the timely administration of a diffusible stimulus, such as a warm aromatic draught, with carbonate of ammonia or ether, together with such a change of posture, and other circumstances as might most favour the expulsion of the matter that was suffocating him. A great deal may often be done in less urgent cases by attention to the posture of the patient.

In most instances the act of expectoration is easiest in that posture in which the respiration is most free, which is commonly the semi-erect posture: but some patients expectorate more freely when lying on one side; and we remember a phthisical patient who really appeared to be several times saved from suffocation by alternating his posture from lying down to sitting up in a particular manner, suggested by a knowledge of the condition of the lungs in that case. When this expedient was neglected, the patient was so shaken with frightful fits of fruitless cough, and so oppressed with the accumulating matter, which they could not expel, that speedy suffocation seemed inevitable. In some cases, the act of expectoration may be favoured by another kind of action, in which

the expiratory muscles are concerned, that of vomiting; and we shall find hereafter, that some emetics may exert an influence of an important nature on the bronchial tubes, besides this mechanical one.

The character of the expectoration frequently furnishes us with very instructive signs. It is the product of diseased action, and in its physical or chemical qualities it may inform us somewhat of the nature of that action, of the condition, and sometimes of the position of the parts from which it comes. As, however, we have seen that the effort of expectoration is sometimes unsuccessful, there may be no expectoration to judge of; and besides this instance, most children and some adults cannot spit out what they expectorate, but swallow it.

The basis of expectoration generally is the secretion of the mucous membrane of the air-tubes. This is naturally a transparent, colourless, slightly glutinous liquid, like thin mucilage. The chief animal matter which it contains is that called mucus, which seems to be a sort of imperfectly coagulated albumen, and the varieties of sputa presented by disease commonly depend on an unnatural condition or quantity of this animal matter. There is also saline matter, which may vary in quantity, and so may the proportion of water. From the recent experiments of Dr. Golding Bird, as well as those of Dr. Babington and Mr. Brett, it would seem that the condition of the animal matter in the expectoration depends in great measure on the proportion of saline matter with which it is combined, this being in abundance in transparent and viscid expectoration, and defective in the opaque kind, with little viscosity, and least of all in that which is absolutely purulent. Dr. Babington found, that on mixing pus with a solution of common salt, after a time it became converted into a nearly transparent viscid mass like mucus; and Dr. G. Bird rendered the physical and chemical resemblance perfect by adding a little soda, and then passing a current of carbonic acid gas through it. (*Guy's Hospital Reports*, No. vi.) Mr. Brett, in a valuable communication to the medical section of the British Association in 1837, states that he found the saline matter of transparent viscid mucous expectoration to amount to from 20 to 33 per cent. of its solid matter, whilst that of the opaque viscid mucus of chronic bronchitis was from 16 to 23, and the puriform expectoration of the last stage of phthisis was only from 9 to 10 per cent. These researches confirm the opinion we have long held, that the difference between mucus and albumen seems to consist in their physical condition, rather than in their chemical constitution. Mucus is a transparent glutinous matter, not coagulable by heat, as liquid albumen is, and not solid and opaque like coagulated albumen; but on ultimate analysis it is not found to differ from this principle. When, therefore, we see expectorated matter opaque and solid, or liquid and

coagulable by heat, it loses the only distinguishing characters of mucus, and is strictly albuminous. For this reason, we submit the following general classification of expectorated matter:—

1. *Mucous*, more or less transparent and viscid. 2. *Albuminous*, opaque without viscosity. 3. *Watery*, thin and transparent. 4. *Compound*, composed of combinations of the preceding kinds.

1. *Mucous* expectoration is that most like the natural secretion, being transparent, and more or less viscid. It is the general result of simple acute inflammation of the mucous lining of the air-tubes, in which case it is increased in quantity, and particularly in viscosity; in fact, the glutinous character of the sputa, and the tenacity with which they stick together and to the containing vessel, or fall out in a ropy mass, was described by Andral, and we think correctly, to be a mark and, in some degree, a measure of acute bronchitis. From the researches just alluded to, it would appear that the viscosity of these sputa depends on their quantity of mucus, which is albumen combined with saline matter, to which is sometimes added free uncoagulated albumen. In the most intense forms of inflammation, and where the disease occupies the finer tubes, to the glutinous character of the mucus is added a frothiness, arising from the mixture of those air-bubbles in the tubes, which, in their breaking, cause the mucous and sub-mucous rhonchi. But the most intense bronchitis is that accompanying inflammation of the parenchyma: here we have the most viscid form of sputum, through which air driven produces the crepitant rhonchus; and the blood in the distended vessels of the engorged parenchyma communicating a little colouring matter to it, gives it that reddish or rusty tinge which is so characteristic of the sputa of peripneumonia. The transparent or semi-transparent condition of these viscid sputa distinguishes them from the albuminous kind, into which, however, they pass in the advanced stages of all the more inflammatory affections of the bronchial membrane. The mucous expectoration has commonly a saltish taste, and with its saline matter is probably connected its irritating quality, so marked in the early stage of bronchitis.

2. The varieties of *albuminous* expectoration are pretty numerous, for under this head are comprehended the opaque kinds of sputa which have no remarkable viscosity, such as the purulent expectoration of chronic bronchitis, the fibrinous or polypous sputa of plastic bronchitis, and the more compound combinations of these with caseous and other matters, which are voided in the advanced stages of pulmonary phthisis. This class of sputa denotes an error of secretion, farther than the mucous from the natural standard, there being a defective proportion of saline matter, as well as an excess of albuminous; but their production generally announces a decline of inflammation from its most acute form. Probably, the very throwing off of so considerable a mass

of animal matter, is the means of relieving to a certain extent the inflamed vessels; for we frequently find the purulent or polypous expectoration in intense bronchitis attended by a remarkable diminution in the signs of local and general excitement. This remark has been made also by Dr. Stokes. But such an expectoration ceases to be a favourable sign when it *continues*, either with undiminished irritation, or with proofs of general weakness; for then a change is implied, either in the structure, or in the habitual action of the membrane, which, secreting pus instead of mucus, goes beyond the mere removal of a temporary congestion, and proves itself a cause of irritation and exhaustion.

Much has been written about the modes of distinguishing pus from mucus in the expectoration. On these formerly the diagnosis of pulmonary phthisis was supposed to depend. These tests are not now much attended to, not only because it is well known that pus may be produced without any ulceration or consumption of the lung, but also because these distinctions cannot be complete between matters that pass by insensible gradations into each other. The chemical composition of pus resembles that of the colouring globules of the blood, and differs from mucus in containing a notable quantity of iron.

3. *Watery* expectoration is that kind in which a liquid of only slightly glutinous quality is coughed up in greater or less abundance. This appears to contain very little animal matter, and to be rather a diluted mucus than to have in it any thing peculiar. It is often covered with a froth, particularly when it is coughed up with much effort. This secretion is to be regarded as the result of irritation, with a relaxed state of the vessels, rather than of inflammation; but it may occur as a consequence of this lesion, as well as of congestion or obstruction to the circulation of the blood in the lungs. It is the expectoration of what is called humid asthma and pituitous catarrh. Some persons of a relaxed habit have it during a common cold, or any form of bronchial inflammation. It sometimes tastes more salt than usual, and in this case it commonly causes a more incessant teasing cough.

4. Under the head *compound* expectoration, are classed various combinations of the preceding kinds, which we meet with in almost every form of pectoral disease. They are either products of different parts, in distinct pathological conditions, although coughed up at the same time; or they may in some cases proceed from the same part in an intermediate pathological state, and capable of secreting different kinds of matter. An example of the latter is the opaque or muco-purulent expectoration of the latter stages of bronchitis, in which the opacity and colour of albuminous matter is apparent, whilst it is held together by a mucus of some tenacity. In the *concocted* sputa of declining acute bronchitis, the mucus predominates; whilst the loose albu-

minous matter is more abundant where the inflammation tends to pass into a chronic state. The sputa of chronic bronchitis, and in fact of most chronic diseases of the lungs and air-tubes, are almost always more or less mixed; for it generally happens that the different parts of the membranes and tissues are variously affected; and when, as in the advancing stages of phthisis, there is structural lesion or destruction of parts, there is the greater reason for a more heterogeneous kind of expectoration. In these cases, however, the albuminous kinds mostly predominate, in the form of muco-purulent, purulent, caseous, or tuberculous matter, and coagulable or fibrinous lymph, occasionally tinged or mixed with the colouring matter of the blood: these constitute the bulk of the expectoration of the consumptive. In catarrhal diseases of a chronic kind, we commonly see very opposite forms of sputa expectorated together. Thus in a spitting-dish full of thin, frothy watery expectoration, we often find portions of tough and almost solid semi-transparent mucus, as if some parts of the tubes were throwing off the water, and others the animal matter, in a separate form. When the subject of catarrh is treated of, we shall find that these opposite products do not imply an equally opposite pathological condition. After hemoptysis, it is very common to see fibrinous concretions, together with purulent and mucous matter, all more or less tinged with blood. In other affections it is not uncommon to see the sputa streaked with blood; and this sign is of less importance when the cough is violent, because it may then merely proceed from a slight abrasion caused by the force of this mechanical action. When, however, there is often blood present, without much force of cough, and especially if there be pus with it, we may suspect the presence of ulceration in some part of the air-passages. The colouring matter of the blood in an altered state, may also be combined with other forms of sputa. Thus, in scorbutic persons affected with humid catarrh or bronchitis, the expectoration is a thin, reddish-brown liquid, like prune juice or diluted treacle; and in the last stages of pulmonary disease, the colouring matter, from the final pulmonary congestion which precedes death, is seen in the dirty reddish-brown or greenish tinge of the purilaginous sputa.

It is evident, then, that the matter of expectoration will often inform us of the pathological condition of the lungs and their tubes; and its quantity or quality may sometimes suggest proper remedies. In some cases we may learn other things from it. Thus, when in consumption, tubercular matter with portions of pulmonary tissue is expectorated, the conclusion is obvious. We also sometimes see the expectoration present physical signs of the state of the interior by its containing albuminous or compound matter, moulded into the shape of the tubes or cavities from

which it comes. The large rounded flocculent muco-purulent sputa of advanced phthisis are often such as could only accumulate in a cavity; and the tubular or vermicular albuminous matter which is coughed up in the plastic kind of bronchitis, sufficiently explains whence it comes, by its being an exact mould or cast of the bronchial tubes, sometimes in an arborescent form, from several of their divisions.

We must not omit to notice a test, which is erroneously used to determine the nature and source of sputa, whether they float or sink in water. The floating of a sputum merely depends on the number of air-bubbles retained in it, and although pus alone, or tuberculous matter alone, will not retain these bubbles, yet a small addition of tenacious mucus will enable them to do so. Again, although the sputa formed in ulcerous cavities are less likely to contain air and to float than those formed in the tubes, yet we not unfrequently find the concocted expectoration of acute bronchitis, which is formed exclusively in the large tubes, sink in water; whilst the mixed product of a vomica and the adjoining tubes, which has been churned together with air, floats. This hydrostatic test of expectoration is then a very inconclusive one; but it may be useful in sometimes causing a rough separation of the albuminous matters from those of a more viscid mucous kind.

Other details regarding the matter of expectoration might be given; but enough has been said to illustrate how it may prove useful in diagnosis and practice. From this it will appear how much more valuable its indications may become when conjoined with the physical signs, by which we may often detect the position, and measure the amount of the local disease, of which the matter expectorated is the product. We shall find many exemplifications of this position hereafter.

Pain. The only other morbid phenomenon, connected specially with the modified vital properties of the organs of respiration, is *pain*. We know that pain may arise either from an excessive impression on the nerves of sensation, or from an excessive sensibility of these nerves, to which common circumstances of position, motion, &c., then become painful. The latter is the more common cause of pain in internal diseases; but it is not unusual to find them combined, as when a tumour, or effused matter, presses on or stretches parts morbidly sensible. The most common causes of pain are inflammation, and those kinds of vascular excitement that are allied to it: this vascular excitement is generally attended, in the first instance at least, with an exaltation of the nervous function. But the nervous function may be *primarily* excited; and although the increased sensibility thus produced seldom lasts long without more or less stirring up the function of

the vessels also, yet we may for a time have pains purely nervous, such as pleurodyne and pectoral neuralgia. Further, as inflammation is not the only cause of pain, so the pain present in inflammation is by no means an index of the extent of the inflammation, nor even of its situation. Most extensive inflammations have been known to occur, not only in the parenchyma of the lungs, but in the bronchial membrane and pleura also, without producing any pain; and it frequently happens in phthisis, that the pains chiefly complained of are low down in the sides, when the disease is almost entirely in the upper lobes of the lungs. So likewise in bronchitis and pneumonia, the pain is often confined to the sternal, lateral, or scapular regions, whilst the disease occupies other parts.

There are, nevertheless, some general characters with regard to pain, which may render it useful as a symptom of disease of the chest. It is commonly remarked, that the pain of parenchymatous and bronchial inflammations is dull and diffused, whilst that of inflammation involving the serous and fibrous membranes of the pleura and pericardium is of a sharp lancinating character. This is generally but not constantly true; and we may find it explained by the circumstance, that the par vagum, which supplies the bronchi and lungs, is by no means so sensitive a nerve as the spinal intercostals, which are distributed on the pleura and pericardium. For this reason, too, there is more apt to be acute pain when the costal pleura or the coverings of the great vessels are inflamed, than when the pulmonary pleura is the chief seat of disease. A further distinction in the variations of these divers kinds of pain will confirm the opinion, that they belong to different orders of sensibility. The dull, heavy, or aching pain of bronchitis, or pneumonia, is generally pretty constant, although it is increased by full inspiration, exertion, or the breathing of cold air; yet even then it gives the feeling of soreness under the sternum, rather than of severe pain. It often resembles the pain of dyspepsia, which is probably seated in a branch of the same nerve, and is also usually referred to the sternum. The degrees of pleuritic pain, on the other hand, are sudden, extreme and intolerable. If it be not felt in ordinary breathing, a long breath, or a cough, just sufficient to bring the membranes to a requisite degree of tension, causes that sharp stitch of the side—that sudden catch of the breath, that has been considered so characteristic of pleurisy. When it is constant, the patient is obliged to hold his side to diminish its severity, by restraining the motions of the chest; and thus placed in opposition to the sensation which prompts the act of respiration, this sharp pain may cause such a voluntary restraint of these acts, as to bring the patient to the verge of asphyxia. It is under these circumstances that the breathing becomes partial, as formerly described, and patients whom pain

constrains to breathe only with the diaphragm or with one side, will perform this supplementary respiration so well, that they are completely free from pain, although the inflammation is as acute and the membranes as tender as ever. Sometimes we may detect the latent tenderness by pressing between the ribs of the affected side; but we are more likely to succeed if we restrain the supplementary respiration by pressing on the abdomen or on the healthy side, and then desire the patient to cough, or to take a sudden long breath. If there be any exalted sensibility or tenderness, it is pretty sure to be discovered by this means; and we have several times met with patients who denied having any uneasiness or tenderness, yet they winced at the pain developed in this way.

As a general rule (not however without some exceptions), we may consider a fixed permanent pain, or a permanent tenderness, which depends on the same pathological cause, an indication of inflammation, or congestion, or some analogous condition of the vessels; and when present it deserves attention, not only as an object of treatment on its own account, but also as an index, which together with the pulse, cough, fever, and other general symptoms, shows the increase and diminution of the complaint, and the effects of remedies, even before these become manifest from the physical signs. Still, if we trust to it alone, it will negatively deceive us in those numerous cases of extensive disease in which it is absent, or scarcely complained of; and it will positively deceive us in those cases in which modified nervous sensibility—a mere neurosis—is the only or the chief disorder.

We come now to examine shortly the nature and value of the symptoms which diseases of the organs of respiration develop in other functions.

Physiology indicates the close relations which subsist between the organs of respiration and those of circulation; and prepares us to expect that disease in the former should disturb the latter, and develop symptoms in the function of circulation. Accordingly, we find such symptoms in the state of the *arterial pulse*, and in that of the *superficial capillary* and *venous* parts of the circulation.

The pulse. The pulse has for ages been relied on as a guide in the diagnosis and treatment of all diseases; but those who have had much experience, know how fallacious it sometimes proves; and those who have had little experience must acknowledge that it is very difficult to distinguish the varieties of the pulse from one another. Some of the fallacies and difficulties connected with the pulse as a sign, appear to arise from our studying it too empirically,—from our not rationally considering those elements on which its varieties depend, and a knowledge of which would

enable us to understand and to foresee the circumstances which are capable of producing these varieties. To guide the student to this knowledge, we will give a brief analysis of the nature and varieties of the pulse of arteries.

The arterial pulse is caused by the jets of blood thrown at certain intervals of time into the arteries by the contractions of the ventricles of the heart. The motion originates exclusively in these contractions, although it may be modified by the blood which is moved, and by the tubes which convey it. Now here are three elements:—1. The heart; 2. The blood; and, 3. The arteries;—and variations in the condition or action of each of these cause varieties in the arterial pulse. Let us consider a few of these variations.

1. Without noticing the modifications in the action of the heart resulting from disease of that organ—a subject to be considered hereafter—it is plain enough, that if the other elements be equal, the strength and frequency or rhythm of the contractions of the left ventricle of the heart will determine the *strength* and *frequency* of the arterial pulse. But the contractions may have another quality—that of abruptness: being rather brisk and short than strong and complete, they communicate to the pulse that character which is called *sharp*. Now what property in the heart gives it this abruptness of contraction? what but an extreme irritability? There is sometimes this irritability in inflammations and fevers; but we find it also in conditions of mere nervous irritation, of which it is more distinctive. And it is when these coexist with inflammation or fever, that the pulse presents a sharpness in addition to other qualities more peculiar to inflammation. In sthenic irritation, or those connected with fulness and tone of the vascular system, which may tend either to acute inflammation or to active hæmorrhage or other discharge, the heart's contractions are strong as well as sharp; and so is the pulse. In these cases, although the original irritation were local, it has now reached the centre of the circulation, and thence, distributed through the whole system, becomes general. But let us see how the other elements modify the pulse.

2. There can be no doubt that the blood in the heart and vessels determine by its *quantity* the character of the arterial pulse: very possibly it does so by its *quality* likewise; but this is not so easy to prove. The fulness and strength of the pulse in the arteries depend materially on the quantity of blood in them; and when the pulse is frequent as well as full, there is the greater proof of plethora, inasmuch as it shows that there is a considerable jet thrown into the arteries at each contraction, notwithstanding that the contractions are so frequently repeated. But there may be a full system of blood-vessels without a large or strong pulse,—as when the heart is acting feebly or faintly; and where its irrita-

bility is lowered, such a mode of action may be actually caused by the congestion or distension, which, for a time, oppresses the function until it is roused into reaction. Under these circumstances, blood-letting will often increase the fulness and strength of the pulse. The opposite condition—a defective quantity of blood—will modify the pulse differently according to the state of the other elements, the action of the heart, and the arterial tubes. When the irritability of the heart is reduced, together with the quantity of blood, the pulse will become softer, weaker and less frequent. But it frequently happens, especially in nervous temperaments, or where the depletion has been carried to excess, that the diminution of the blood is accompanied with an augmented irritability of the heart, and the pulse becomes not only quicker, but sharper than usual; and the effect of the abrupt jets into a small bulk of blood contained in imperfectly distended tubes, is to give to the pulse that jerking or bounding character, as if a mere ball of liquid were suddenly shot through the empty tube, which is so remarkable in the irritation of inanition and chlorosis.

3. But we cannot fully understand the variations of the pulse without attending to the properties of the tubes in which it is felt. If the arteries were tubes of an unyielding or an unvariable character, then the pulse in them would more uniformly represent that of the heart, which would be transmitted through them unmodified. But we know that they are not so: they possess properties of elasticity and tonicity, which vary according to circumstances, and which modify the pulses from the heart, by changing the size of the tubes, and the yielding or the resisting nature of their walls. It is plain that the impulse of a jet of blood must be differently transmitted by vessels when they are large and yielding, and when they are contracted and tense: in the first case the pulse would be *soft* and *full*, in the latter *hard* and small. We know but imperfectly what are the circumstances which affect the tonicity and elasticity of the arterial coats, and thereby the pulse: further experiments are wanted to elucidate them, but the following are pretty well ascertained, and they should not be forgotten in estimating the signs of the pulse. Cold causes the arteries to contract, and therefore renders the pulse smaller. We know how a cold lotion will often diminish the fulness and throbbing of the arteries of an inflamed part; and we have seen the same effect of cold more strikingly produced in the large arteries. In the experiments on the sounds of the heart carried on in February, 1835, we repeatedly observed, that when the aorta of an ass, recently killed, was plunged into cold water, it contracted, so as not to permit the introduction even of the little finger, and its coats acquired an increased thickness and rigidity: the pulmonary artery did not contract nearly so much. The circumstance of temperature must

therefore be taken into account in judging of the pulse; for cold may render the pulse of an artery small and hard, or, if severe, small and weak, when the action of the heart and the condition of the system would give it the reverse qualities. Heat, on the other hand, within certain limits, tends to diminish the tonic contraction of the arteries, so that under its influence they receive more strongly and fully the pulse from the heart. We know how warmth restored to a limb makes it throb with these expanded pulses.

But there is another circumstance that may modify these actions of heat and cold on the pulse, besides proving by itself a cause of modification—the condition of the capillary circulation. When this is not free, the artery will be more distended, and therefore the pulse harder and stronger than usual; and thus in fevers, where the surface is pale and constricted in the cold stage, and dry and unrelaxed in the hot stage, the pulse often preserves through these changes of temperature a hardness and strength which would be much more varied were the capillary vessels free and exhaling their usual excretion, and which is actually diminished under the influence of a warm bath or temporary moisture of the skin, although the fever still continue. Again, whatever view we take of the nature of inflammation, we cannot, in the present state of pathological knowledge, doubt that the circulation through the inflamed vessels is to a certain degree obstructed; whilst, either as a consequence of this, or from some co-operating influence, the vessels leading to the part become dilated, and being thus more open than others to the pulse-wave from the heart, which their distended coats cannot temper as usual, they become the seat of that throbbing hard pulse, that has been mistaken for increased action of the vessels themselves. And there are many other variations in the pulse explicable on these principles, but this is not the place to consider them further in detail.

There is, however, one more cause of variety connected with the arteries, so frequently occurring, that it must not be overlooked, viz., the difference in the arteries of different individuals. Without any adequate difference in the action of the heart, in the quantity of blood, or in the temperature, we find a very remarkable variety in the character of the pulse in different healthy individuals; and the same difference extends to the modifications of disease. Some have always a soft large pulse; in others it is small and feeble; in others small and hard: others, again, have habitually a hard strong pulse, which scarcely becomes soft under any circumstances. The first depends on the arteries being large, with thin elastic coats. The small feeble pulse may result from their small size and thin coats: this is common in females, and may coexist with inordinate action of the heart. The hard wiry pulse is connected with small arteries with rigid coats; and the same

rigidity or deficiency of elasticity in the coats of arteries of larger size gives that unvarying hardness and strength to the pulse which we so often meet with in old people, and which renders it so uncertain a sign in these cases. We may often, in the radial artery, feel the permanent thickening and hardness of its coats, which thus, like a tube of glass or metal, rigidly transmit the heart's pulses, without tempering them by any yielding or spring. With these peculiarities of pulse there are often connected characters of constitution or temperament, and proclivities to disease or health, which are of great importance in guiding us in practice.

Besides the general causes which modify the pulse, which we have now briefly considered, there are some specially connected with diseases of the pectoral organs. Those arising from diseases of the apparatus of the circulation will be treated of in the article devoted to that subject. But severe affections of the respiratory organs also sometimes signally modify the pulse, and that in a manner which may tend to confuse its indications. We know how closely the heart is linked with the lungs; by the circulation even more closely than by mere position; for the lungs may be said to lie between the two compartments of the heart, and any considerable obstruction in the lungs will derange the usual relations of these compartments. There is then a distension or overstimulation of the right side of the heart; while the left, receiving a diminished quantity of blood from the lungs, and that not thoroughly aerated, is less excited than usual, and may give to the arterial pulse a character of weakness and smallness that by no means represents the condition of the whole vascular system, and which often is remarkably contrasted by the action of the right side of the heart, as felt or heard under the sternum. These varieties are produced by any of those affections of the chest which infringe far on the respiratory function. These are more commonly those of the bronchial and parenchymatous kind, which have accordingly been described to be accompanied by a softer and weaker pulse than those affecting the serous membranes. But a pleurisy may occur also with a small weak pulse, when the effusion or pain is such as to interfere largely with the function of the lungs. Neither is it to be supposed that the pulse in severe pneumonia or bronchitis is always weak, even when these affections infringe considerably on the function of the lungs. Even under asphyxiating influences the left ventricle may sometimes become excited, together with the right, and give a sharpness to the pulse, which, combined with the arterial tension of fever, may be readily mistaken for hardness and strength. But this character is seldom permanent; and we generally find in all diseases, when the function of respiration is much impaired, that the pulse soon loses its body and strength. These considerations suggest the expediency of examining the state of the circulation not only by

the arterial pulse, but also by the pulsations of the heart itself, and by the condition of the veins and capillaries.

Under the circumstances just mentioned, when the indications of the arterial pulse are most variable and deceptive, we may often find useful signs in the condition of the *venous* and *capillary* part of the circulation. The distension of the more superficial venous trunks, especially the jugulars, in which a double pulsation often shows also the retropulsive action of an over-distended right ventricle,—the fulness of the capillaries of the lips, tongue, throat, cheeks, eyelids, nails and other parts, at first having a florid and flushed appearance, but afterwards, as the respiration becomes more injured, assuming a purple or livid hue,—are signs of great practical importance, and of a constancy more approaching to that of the physical signs. They do not, however, present themselves in the early and more tractable stages of disease; and they are always less distinct in pallid persons with small superficial vessels.

Intimately connected with the state of the circulation is the symptom of *general fever*, or *increased heat*, which attends many diseases of the chest. It depends on increased force and rapidity of the circulation, with diminished perspiration. When the perspiration is restored, the heat always falls. This exhalation of fluid not only lowers the temperature by its physical agency of evaporation, but being in itself a sign of a relaxing of the superficial vessels, it implies an abatement of the vital irritation. In the more transient forms of fever, such as the intermittent and hectic, the profuse perspiration sometimes reduces the animal heat to below the natural standard, just as the circulation is proportionately enfeebled; and the same chilling influence is illustrated by the cold sweats which succeed to temporary and irregular excitement. There are degrees of vascular irritation in which the increased heat of skin is partial, and determined by the structure of particular parts. Thus in the asthenic excitement of hectic fever, the heat is most felt in the palms of the hands and soles of the feet, because the circulation is not strong enough to drive the perspiratory excretion through the thick cuticle of those parts, which become consequently dry and hot. The same thickness of cuticle, on the other hand, when once imbued with perspiration, often keeps these parts soft and moist, when there is no sensible perspiration on other parts. Not unfrequently the unequal state of the circulation is exhibited in febrile and inflammatory disorders by the heat of the abdomen, back, chest, or head, whilst the extremities are cooler than usual; and occasionally the same locally increased action is manifested by partial sweats, which prevent the increase of heat, and tend to reduce the excitement. We have known a patient with pleurisy perspire profusely only

from the affected side, for several days; and nothing is more common, in slight abdominal inflammations, than to find the pungent heat of the belly relieved by a perspiration equally confined to that part. But we practice on the same principle in applying to irritated or inflamed parts poultices, fomentations and partial baths, which tend to bring the skin and superficial vessels to the same relaxed and expanded state which they have in a perspiring part.

Heat of skin, therefore, is an uncertain symptom; for it depends on a condition of the superficial circulation that is by no means constantly associated with disease of the internal organs. When present, it may as much result from a general cause—an idiopathic fever—as from a local inflammation; and cases are not uncommon in which severe, and even fatal, visceral inflammations are attended, through a great part of their course, by free perspiration; nay, the same may be said of some fevers which are called idiopathic. Still the heat and condition of the skin become valuable guides, when taken in conjunction with other signs, inasmuch as they indicate the constitutional disturbance, which is an important part of the disease, and which is sometimes as much to be considered in the treatment as the local disease which has excited it. So, likewise, when the presence of a disease has been established by other signs, the condition of the skin may prove a measure of its increase or diminution more delicate and sooner appreciable than can be found in the physical signs. Thus an increased heat of skin, coming on during a bronchial or pulmonary inflammation, either indicates an increase of that inflammation or the addition of some abdominal or other irritation, which tends to aggravate the condition of the patient. So, too, perspiration breaking out in the hitherto dry and hot skin of a pleuritic patient, occasionally does prove *critical*, whether that word be applied to the excretion as a cause or as a sign of the amendment.

Where there is disorder of the circulation, especially of a febrile kind, we may expect alteration of the *secretions*, which are so intimately connected with it: hence we find the urine is scanty and high-coloured, and the secretions of the liver and intestines variously deranged. As a natural consequence, too, there will be disorder of the digestive and nutritive function: the tongue will be furred, or florid: the appetite will fail; the stomach will cease to digest; thirst will torment; the blood, no longer fed with chyle, will not duly nourish the textures, nor support the functions: the strength will fail; absorption continuing active, if time permit, emaciation will ensue: and various complications of these disturbances may differently modify the character of the diseases of the chest. The sensorial functions, too, may be deranged, either in consequence of the secondary visceral disturbances, or more rarely by a more direct influence of the imperfect respiration on the brain

and nervous system. A knowledge of the causes of asphyxia suggests also how certain states of the nervous system may tend to develop disease of the lungs. Thus insensibility, or coma, causes imperfect respiration, and consequently congestion of the lungs; and, as we shall hereafter see, a long-continued congestion of the lungs only requires the addition of vascular reaction to convert it into inflammation. Persons rarely recover from an asphyxiated state, without suffering more or less from the injury which it leaves in the vessels of the lungs; and not a few who have been recovered from suspended animation, have sunk under the pneumonia, or bronchitis, which supervened.

We have thus rapidly glanced at some of the pathological relations of the organs of respiration to other functions, to give the reader an opportunity of considering rationally the nature and value of general symptoms. Dyspnœa, cough, pain, and signs of the circulation, with its concomitant, temperature, although often equivocal, yet, when strongly marked, sometimes assist us in diagnosis. It is just the reverse with the symptoms arising out of disorder of the other functions. The altered secretions of the kidneys, the liver and the intestines, cannot inform us of the nature or presence of a disease of the chest; and still less will gastric derangement or sensorial disturbance. Not only will they not direct, but they tend essentially to blind us to the presence of pectoral disease; for they set up prominent symptoms of a new character, that may take the attention entirely from the real source of disease, and fix it on the brain, the liver, the stomach, or intestines, the affections of which are only secondary, and often trivial. How often do we find peripneumony, or bronchitis, disguised by delirium or stupor, or by vomiting, a loaded tongue or diarrhœa. How often pleurisy, masked by a jaundiced skin, a tender right hypochondrium, and clay-coloured fœces; or by lumbago, or nephralgia. How often tubercular consumption, obscured by sundry bilious, dyspeptic, or nervous symptoms. It will be happy for the practitioner (for his credit, at least, if not always for the success of his practice,) if he detect the enemy through its false colours, ere it triumph, and before the scalpel shall proclaim the delusion of his unwary mind. The physical signs will enable him to do this, and again we recommend them to the best attention of the student. On taking a rational review of the general symptoms in comparison with the physical signs, we must come to the conclusion that, as diagnostic means, the general symptoms fall far short of the physical signs.

But it is not to be supposed that, because the general symptoms are often comparatively of little aid in diagnosis, we are to neglect the study of them. They are almost always of great importance in prognosis and practice. The physical signs more surely show how the pectoral organs suffer; but having discovered this, to the

general symptoms we must look for how the system suffers; and as the symptom often closely sympathises with the injured organ, we may through them often watch the first turns of the disease before the change in the organ becomes physically appreciable. In the general symptoms we seek for those *critical* phenomena, which, although sometimes deceptive, yet generally announce the tendency of the disease to one or other mode of termination. In them we study the vital forces and properties with which nature works, and the signs of what nature can do: and in our methods of treatment, these become the standards to which we direct, and by which we modify, our remedies. When we treat a patient with peripneumony or catarrh, we do not apply our remedies merely to the local lesions, inflamed vessels, or a discharging membrane; we study the system at large, we examine other functions through the general symptoms, and we direct our treatment with due reference to indications from all these several sources. We see, then, that the mere stethoscopist is but ill fitted to practise medicine. He may justly boast of his skill in diagnosis; his place of triumph will be the dissecting-room, where he can show the lesions that he had detected; but his practice at the bed-side will be unsuccessful in proportion as local lesions vary in their general relations, and in the conditions of the constitution, or of other functions that may accompany them. The judicious physician will not omit to study the condition of the vital properties, which are exhibited in the general symptoms, as well as the local physical changes which have been already produced; and whilst he chiefly confides in the physical signs to indicate and measure the present local lesions, he carefully watches in the general symptoms the tendencies of those properties and functions which are capable of increasing or modifying these lesions, and are equally liable to be affected by them. The general symptoms being less intelligible and certain than the physical signs, need more experience to enable us to appreciate them; but we have found that even these also may be *rationally* studied, and may derive a light from a knowledge of physiology and the physical signs, which experience alone could never throw on them.

CHAPTER II.

DISEASES OF THE LARYNX AND TRACHEA.

Mucous or catarrhal inflammation not unfrequently affects the larynx, and is the cause of the hoarseness which often attends both mild and severe bronchitis. There are, however, other inflammatory affections of the larynx of a very serious and fatal tendency—those, namely, in which the inflammation affects the submucous cellular membrane, and causes œdematous effusion into this tissue. The swelling which results, narrows the caliber of the larynx, particularly at the glottis, impedes the respiration, and often destroys life. To this form of inflammation the term *Laryngitis* is generally restricted. It may occur under the different forms common to other inflammations, varying according to its exciting causes, and to the state of the constitution. Dr. Cheyne has specified no fewer than nine varieties of Laryngeal inflammation, including the catarrhal form. For practical purposes, however, and for the sake of conciseness, we shall comprehend all the varieties under the *Acute* (which may be sthenic or asthenic) and the *Chronic*.

SECTION I.

ACUTE LARYNGITIS.

SYMPTOMS.—The sthenic form of *acute* laryngitis often begins with symptoms of tonsillitis, with difficulty of swallowing and fever, which is generally preceded by rigors. In this case the extension of the inflammation to the larynx, or its establishment in other cases, is announced by hoarseness, a frequent husky, and sometimes convulsive cough followed by tenderness, pain and constriction in the larynx itself, with difficult, prolonged, and sonorous inspiration, the chest being free from signs of disease. On examination, the fauces generally, but not always, are red and swollen, and sometimes, by pressing the tongue forwards and downwards, the epiglottis may be seen erect, thickened, and of a bright or deep red colour. In this state the epiglottis no longer protects the glottis from the contact of matters passing into the pharynx; hence the act of swallowing not only is painful, but often causes convulsive fits of coughing, and increased difficulty

of breathing. At first the fever is decidedly inflammatory: the face is flushed, the skin hot, and the pulse full and hard; but this state is soon changed under the depressing influence of the obstructed state of the respiration. A frightful train of symptoms then ensues, induced by the rapidly increasing impediment to the supply of air. The countenance becomes anxious in the extreme, and pallid; the lips livid; the eyes staring and watery; the nostrils raised; the voice is reduced to a whisper; the integuments in the fore part of the neck are sometimes œdematous; the pulse becomes quicker, feebler, and less uniform. To quote the expressive description of that experienced observer, Dr. Cheyne, "the patient is restless and apprehensive, often changing his position, in the vain hope of obtaining relief; walking, or rather staggering to and fro in great distress; feeling that he is on the point of suffocation, he cannot be ignorant of the danger to which he is exposed; hence he is willing to submit to any means of relief, and is impatient of delay. In this stage the sufferer seldom sleeps for many minutes at a time; when he begins to doze, he starts up in a state of the utmost agitation, gasping for breath, every muscle being brought into action, which can assist respiration, now a convulsive struggle. He is quite enfeebled, becomes delirious, drowsy, and at last comatose, the circulation being more and more languid, and he dies on the fourth or fifth day of the disease, or even earlier." Death has been known to take place seven hours after the attack; in some cases it has been delayed for two or three weeks.

The asthenic form of laryngitis differs from the sthenic in the absence of symptoms of inflammatory fever, and sometimes of pain in the larynx and difficulty of deglutition. In other respects the symptoms are similar; with the same hoarseness and cough at the commencement, difficult and stridulous respiration, rapidly amounting to a feeling of strangulation, as if the upper part of the windpipe were closed, often with fits of convulsive coughing and increased difficulty of breathing, apparently of a spasmodic kind; and after inducing symptoms of partial asphyxia in one of these paroxysms, the disease may prove fatal suddenly or more gradually, by the patient, after repeated attacks, falling into a state of insensibility.

In one of the asthenic forms of laryngitis, the inflammatory symptoms are by no means prominent; and the affection has long been termed *œdema of the glottis*, because an effusion of serum or pus into the cellular tissue of the lips of the glottis is the destructive lesion, and few other traces of disease are found after death. In other cases, particularly those arising from erysipelas, whether propagated from other parts or at first attacking the throat and larynx, and those of laryngitis supervening on continued fever, small-pox, scarlatina and measles, the symptoms of local inflam-

mation are more severe, pain and difficulty of swallowing are present, and after death, the epiglottis and other parts of the larynx are found inflamed and swollen by the effusion of lymph or pus into their cellular texture. The course of all these forms of laryngitis may be as rapid as that of the sthenic kind, but it is seldom so uniformly progressive, particularly in the œdematous variety, in which the attacks of difficult breathing are sudden and rather severe at first, and may prove rapidly fatal; or they may subside for a while after the expectoration of a little glairy mucus, and recur again with increased severity; in the interval, the breathing being pretty free, but the voice still hoarse, and the sensation of a tightness or lump in the throat remaining. In the cases in which the obstruction is chiefly œdematous, it generally occupies the cellular tissue of the glottis, and from thence to the ventricles, the epiglottis being comparatively free, and there being little or no difficulty of deglutition; but in the erysipelatous cases, as in the sthenic form, the epiglottis is frequently thickened, the patient experiences difficulty and pain in swallowing, the attempt to swallow liquids sometimes causing a spasm so violent as to resemble that of hydrophobia.

[The investigation of this disease is of recent date. The first genuine case of acute laryngitis on record is that of General Washington by Drs. Craik and E. E. Dick (Dec. 1799.) The first case published as such was by Dr. Cheyne, (Ed. 1809.) Dr. Dick, a distinguished physician of this country, referred to it in 1808, (Barton's Med. and Phys. Journal, vol. 3.) Bayle published a description of the pathology of the disease in 1805, and Dr. Baillie the first regular account of the disease in 1808. (Transactions of the Society for the Improvement of Med. and Chir. Know., Vol. III*.)]

CAUSES.—Acute laryngitis may follow exposure to cold and wet. It may originate in cynanche tonsillaris, and, according to Dr. Stokes, in cynanche parotidœa, which he has found to be inflammation of the cellular membrane only, and not of the parotid gland itself. Acute inflammation of the larynx has been brought on by swallowing scalding or corrosive liquids by the convulsive action which these excite in the throat; they are in part thrown on, and even into the glottis. Children accustomed to drink from the mouth of a tea-kettle or tea-pot have often attempted to do this when these vessels contained scalding water: the result has been violent inflammation of both pharynx and larynx. Instances of this accident were first recorded by Dr. M. Hall. Mr. Porter observes, that when a person attempts to drink by mistake a cor-

* [This disease counts among its victims several illustrious names—those of General Washington and the Empress Josephine, and in our own profession, Sir John Macnamara Hayes, Sir George Tuthill, and Dr. David Pitcairn.]

rosive liquid, a similar convulsive action takes place, closing the pharynx, and throwing the offending matter violently backwards through the mouth and nostrils, under the epiglottis, and thus this accident becomes a cause of acute inflammation of the larynx. Mr. Ryland has, with good reason, placed the inhalation of flame or of very hot air among the causes of acute inflammatory injuries of the larynx. Persons who die from severe burns, if it be only about the head and face, generally suffer from severe dyspnoea, and the mouth and larynx are found in a highly inflamed and congested state: these effects he very rationally ascribes to the great heat of the air inhaled at the moment of the conflagration. The inhalation of very acrid vapours might possibly have the same effect. As exciting causes of asthenic laryngitis, erysipelas, scarlatina, small-pox, and measles, have been already mentioned; and we may add, that inflammation of the tongue from the excessive use of mercury, and diffusive cellular inflammation from punctured wounds, have been known to extend to the cellular tissue of the larynx and cause death. M. Bayle and Dr. Tweedie have noticed that œdematous laryngitis sometimes suddenly supervenes without any obvious cause during and after typhoid fevers. It occurs also not unfrequently in the course of chronic disease of the larynx, and is sometimes the cause of death in these cases. We have known it to come on and hazard life in a patient with aneurism of the arch of the aorta, before the tumour had well shown itself outwardly: Mr. Lawrence has adverted to similar cases.

Habitual intemperance, long courses of mercury, frequent and long-continued exertions of the voice, are supposed to predispose persons to attacks of laryngitis. Except in case of scarlatina, measles, and small-pox, and of the accidents before alluded to, laryngitis never attacks children; and of those advanced in life, Dr. Cheyne states that it most frequently occurs in such as are liable to indigestion connected with a disordered state of the liver. In most instances, the subjects of it had previously been liable to sore throat.

ANATOMICAL CHARACTERS.—The effects of laryngitis are commonly found in the red injection and thickening of the lining membrane of the larynx, and an œdematous state of the cellular tissue underneath, particularly at the upper portions, from the epiglottis to the ventricles, the parts beneath being nearly or quite free from disease. In the more sthenic cases especially, the epiglottis is very red, thickened and erect, instead of lying over the glottis. The folds forming this chink are generally also red and much swollen. On cutting into them, serum, or if the disease have not terminated very rapidly, a sero-purulent liquid or pus, exudes. In a few instances, lymph has been found in the cellular textures,

and in two or three there have been small patches of lymph on the glottis and under surface of the epiglottis. Rarely these parts have been found ulcerated, even in acute cases. In the erysipelatous disease, and that arising from diffusive cellular inflammation, the matter effused in the submucous tissue of the epiglottis, vocal ligaments and ventricles, is a sloughy kind of lymph with serum, sometimes mixed with pus; and the longer the case has lasted, the more purulent the liquid is. This effusion is often found to extend to the cellular texture at the root of the tongue outside the larynx, and even among the muscles of the neck and throat. In the œdematous variety, the epiglottis is nearly free from disease; the mucous membrane is little injected, but the folds of the glottis are so distended as nearly to close the orifice, and on cutting into them, a clear or purulent serum flows out. It can scarcely be doubted, that in most cases this serous effusion is the result of a low form of inflammation: but it may be favoured by the existence of a dropsical diathesis, or by the pressure of a tumour on the neighbouring venous trunks: to the latter cause we would chiefly ascribe the laryngeal symptoms which occasionally show themselves in cases of aneurisms of the great vessels or other tumours at the lower part of the neck. Dr. Stokes notices the occurrence of œdema of the glottis in a patient labouring under a cancerous tumour below the jaw.

DIAGNOSIS.—The symptoms of acute laryngitis are generally sufficiently characteristic to separate it from other diseases affecting the breathing. The stridulous or hissing inspiration, heard most distinctly at the larynx, which is drawn down at each act, the seat of the sensation of pain or constriction at that part, often the visible condition of the epiglottis, and the absence of pectoral signs, suffice to distinguish it from disease of the chest. Abscesses external to the larynx and compressing it, may cause difficulty of breathing and swallowing: sixteen years ago we saw a fatal case of this kind, which was mistaken for a laryngitis, until the first incision of the throat after death gave issue to a quantity of pus which had formed among the numerous muscles of the tongue and larynx. A careful examination will generally distinguish these cases by the partial or general swelling at the upper part of the neck, often with tenderness, and an inability to open the jaw. Mr. Porter thinks that they differ from those of laryngitis in the breathing, although obstructed, being less sibilous, and more gradually oppressed, and in the diminished mobility of the larynx when pressed from side to side against the spine. We should conceive that the absence of the peculiar cough and hissing hoarseness of laryngitis might in some cases better assist the diagnosis. Spasmodic affections of the larynx may generally be distinguished by the complete absence of fever and by the

suddenness of the attack; but they may not be so easily distinguished from the œdematous laryngitis supervening on chronic diseases, which is in effect generally combined with spasm: still in this case there is usually a previous slight access of fever and increase of the chronic symptoms. Spasm of the glottis is a very rare affection in adults, and occurs only in hysterical or highly nervous subjects.

[Acute laryngitis may be confounded at first sight with intense acute pharyngitis, attended with great tumefaction of the tonsils. Inspection of the throat will elucidate the diagnosis by showing the absence of this phenomenon in laryngitis. In pharyngitis the voice is nasal, and not hoarse or extinguished; there is pain at the base of the lower jaw, which is increased on pressure, with very difficult deglutition; the attempt to swallow is agonizing; the dyspnœa is rarely intense early in the course of the disease as in laryngitis. It should be remembered, however, that laryngitis may supervene on pharyngitis. The absence of false membranes on the tonsils and pharynx, and in the expectoration, with the difficulty of deglutition, serve to distinguish it in some cases from croup. But as the former are not always present in croup, the diagnosis is often very embarrassing. The disease is, however, very rare in children, occurring generally in advanced life. Foreign bodies in the larynx give rise to a train of symptoms similar to those of acute laryngitis. In the want of precise information, the sudden invasion of the disease, without premonitory symptoms, the absence of fever at the debut, notwithstanding the violence of the local symptoms, and the intervals of entire calm, announce the presence of foreign bodies. Aneurism of the thoracic aorta, by its pressure on the first divisions of the air-passages, and on their nerves, produces a laborious, stridulous breathing, with dyspnœa, liable to exacerbations, and has often been mistaken for laryngitis, and tracheotomy has even been resorted to for its relief. In one case the tumour was opened in the operation. The absence of constant pain in the larynx, the slight alteration in the voice, and the signs of aneurism revealed by percussion and auscultation, will prevent so gross and fatal an error. Dr. Watson relates an instance where the trachea was opened in a woman, suffering under mere hysteria, so closely did the disease mimic laryngitis.]

PROGNOSIS.—Laryngitis has been considered by Dr. Cheyne and others to be the most fatal of all the inflammations. Of seventeen cases observed by Bayle during six years only one recovered. Of twenty-eight cases collected from various authors by Mr. Ryland, ten recovered, which he justly considers to be above the average. In most of the fatal cases, death took place between the first and fifth days. The prognosis must, therefore,

in all cases, be unfavourable; and the more so, as the disease has lasted longer and with progressive increase of the difficulty of breathing. When the face loses its colour or becomes livid, and the faculties obtuse, from the circulation of black blood, the danger is extreme. On the other hand, decrease of the difficulty of breathing and of swallowing, a returning freedom of expectoration, with an improved expression and colour of the countenance, give rational hopes of recovery.

TREATMENT.—In no disease is an early and energetic use of remedial measures more essential to their success than in *acute sthenic* laryngitis. There is a period during which free blood-letting and the administration of calomel and antimony may arrest the inflammation before considerable effusion has taken place; but this period is very short, and has often elapsed before medical aid is resorted to; and when once the effusion has taken place, antiphlogistic measures become worse than useless, and unless artificial means of supplying air to the lungs be employed, the disease generally destroys life before there is time for ordinary curative measures, however energetic, to produce their effect. The chief indications of treatment, therefore, are,—1. To prevent effusion by reducing inflammatory action:—2. Effusion having taken place, to prevent the obstruction which it causes to respiration from producing mortal injury to the functions:—3. To promote the removal of the effused matter.

1. In endeavouring to fulfil the *first* indication by free blood-letting, we cannot do better than by quoting the directions of Dr. Cheyne. He recommends free blood-letting, but not to syncope, as advised by Dr. Baillie, for this may deprive the patient of strength sufficient to struggle against the next spasmodic paroxysm of dyspnoea. “We would bleed the patient freely during the first twenty-four hours:—we should be disposed to do more: as long as the complexion of the patient is good, we would have recourse to venesection, keeping a finger on the artery while the blood flows, and closing the orifice when the pulse is reduced; we would have leeches applied or blood removed from the nucha by cupping; and we should be disposed to bleed again or even a third time, so as to abstract forty or fifty ounces of blood, and at the same time let the patient have a powder containing two or three grains of calomel, three or four of Pulv. Jacobi Verus, and one-half or one-third of a grain of opium should be taken every third or fourth hour till the gums become affected.” We would not hesitate to give double this quantity of calomel. Dr. Cheyne justly objects to blistering on account of its trifling advantages in comparison with the additional suffering which it occasions, and possible interference with the operation of bronchotomy. Perhaps the same objections would not apply to the speedy and

energetic counter-irritation by the strong liquor ammoniæ, which, if applied at the side of the neck in the manner directed by Dr. J. Johnson, may produce vesication in two or three minutes; [and the application of sinapism, or mustard poultices, is said to be followed by marked relief.

1. R.—Liq. Ammon. Fort. fʒj.
Spr. Rosmarin. fʒiv.
Tinct. Camph. fʒij.

M.—A piece of thick, coarse flannel is saturated with the lotion, and held firmly over the larynx for several minutes.]

Dr. Cheyne also deprecates the use of tartar-emetic, lest it should excite vomiting, which, with the erect state of the epiglottis, would throw matters on the unprotected glottis, and cause a frightful convulsive irritation. For a similar reason we would object to the direct application of leeches to the tonsils, a measure proposed by Dr. Cheyne. We can testify of its utility in tonsillitis, for which it was first recommended by Mr. Crampton; but the irritation from the bites, and the blood proceeding from them, could scarcely be tolerated with an exposed glottis.

[In the treatment of throat affections, it is very common to apply leeches immediately over the larynx, and subsequently a blister. Serous infiltration is liable to follow both practices, which, from the superficial situation of the laryngeal cartilages, is apt to extend to them, and induce œdema of the glottis. Blood, therefore, as recommended, should be drawn from the back of the neck, and the blister placed on the upper part of the sternum.

According to Dr. Chapman,* nothing controls the distressing periodical exacerbations as well as a cataplasm of tobacco around the neck, or smoking a segar, when the patient is unaccustomed to it. From a few experiments that he has made with it, he believes that it may prove a very valuable therapeutic agent in the more general management of the disease.

Active purgation has also been highly recommended, and Dr. Requin relates two cases occurring in females, where imminent suffocation was prevented by the administration of croton oil, (El. Pat. Med. t. i. p. 749.)

2. R.—Olii Tiglii, gtt. iv.
Ext. Col. Comp., gr. xx.
M. Div. in pil. iv.

Sig. One every two hours till copious evacuations occur.]

Active depletory measures employed early may for a time relieve the symptoms without removing the inflammation: they often only delay the effusion, which, with its resulting permanent increase of difficulty of breathing and appearance of lividity, instead of taking place in the first day, may not come on for several days. [Copious venesection early in the disease must be our main reli-

[* Lectures on the most important diseases of the Thoracic and Abdominal Viscera, p. 108—Phil. 1844.]

ance. "There is, perhaps," says Dr. Watson, "no disease in which *καιρος οξυς*, the fleeting opportunity is more conspicuous than in this." The safe rule to be guided by in the employment of venesection is not the number of hours the disease has existed, but the real progress that it has made, for it sometimes travels with fearful rapidity. As long as the fever is high, the pulse full, and the cheeks and lips red, bleeding is of advantage; but so soon as the face and lips become pale, the pulse small, the skin cool, the mind uneasy, blood-letting will increase the apnœa, and accelerate death.] Hence the importance of attempting, from the first appearance of the disease, to fulfil the *third* indication by the free use of mercury both by calomel internally and by external inunction; for if the gums can be made sore, a secretion from the throat is established which generally reduces the swelling of the glottis. [A grain of calomel administered every hour, with extract of gentian, according to the plan of Dr. Law, of Dublin, will induce rapid salivation; copious salivation would no doubt be injurious; and there exists much diversity of opinion of the efficacy of mercurialization in the disease.

3. R.—Hydrarg. chlor. mit., gr. xxiv.
Ext. gentianæ, gr. xl.
M. Div. in pil. xxiv.

Sig. One every hour until the gums are touched. One drachm of unguent. hydrarg. should be rubbed into the inner part of the thigh two or three times a day.]

We have more confidence in the power of mercury to *cure* laryngitis than in that of blood-letting; and would consider the great utility of the latter to be in so far retarding the progress of the inflammation as to enable the mercury to act before a fatal obstruction is produced. Some few cases have yielded to bleeding alone, and its employment should never be neglected when the strength can bear it, and the conditions so well stated by Dr. Cheyne indicate it. But if the strength have already failed, or these conditions cease, and the undiminished dyspnœa and commencing lividity announce the approach of asphyxia, blood-letting becomes worse than useless, and the *second* indication by the operation of bronchotomy must then be attempted without delay. Dr. Baillie considered it advisable to resort to bronchotomy if no considerable relief be obtained from other measures in thirty hours. Dr. Cheyne more rationally takes as a criterion the condition of the patient rather than the period; and says that if the symptoms be such as to contra-indicate bleeding, and yet asphyxia is imminent, *thirty minutes'* delay may be too much: but if the complexion is good, and asphyxia not threatened, the operation may be delayed *thirty days*. Surgical writers strongly urge the early performance of the operation. Louis observes, "as long as bronchotomy is considered an extreme measure (*un dernier resort*) it will be always performed too late;" and Mr. Lawrence says that

it should be done, "as soon as the symptoms enable us to determine the nature of the disease." It is because we are convinced that it should be resorted to early, that we have included it in the second indication. If free bleeding produce no relief, or be not borne, and serious difficulty of breathing have become established, we would not wait for the appearance of pallor or lividity as recommended by Dr. Cheyne, and still less for the lapse of a certain number of hours as proposed by Dr. Baillie, but we would urge the performance of bronchotomy without delay. To defer the operation on account of the difficulty or danger attending it, is most unreasonable; for experience has proved that these are increased rather than diminished by delay, and the danger from the operation is at no period to be compared with the danger from the obstruction to the breathing that it is calculated to remove. Laryngitis destroys life, not by the extent or the vitality of the organ which it occupies, but by closing as it were the door of the breathing apparatus: by opening another door we render the disease comparatively trivial; and it may then be deliberately attacked by mercurial and other remedies, or, if slighter, even be allowed to run its course, which commonly ends in muco-purulent secretion. [It is well remarked by a recent authority that, "in the treatment of laryngitis, the physician too often neglects the means which surgery affords for the relief of his patient, and that under the routine practice of bleeding, calomel and tartar emetic, many have perished by suffocation whom tracheotomy would have kept alive." So soon as it is evident that blood-letting is not telling, and the moment the skin becomes dusky, tracheotomy should be performed. The operation should be performed if possible whilst the patient's strength is yet entire, and before the system is already poisoned by unarterialized blood, and the lungs congested; if it do not save life, it will disarm death of its agony. Its early performance is urged by Dr. Chapman. It is more successful in this disease than in croup, because the trachea and lungs are rarely affected, and there is no membranous exudation; it is attended with no danger, and is very simple of performance, as the trachea of the adult is larger than that of children.

In the London Med. Gaz. for March 8, 1844, Dr. J. A. Wilson, physician to St. George's Hospital, London, relates a case of severe acute laryngitis, in which the patient, on the eve of suffocation, and fast lapsing into the state of coma, was immediately relieved by the operation of tracheotomy performed by Mr. Keate, and finally recovered. He relates another case in which life was saved.]

When the operation has been delayed until asphyxia approaches, it will have less chance of success; but should still be tried, for a very few instances are on record where it succeeded at almost the last extremity. It is not within our province to give directions for

the mode of performing the operation; but we may state that we have seen reasons for making a free incision between the thyroid and cricoid cartilages, and keeping them separated for the first half hour by the thin handle of a scalpel, and afterwards by a short tube half an inch in diameter, with a projecting rim to *button* into the opening, and a ligature passing round the neck to prevent its slipping in too far. Such a tube may be made in a few minutes of a piece of hollow reed or elder stick, by winding a few turns of waxed twine around the end to be inserted, and passing the ends of the twine through the two holes bored across the outer extremities of the tube, whence they are passed and tied round the neck. The less of the tube that is introduced within the windpipe the better; for the presence of a foreign body often excites terrible paroxysms of coughing. The act of expectoration is often impossible with the opening free; it should therefore sometimes be closed after a long inspiration, that the patient may forcibly expel the accumulating matter by a full expiration through the glottis, which is sufficiently free to the exit of air: varying the posture will aid this act.

[Tracheotomy is preferred by the generality of authorities, and possesses indisputable advantages over laryngotomy—the trachea is rarely involved in the disease, and an incision through the inflamed membrane of the larynx, and the subsequent introduction of a canula, would not fail to increase the irritation. (See Remarks on Tracheotomy by Prof. Trousseau appended to the section on Croup.)]

Until and after the mercurial action is established, it is often useful to apply leeches or a blister, or other counter-irritants, to the upper part of the chest; for there is a tendency to bronchitis as the laryngeal inflammation subsides; and this extension of disease has, in not a few instances, caused death where bronchotomy had saved the patient from the laryngeal affection. The treatment of the after stage of laryngitis is much the same as for the same period of bronchitis.

The great difference to be remarked in the treatment of *acute asthenic* laryngitis, whether of the œdematous or erysipelatous kind, is in the total absence of a phlogistic period in which general blood-letting may do good. Leeches freely applied to the sides of the larynx, and speedy blistering the sides and back of the neck by the strong liquor ammoniæ or acetum lyttæ, may sometimes diminish or retard the effusion until the system can be brought under the influence of mercury, which here, as well as in the sthenic form, is the only remedy to be relied on for dispersing the swelling. [The application of a strong solution of lunar caustic, or of powdered burnt alum, both in this and the sthenic form, will often be productive of the greatest relief.] But if, as it more commonly happens, the progress of the disease towards causing a fatal obstruction be more rapid than the influence of the remedies, the

obvious resource will be in the early performance of bronchotomy [or tracheotomy.] These cases will bear even less delay than those of the sthenic disease; for besides that they are still less under the control of remedies, they occur in weakly subjects, which are sooner injured by an obstructed state of the respiration: and it has repeatedly happened that a late operation has relieved the breathing, but the patient has sunk from the injurious influence of imperfectly arterialized blood, which had already circulated in the lungs, brain, and other organs. Hence, too, even if this influence be not immediately fatal, it may lead to secondary congestions of these organs, which, in the form of asthenic bronchitis, pneumonia, or arachnitis, may ultimately endanger, and even destroy life.

In case of the secondary laryngitis supervening in erysipelas, scarlatina, measles, typhus, and other febrile diseases, due regard must be paid to the original disease, which, according to circumstances, may require a stimulant or an opposite plan of treatment.

SECTION II.

CHRONIC LARYNGITIS.

This form is of more frequent occurrence than the acute, and presents itself in a great variety of degrees. As acute laryngitis is a comparatively trivial disease as long as it is confined to the mucous membrane, and produces no swelling of the tissues beneath, so chronic inflammation may affect the internal surface of the larynx for many months, and produce little inconvenience except hoarseness, habitual husky cough, and perhaps some feeling of soreness at the top of the windpipe. This affection not unfrequently succeeds to a neglected catarrh, especially in those persons who are continually exposed to cold and wet, and are habitually intemperate; for example, hackney-coachmen and street porters. The purple faces of many such individuals give evidence of a congested condition of the capillaries, that in all probability extends to the lining membrane of the larynx; increasing its sensibility and injuring its nice adjustments in the production of the voice. This form of disease may exist long without inducing further change, and tends rather to induce thickening of the membrane and vocal ligaments, than to end in ulceration.

It is different with the serious disease which more commonly goes by the name of *chronic laryngitis*, or *phthisis laryngea*, which, like the acute disease, reaches to the submucous cellular tissue, from whence it may extend to the other constituents of the larynx, and involve them in the intractable and destructive effects which inflammation induces in these less vital textures. The chief of these are, erosion and ulceration of the mucous and submucous

tissues; softening, thickening, œdema, induration, contraction, and dissecting abscesses of these textures, and of the ligaments and muscles attached to them; ossification, caries, and necrosis of the cartilages: warty and fibrinous excrescences; scirrhous and tuberculous formations in the different structures. These several lesions may be variously combined, and produce disease of very different degrees of severity, those being the worst forms in which the cartilages are diseased, or extensive ulceration of the other tissues already produced. These more destructive changes may follow simple inflammation; but they are more commonly either the result of a scrofulous diathesis, and often complicated with tuberculous disease of the lungs and other parts; or they are the product of a syphilitic taint, or much more rarely of scirrhous or other malignant disease.

SYMPTOMS.—Chronic laryngitis is generally a very insidious disease, often beginning as a common catarrhal cough with hoarseness, and not attracting particular attention until it has lasted for a long time, and seriously injured the general health as well as the tissues in which it is seated. The chief symptoms are hoarseness, a husky dry cough, with soreness or pain in the larynx, felt sometimes on pressure, or rubbing it against the spine, sometimes only in the act of swallowing. Of these, the most constant sign is the change of the voice, which varies very much in degree and kind. The dry, stridulous, or squeaking kind of hoarseness, if permanent, generally implies a worse form of disease than the deep, loose, or mucous hoarseness which may proceed more from relaxation: sudden loss of voice may occur with slight diseases affecting the thyro-arytenoid ligaments, or a nervous affection of the muscles, and may not be permanent; but where a voice gradually becomes more and more cracked until it is at last lost, there is probably a progressive destruction of the vocal apparatus. In some cases the defect of the voice is perceptible only on speaking loud, or in any attempt to vary the tone; for the patients instinctively acquire the habit of speaking in that tone and degree in which the voice is best produced. Pain is so uncertain a symptom, that Trousseau and Belloc state that in more than half the cases of laryngeal phthisis which fell under their observation, there was no pain throughout the disease. There is, however, generally increased sensibility of the larynx, so that the inhalation of cold air, or any hurry of the circulation, very readily excites coughing. The cough, which, in the early stages, is commonly short, dry, and hacking, is described by MM. Trousseau and Belloc to assume, in some instances, in the latter stages a very peculiar loose continuous character, like eructation or belching, which they ascribe to an inability to close the glottis, its closure being the first act of an ordinary cough. As the disease advances, there is often abun-

dant purulent and sanious fetid expectoration, sometimes streaked with blood; but not unfrequently the sputa are scanty and chiefly mucous. The occurrence of purulent expectoration is sometimes accompanied by relief to the breathing, although the voice may suffer more, and there may be more pain or soreness in coughing; this marks the formation of an ulcer, the discharge from which diminishes the constriction of the air-passage. Instances have occurred of the expectoration of dead and ossified portions of the arytenoid and cricoid cartilages, and of calcareous concretions formed within the larynx; and in more than one case, such solid fragments having fallen back into the trachea, and caused much irritation and consequent disease in one of the large bronchi. The respiration generally becomes affected sooner or later in chronic laryngitis; the difficulty of breathing commonly coming on in the night, and on any exertion sometimes in very severe spasmodic paroxysms, leaving the patient only with a short breath in the interval. The attacks of dyspnœa afterwards increase, and prevent the patient from lying down; and in the interval, the hissing sound of the laryngeal breathing indicates some degree of permanent impediment to the passage of the air. After the orthopnœa has once commenced, death generally ensues in a fortnight or three weeks; but at an earlier period the patient may be suddenly carried off by an attack of acute œdematous inflammation of the glottis. Of nine fatal cases of œdema of the glottis, examined by MM. Trousseau and Belloc, five occurred in the course of chronic laryngitis. In many instances, chronic inflammation and ulceration of the larynx are accompanied by progressive emaciation, hectic fever, night-sweats, and other signs of phthisis, without marked dyspnœa; and the patient is ultimately worn down by cough and weakness, and is perhaps carried off by diarrhœa or some other superadded disorder. In by far the greater number of these cases, tubercles are formed within the lungs, either before or after the laryngitis begins, and become the chief cause of the decline, although too gradual in their effect to affect the breathing in a marked degree. In a few instances recorded by Trousseau, Belloc, Ryland and others, the laryngeal lesion was uncomplicated with any pulmonary disease, the consumption having been purely laryngeal. In most of these cases the cartilages of the larynx were diseased. Chronic inflammation and ulceration of the larynx and trachea are very common with tuberculous consumption of the lungs, and are the cause of the loss of voice, and smarting or pricking sensation in the larynx, so often occurring in the advanced stages of phthisis. Ulceration was found by Louis in upwards of a fourth of the cases of phthisis noted in his work.

CAUSES.—Chronic laryngitis may succeed to the acute disease; but it much more commonly arises from the frequent recurrence

of catarrhal inflammation, particularly in those who are addicted to ardent spirits. Excessive exertions of the voice, repressed eruptions, wounds or contusions of the throat, foreign bodies introduced into the larynx, (among which may be mentioned the habitual inhalation of air loaded with dust,) and the extension of syphilitic disease from the throat, [which is a frequent cause, the ulcers extending from the throat by continuity of surface,] may be enumerated as occasional exciting causes. A scrofulous or tuberculous constitution particularly predisposes to laryngeal phthisis. The excessive use of mercury, habitual intemperance, and other debilitating influences, are also supposed to render persons more liable to chronic inflammation of the larynx. The disease appears to be most common at the middle period of life. According to Mr. Ryland, it affects women more frequently than men, but this is at variance with the experience of MM. Trousseau and Belloc. [The vocation of the clergy has been thought to render them peculiarly liable to this disease, especially in this country, and it has, in consequence, been called the "clergymen's sore-throat." This peculiar susceptibility, from the nature of their pursuits, may be doubted. The disease in fact to which they, in common with others, seem particularly liable, is a chronic pharyngitis, and is popularly known as *bronchitis*. On inspection of the pharynx, its lining membrane will be found to be injected, and the follicles greatly enlarged, and resembling split peas.]

ANATOMICAL CHARACTERS.—We have already enumerated the principal lesions which chronic laryngitis induces. They are very various, and have been minutely described by Porter, Lawrence, Stokes, Ryland, and Trousseau and Belloc, to whose works, (particularly the last,) we refer for details. The simplest effect of the chronic inflammation is, 1. Redness of the mucous membrane in patches; even when not ulcerated, it has often a rough, granular appearance, from the irregular enlargement of the mucous follicles. 2. Thickening of the submucous tissue: this is frequently observed in the epiglottis and the lips of the glottis, causing enlargement and diminished mobility of these parts; the ventricles of the larynx are sometimes nearly obliterated from the same cause. 3. Contraction of the ligaments, wasting, induration, and fibrous degeneration of the muscles which move the cartilages of the larynx: this is a common result of chronic inflammation on fibrous and muscular textures, and must in this case impair or destroy the mechanism of the voice. Contraction, together with partial thickening affecting the epiglottis, renders it curved or corrugated, so as to defend the glottis very imperfectly. 4. Ulceration of the mucous and submucous textures: this is a common result of chronic inflammation, and presents itself in great variety as to form and seat, of which the following are the most remark-

able: the ulcers are sometimes small and round, but confined to the mucous membrane: in other cases they have been known to penetrate to the cartilages or ligaments; and M. Andral notices a solitary case in which one perforated the thyroid cartilage, just above the insertion of the vocal ligaments. In this case the voice was unaffected. When these ligaments are injured, the voice is generally destroyed. When again the ulcers are large and superficial, denuding but not injuring the vocal chords, there is commonly hoarseness, but not aphonia. It is between the vocal ligaments and the epiglottis that ulcers are most commonly found, but they are often met with in other parts of the larynx and trachea. They are frequently seen on the laryngeal surface of the epiglottis, and sometimes at its margin; it is only in case of syphilitic disease that the upper or lingual surface is found affected. Considerable parts of the epiglottis, as well as of the arytenoid and cricoid membranes and cartilages, have, in a few instances, been found destroyed by ulceration. 5. The ulceration, however, does not frequently extend to the cartilages except in young subjects. MM. Trousseau and Belloc do not consider the cartilages of the larynx sufficiently vital to take on the process of ulceration or caries. The common effect of ulceration of the adjoining textures on them is in the first place ossification, and afterwards necrosis. The cricoid and thyroid cartilages naturally become ossified in advanced life; but chronic laryngitis of two years' duration produces the same change in young persons. This is in conformity with a law well developed by Andral, that a certain degree of irritation accelerates in tissues those changes to which time would naturally bring them. The osseous matter is deposited in irregular places on the surface of the cartilage, and sometimes quite encases it. Instances of necrosis of the cricoid, arytenoid, and even of the thyroid cartilages, have been recorded by Porter, Lawrence, Cruveilhier, Ryland, and Trousseau and Belloc. The last authors state that they have found this lesion in more than half of the fatal cases of laryngeal phthisis which they have examined. In this state, the cartilages are denuded of their perichondrium, and are of a dirty dull hue without their natural lustre. The sequestrum of dead cartilage is not readily thrown off; but there is often fetid pus in the cellular texture near it. These abscesses may open and discharge their offensive contents, and even the dead portions of the cartilage, either into the larynx, or outwardly through the integuments of the neck, or into the œsophagus. It can readily be conceived how much local and constitutional irritation these dead matters may produce before they are discharged, and how, in the very act of separation, acting as foreign bodies, they may produce suffocation.

DIAGNOSIS.—The most characteristic signs of chronic laryngitis

are the permanent change of the voice and the peculiar cough before described, with hissing breathing and pain or tenderness in the larynx when these happen to be present. Except in syphilitic cases, where the fauces are also diseased, little is to be learnt from examination of the throat; for it is impossible to see or reach further than the epiglottis, and to get a view of this is a matter of difficulty. Neither is crepitation felt on pressing the larynx to be depended on; for, according to Trousseau and Belloc, this may be produced in a healthy larynx. Dr. Stokes describes, as a stethoscopic sign of chronic laryngitis, a harshness in the sound of the air passing through the larynx, giving the idea of a roughness of surface, perceptible even when the breathing is not distinctly stridulous. In a few cases he observed above the thyroid cartilage a rhonchus, like the sound of a valve in rapid action, combined with a deep humming. We much question that the latter sound was seated in the larynx, for such a sound is often produced in the jugular veins. When the laryngeal constriction is considerable, the peculiar sound of the passage of air through it will sufficiently distinguish it; and where it is slight or altogether absent, laryngeal disease may yet be known as the cause of the cough and other symptoms, by the negative indications of the thoracic organs, the sound of percussion and of respiration being good throughout the chest. But pulmonary tubercle is very commonly conjoined with laryngeal disease, and the two affections are apt to disguise each other. The noisy laryngeal respiration, and the absence of the voice may destroy the chief distinctive signs of phthisis in its early stages; but as the disease advances, the dullness on percussion and perhaps cavernous rhonchus in some part of the chest, particularly under a clavicle or scapular ridge, with a more copious purulent expectoration, night-sweats, and more rapid emaciation, sufficiently announce this most destructive complication. When the breath and sputa in laryngeal disease are very fetid, it may be suspected that some part of the cartilages is dead. This is generally the case where a chronic abscess opens outwardly about the thyroid cartilage.

PROGNOSIS.—The milder and simple forms of chronic laryngitis are by no means incurable; in fact, they generally yield to judicious treatment; and were it not for their liability to exacerbations from acute œdematous inflammation, and to complications with pulmonary disease, they could hardly be called dangerous. Both these destructive complications may be apprehended when the disease has continued long, with increasing severity of symptoms of the voice and respiration, with a change of the cough from dry and ringing to loose and undivided, with increasing purulent expectoration, and particularly if the disease has resisted

treatment. If, from the history of the individual, there be any suspicion of a scrofulous tendency, and particularly if symptoms of pulmonary disease, such as slight cough, shortness of breath, pains in the chest or shoulders, quickened pulse, &c., preceded those of the laryngeal affection, the prognosis is unfavourable; and if there are found any physical signs of phthisis, such as dullness under a clavicle, the case of the patient must be considered almost hopeless. Fœtor of the breath and sputa, implying mortification of the cartilages, is also very unfavourable; but it is more probable that the dead portions of these may be thrown off, than that tuberculous disease of the lung, combined with a laryngeal lesion, may be cured. In all doubtful cases, particularly those of a syphilitic origin, the state of the general health and strength, as well as the degree of the local affection, must be duly taken into account in estimating the probable issue of the case.

TREATMENT.—The curative indications are, 1. To subdue the chronic inflammation and to promote the removal, as far as possible, of its effects on the structure; 2. To relieve urgent symptoms as they arise; 3. To improve the condition of the general health.

1. It is necessary to premise, that as a condition essential to the success of any mode of treatment, the diseased parts must be kept as much as possible in a state of rest by suspending the exercise of the voice, which is the work of the larynx; and to effect this it is sufficient to limit the patient to speak in a whisper only, which exerts the larynx no more than respiration does. This restriction is a more practicable one than that to absolute silence. The protection of the parts from the irritating influence of cold air, smoke, dust, &c., is also very necessary. This may sometimes be effected by means of a respirator, without confining the patient to warm rooms. As is generally the case in chronic inflammations, general blood-letting is useful only to relieve temporary congestions, or in plethoric subjects to prepare for the better action of other remedies. Local bleeding, especially by leeches, is more frequently beneficial, particularly in case of temporary increase of the local symptoms, when the cough is more troublesome than usual, with pain or increased tenderness in the larynx. They should be applied to the sides of the larynx or under it; and if they give relief they may sometimes with advantage be repeated in small numbers, every two or three days for some length of time. In a greater number of instances, however, more benefit will be derived from continued counter-irritation at the sides of the neck or upper part of the chest; and for this purpose the tartar-emetic solution or ointment, [or croton oil,] or a caustic issue, or well-managed seton, will answer better than blisters. A succession of pustular erup-

tions, or a discharge of pus from beneath the cutis, has an influence over an established chronic inflammation of a submucous tissue far greater than serous discharges.

To modify the action of the diseased textures, and to promote the absorption of the solid matter effused in them, no measure has been found so efficacious as a mild mercurial course, varied to the extent of affecting the gums. Unlike in the acute disease, there is time enough to produce this effect without giving very large doses; and as soon as it takes place, there is generally a diminution of the pain and constriction in the larynx, improvement of the voice, and a loosening of the cough. If the disease be not of long standing, and there be no extensive ulceration, or disease of the cartilages, the means already named will often effect a cure. But where the disease has lasted long and induced considerable local lesions and constitutional derangement, other measures, both local and general, should be employed. In cases where the influence of mercury might be hurtful, as in those of a strumous diathesis, a course of hydriodate of potash, with an excess of alkali, will sometimes prove very beneficial. The inhalation of steam, in some cases rendered slightly stimulant and alterative by the addition of camphor, turpentine, or a balsam, has been found useful in promoting the secretion of the diseased membrane. MM. Trousseau and Belloc place much confidence in medicaments applied directly to the diseased part, and some of those which they recommend are of a very energetic kind, such as nitrate of silver, corrosive sublimate, sulphate of copper, &c. They may be applied either in solution or in powder. The solution which they have found most effectual is that of nitrate of silver in the large proportion of from one to two parts in four parts of distilled water. This solution may be applied to and behind the epiglottis, by a small roll of paper bent at its moistened end. A more effectual mode is with a small round piece of sponge fixed to a long rod of whalebone bent, at an inch from the sponge, to an angle of eighty degrees. The patient's mouth being opened wide, and the tongue pressed down with a spoon, the sponge is passed to the top of the pharynx; as soon as it reaches the fauces, a movement of deglutition takes place, which carries the larynx upwards, at which moment the sponge is brought forward and squeezed under the epiglottis, and the solution freely enters the larynx. Convulsive cough and sometimes vomiting ensue; but the application causes no pain. [Or a strong solution of lunar caustic, (grs. x. a. xx. aq. f̄ij.) or burnt alum may be applied by means of a piece of sponge or a brush of lint, sewed to the end of the finger of a glove; the glove being drawn on the index finger, the lower portion of the throat may be swabbed, and the glottis even reached.] A less disagreeable mode of applying the solution is by a

small silver syringe, filled one-fourth with the solution and three-fourths with air. To this is affixed a tube five inches long, bent at the free end, which, being carried beyond the epiglottis, the syringe is forcibly discharged, and in consequence of the air in it, throws the solution not in one stream but in a fine shower, part of which enters the larynx. The patient is then made to rinse his mouth with and swallow salt water, or water acidulated with muriatic acid, which decomposes the remains of the nitrate; the same precaution should be used where this agent is applied in substance. MM. Trousseau and Belloc found this application (which they term cauterization) highly beneficial in several cases of chronic laryngitis. In cases of aphonia, probably dependent on relaxation rather than inflammation, it effected a cure in a few days; in some worse forms of the disease, with probably ulceration of three or four years' standing, its repeated application during five or six weeks was successful; and it produced considerable temporary improvement in three cases which proved afterwards to be tuberculous. Solid substances may be applied to the larynx in powder by insufflation, as recommended by Aretæus for angina maligna. The powder is put into one end of a reed or glass tube, and the other is carried back as far as possible into the mouth: after a full expiration the patient closes his lips around the tube, and inspires suddenly and forcibly through it, by which some of the powder is carried into the larynx and trachea. The cough, which is excited, should be restrained as much as possible, to prevent the too speedy expulsion of the medicine. The powders used by MM. Trousseau and Belloc are sub-nitrate of bismuth, which may be used pure with safety and advantage in most forms of chronic laryngitis, even that accompanying phthisis; calomel with twelve times its weight of sugar; red precipitate, sulphate of zinc, and sulphate of copper, each of which must be mixed with thirty-six times its weight of sugar; alum with twice its weight, and acetate of lead with seven times its weight of sugar; and nitrate of silver with twenty-two, thirty-six, or seventy-two times its weight of sugar. The last is said to be most effectual in erythematous laryngitis with erosions or ulcerations. Calomel and red precipitate have proved beneficial in ulcerations, whether syphilitic or not, but they should not at first be repeated oftener than twice or thrice a week. The others may be used twice or oftener daily, according to the nature of the case. The powders should be impalpably fine; the least roughness or perceptible fragment of a crystal excites such efforts to cough as insures the expulsion of the powder. This description of the treatment of MM. Trousseau and Belloc is taken from an abstract in the *British and Foreign Medical Review* by the writer, and appears to be well worthy of the attention of British practitioners, in proving the safe direct application of powerful

agents, which, as in external diseases, are likely to improve the action of the diseased parts.

2. The second indication—to relieve urgent symptoms, especially requires attention, when the attacks of difficult breathing or of cough are very urgent. These arise in some degree from spasm, and may often be relieved by sedatives and antispasmodics, such as belladonna, [cicuta, morphia,] camphor, ether, and opium, both taken internally and applied by inhalation in the steam of hot water. Drs. Graves and Stokes recommend particularly the use of a belladonna plaster to the external throat, and a hot pediluvium.

[4. R—Ext. Belladonnæ, ℥i.
Cerat. Simp. ℥iv.—M.

Sig.—A small portion to be rubbed over the larynx twice daily.

5. R—Morph. Hydrochlor., gr. j.
Ol. Sassafras, gtt. j.
Syr. Acac. f℥j.—M.

Sig.—A tea-spoonful when the cough is urgent.]

If, however, the more gradual supervention of the dyspnœa, with feelings of increased uneasiness in the larynx, and perhaps some fever, indicate that the aggravation of the symptoms is produced by an attack of œdematous inflammation, and this be not speedily relieved by leeching, it may be necessary to adopt the surgical means of relief recommended for that affection, avoiding dangerous delay after the character of the attack has been clearly made out.

3. The third indication—to improve the condition of the general health, is in many cases a point of the first importance; and until it be fulfilled, any other measures may be of no avail. No particular rules can be laid down for this purpose; but the practitioner may well be guided by the state of the constitutional symptoms. To preserve a due balance of the secretions, to improve the nutrient functions by a well-regulated mode of diet and regimen, aided by mild alterative tonics, such as sarsaparilla and saline chalybeate waters, and especially to assist both nature and art by placing the patient in a salubrious and congenial climate, are the objects chiefly to be aimed at, in order to fulfil this indication. When the disease has a venereal origin, a proper course of mercury will generally be indicated; but this will often fail, unless measures be at the same time taken to improve the general health; and if this have already suffered much from mercury in repeated or ill-directed courses, or in a strumous habit, it will be necessary, for the time at least, to use the iodide of potassium [or iodide of iron], and other general measures, with whatever local treatment the nature of the case may admit. In such cases, fumigation of

[6. R—Potass. Iodidi, ℥i. vel ℥ij.,
Aq. Dist. f℥iv.—M.

Sig.—A teaspoonful in f℥ii of Syr. Sarsaparill. comp.

[7. R—Syr. Ferri Iodidi.

Sig.—Five drops three times a day, and increase gradually to twenty.]

the fauces with cinnabar (sublimed from a hot plate, or a laundry iron) will sometimes improve the character of the local disease.

SECTION III.

[PSEUDO-MEMBRANOUS LARYNGITIS] OR CROUP.

THIS disease has been described under a variety of names: *Tracheitis*; *croup*; *cynanche vel angina trachealis*; *cynanche stridula infantum*; *angina polyposa, membranacea vel exudatoria*; *tracheitis infantum*, &c. Its essential pathological character is inflammation of the [lining membrane of the larynx and] trachea, attended by swelling of the tissues, and often by the exudation of a concrete albuminous membrane, which, by the spasmodic contractions which its presence excites in the windpipe, occasions difficult and stridulous breathing. This disease, so serious and destructive in early life, has been the subject of several able treatises; and although its existence was scarcely recognized till the middle of the last century, it is now as well understood as other diseases of the air-passages. In the history of the usual form and progress of the disease, we shall often avail ourselves of the descriptions given by the latest writers, Dr. Cheyne and Dr. Copland.

SYMPTOMS.—For practical purposes rather than because they are in an obvious degree so presented in nature, it is useful to divide the symptoms into, 1. Those of the invasion; 2. Those of the developed stage; and, 3. Those of the collapsed or suffocative stage.

1. The first symptoms of an attack of croup are by no means distinctive; they are commonly of a catarrhal kind, but with more fever, perhaps a more hard hollow cough, with alternate chills and heats and flushing, a loaded tongue, hoarseness, heaviness of the eyes, fretfulness, restlessness at night, and sometimes a manifestation of uneasiness in the throat, by the child frequently putting the hand to it. The presence of bronchial inflammation at this time is shown by the sonorous and sibilant rhonchi heard in many parts of the chest; but the tracheal breathing is not yet stridulous.

2. The developed stage of the disease is manifested by stridulous inspiration, which is like a sonorous or sibilant rhonchus, only much louder; it can be heard through the stethoscope or ear applied to the neck, before it is otherwise distinct: the cough is of a peculiar rough barking or ringing kind, followed by an inspiration more hissing and sonorous than usual: hence the combination of the cough and inspiration has been compared to the

barking of a puppy or the crowing of a young cock: the voice becomes decidedly hoarse: the pulse is frequent and hard: the carotids beat strongly, and the pulsations of the heart are heard all over the chest; the skin is hot; the face flushed; the eyes watery and injected; the head thrown back; and the child is extremely restless and indicates pain or uneasiness about the trachea and larynx, which is often slightly swollen externally, and tender to the touch. These symptoms generally come on at night, and may somewhat subside in the morning; but the quickness of pulse, stridulous breathing, and hoarseness continue. The remission may last until the evening, or until the patient falls asleep, when the symptoms soon return, and become more severe than ever; the difficulty of breathing, with its accompanying distress, being increased. The cough is more harassing and convulsive, and threatens suffocation; the respiratory muscles are thrown into their fullest action; and whilst the whistling inspiration shows the constriction of the upper portion of the air-passages, the indistinctness of the respiratory murmur in the chest, and the concave state of the intercostal spaces at each inspiration, show how little air enters the chest. All these symptoms become more and more urgent, particularly the state of the breathing and the cough, which now sometimes ends in vomiting or in the expectoration of viscid phlegm, occasionally streaked with blood, or containing shreds of opaque albuminous matter, and, in rare cases, a tubular mould of the trachea formed of this matter, like a piece of softened macaroni. The voice, too, by this time, has become changed to a hoarse whining note, and afterwards is suppressed; the pulse becomes excessively frequent, and sharper and smaller; the face and neck become more swollen, and either purple or pallid, especially during the fits of coughing. During the intervals, the child remains in a half stupid state, the whole strength being given to the act of respiration. The disease may reach the acme of this stage within twenty-four hours, in rapid cases; but in those of slower progress, in which there have been several remissions, perhaps following the expectoration of the viscid or albuminous exudation before noticed, this stage may be protracted through several days; and, in favourable cases, terminate in recovery without passing to the third stage.

3. The third or collapsed stage is marked by a general failure of the vital powers, the difficulty of breathing being undiminished. The pulse becomes extremely weak, thready, and irregular; the cough more suppressed; the voice gone; the face swollen and pallid, or with the lips slightly livid; the neck full, the superficial veins distended, the skin cold and perspiring, and the efforts of the poor little sufferer to get breath are most painful to behold; they become weaker and weaker, and at last cease; or, in the case of infants, they are sometimes cut short by a fatal convul-

sion. From this stage, recovery can take place only in the rare event of free expectoration of the albuminous exudation. The noisy state of the tracheal breathing renders it difficult to investigate the state of the chest; but there may sometimes be heard, especially after coughing, a general mucous rhonchus throughout the lungs; and in some instances, the chest becomes partially dull on percussion.

Such is the common course of croup in its severe forms: but as in the case of other inflammations, the disease may vary in intensity; and, instead of being precisely of the character described, it may exhibit sthenic, asthenic, and catarrhal varieties in regard to the fever and inflammation; and it may be more or less complicated with a spasmodic tendency.

The *sthenic* form attacks plethoric and robust subjects, with high fever, strong pulse, hard cough, pain in the larynx, with little or no remission in the stridulous constricted breathing; and, unless very promptly treated, passes into the stage of collapse, and proves fatal in from twelve hours to five or six days.

The *asthenic* form occurs in debilitated or cachectic subjects, especially those reduced by previous disease: the fever is low, and the progress of the disease more tardy; but the stage of collapse supervenes early, if the disease be severe. The albuminous exudation often extends to the throat and fauces, and is then identified with the *Diphtheritis* of Bretonneau, especially in the asthenic form of croup, which occasionally comes on in connection with scarlatina and cynanche tonsillaris.

The *catarrhal* variety of croup is by no means uncommon, and forms the link between the plastic and mucous inflammations. It is attended with much cough, and various rhonchi in the chest, and, from the extent of the inflammation, is often of a very serious character, its favourable issue depending on the free expectoration of tenacious bronchitic mucus. Like both croup and bronchitis in children, it is liable to remissions and exacerbations, dependent partly on the subsidence or increase of the inflammatory swelling, and afterwards of the secretion within the air-tubes, and partly on temporary spasmodic constriction induced in the upper portions. This form of croup may supervene on ordinary bronchitis, adding to its symptoms the stridulous inspiration and ringing cough indicative of the constriction of the trachea and larynx. The addition of croupy symptoms to bronchitis, or of general bronchial inflammation to croup, must be considered a serious aggravation of the simple disease.

The *spasmodic* form of inflammatory croup is that which, occurring in irritable children of a nervous temperament, and disposed to nervous affections, presents a preponderance of spasm in the constriction causing the difficult breathing: hence the

attacks are more sudden, and may be very severe: but they are succeeded by more complete remissions than in the purely inflammatory form. There may be every degree of combination of the nervous with inflammatory symptoms; the most inflammatory kind of croup is not free from some admixture of spasm, particularly in its advanced stages; and the asthenic and catarrhal varieties generally evince, by the sudden character of the exacerbations and remissions of difficult breathing, that the muscles of the larynx and trachea are thrown into a temporary spasm. But there are cases in which there are few inflammatory symptoms; and the more nervous the subject, the more readily may even slight bronchial and tracheal inflammation excite this spasm. So it may happen, too, that mere nervous irritations, such as from teething, disordered bowels, worms, &c., may, without any inflammation, cause spasmodic constriction of the windpipe, and thus imitate croup; this is the true *spasmodic* croup, which will be noticed hereafter.

ANATOMICAL CHARACTERS.—On examining fatal cases of croup, there are generally found a variety of lesions in the respiratory organs, indicating the effects of different degrees of inflammatory action. In the instances in which death has occurred early, the mucous membrane of the trachea, and generally of the larynx and bronchi, is found to exhibit bright vascular redness, continuous or in patches; and it is often covered with a viscid mucus, sometimes tinged with blood. The submucous tissue between the rings of the trachea, and in the looser parts of the larynx, is often much swelled: at a more advanced stage, is mixed with an opaque, yellowish or gray-white albuminous matter, in films or patches, often tinged with blood, adhering to the mucous membrane; and in the sthenic cases that have run their full course, this is of such abundance and consistence as to form a false membrane or a tubular mould of the trachea, in some instances extending to the larynx or bronchi. [It is of great practical importance to know how frequently the false membranes extend into the bronchi. In 120 cases examined by M. Hussenot, in 78 they were limited to the trachea, whilst in 42, or one-third, they had invaded the larger bronchi. They rarely reach the smaller ramifications.] This is obviously the product of the inflamed membrane; and it is remarkable that in the most sthenic cases, or purely inflammatory croup, it is usually thickest and most consistent, but confined to the trachea; whereas, in asthenic cases, it is thin, loose, and often extends to the bronchi. In some of the severest and most speedily fatal cases, the albuminous matter is found in a semifluid state intermediate between lymph and pus; and this matter has been sometimes expectorated when the disease has not proved fatal. The membrane is neither so red nor

so much swelled as in the earlier stage, before the albuminous effusion has taken place. In catarrhal croup, this effusion is in smaller quantity, and mixed with an abundant viscid mucus. In the more spasmodic forms, a false membrane or opaque exudation is seldom found, but merely viscid mucus covering patches of vascular redness, especially in the larynx. In most instances that have lasted for some days, and in all of the catarrhal variety, the bronchi exhibit the marks of acute bronchitis, and contain much viscid mucus. Sometimes, too, in such cases, portions of the lung have been found in the state of inflammatory engorgement and hepatization; [In the cases observed by MM. Rilliet, Barthez and Hache, lobular pneumonia existed in five-sixths of them;] and signs of inflammation are now and then seen in the pleura. Interlobular and subpleural emphysema are also occasionally met with.

NATURE.—The nature of croup has been the subject of much discussion. In Dr. Copland's *Dictionary*, the reader will find an account of the various opinions which have been held respecting it. Our limits do not permit us to enter into these; and we shall only give that view which, in the present state of our knowledge, seems most tenable, and which best comports with the whole history of the disease and the effects of remedies on it. These indubitably prove true croup to be essentially an inflammatory disease of the air-passages, especially of the trachea and larynx. But why does it differ from the catarrhal or bronchitic inflammations which we find to occur in the same parts? Many authors seem to consider its seat to be the same as that of catarrhal inflammation, and that the difference of its product (lymph instead of mucus) is to be ascribed to the early age at which it most frequently occurs. But this is insufficient; for, at the same age, we meet with bronchitis affecting every portion of the air-tubes, yet without constituting croup. Others, again, and among them Dr. Copland, refer the peculiarity of the product to an excess of albumen in the blood; but even this, although it probably has a share in determining the amount of membranous or other solid formations within the air-tubes, does not alone seem sufficient to cause it; nor can it be ascribed to the intensity of the inflammation; for although the albuminous effusion is generally thickest and most tough in sthenic cases of croup, yet it is pretty abundant in asthenic cases; so much so, that Andral and Gendrin consider plastic inflammations of mucous membranes to be rather of the subacute than of the most acute kind. To say that the inflammation is one of a specific character, throws no light on its nature. But does not the pathological and anatomical history of croup seem to point out that the seat of its inflammation is deeper than that of bronchitis? The distinct and circumscribed position of the inflamma-

tion and painful constriction in the most marked cases; its fixedness in this part, not wandering or creeping about, as catarrhal inflammation does; the tenderness, and sometimes the swelling of the trachea and larynx externally; the nature of the product of the inflammation, which is coagulable lymph, as from serous or cellular membrane; the thickened state of the submucous texture found after death in the earliest stages, and the tendency of this texture to suppurate in chronic cases, where the subject approaches adult age,—seem to render it probable, that the inflammation owes its peculiar character and results to its being more deeply seated, more of a phlegmonous character than mucous inflammations, and involving essentially the submucous cellular tissue. This view has not been generally held; Mr. Ryland alone distinctly inclines to it, when he remarks, that “the inflammation of croup appears in the first instance chiefly to affect the cellular tissue that enters into the composition of the mucous membrane, and not the muciparous follicles themselves; and the albuminous exudation is poured out by the secernent arteries of the cellular structure.” Dr. Stokes remarks, that no satisfactory explanation of the greater frequency of croup in the infant has been given; and he seeks to account for it by the general fact of the predominance in the young subject of white tissues, which reproduce their kind. This idea may lead to an explanation, but it does not set it forth; and it leaves still a mystery why croup differs from bronchitis in the same subject. But if we examine the air-tubes of young subjects, we find in them, as in other parts, an abundance of the fine submucous cellular tissue, whilst the mucous membrane is more fine and less complex than it becomes in after life, when, from the continued irritations to which it has been exposed, its follicular apparatus attains its full activity and development. The blood, too, in the young subject, abounds with the plastic material of nutrition, which is more abundantly thrown out under the influence of inflammation, than in the adult. Yet, as long as the inflammation, even in young subjects, is confined to the mucous membrane, the disease is simply catarrhal or bronchitic, and its product mucous or purulent. But the inflammation may readily reach the active and vascular submucous tissue, and then it has the more fixed character of the inflammation of croup, the product of which easily transudes through the fine mucous membrane; and, as in the analogous case of serous inflammations, which are also seated chiefly in the subserous tissue, the product is coagulable lymph. In adults, where the mucous membrane is more developed, and the submucous tissue less so, inflammation is less likely to reach the latter: when it does, it attacks the looser parts of the larynx, and, modified by the active mucous secretion, its product is pus instead of lymph; or it may be confined to the tissue, and cause the œdema, thickening, or purulent infiltration of laryngitis.

The pathological history of croup is quite intelligible. The inflammation may commence at first in the submucous tissue, or it may have been first catarrhal, in which very common case, catarrhal symptoms precede those of croup. The inflammation immediately causes increased sensibility of the contractile fibres, and interstitial effusion in the lining of the trachea and larynx: hence results the constriction, partly spasmodic, partly from swelling of the air-tubes; and hence the croupy inspiration and cough, and the hoarseness. Afterwards lymph is poured out in a liquid state, and becoming concrete, forms the false membrane, another cause of obstruction to the passage of the air, both directed by its bulk, and also by the spasmodic contraction which its presence causes in the muscular fibres of the tube. The latter cause acts especially when the false membrane reaches to the larynx, and excites its very irritable muscles; in such cases, the paroxysms of dyspnœa and cough are frightfully severe and suffocating. The share which spasm has in causing the dyspnœa may be inferred from the fact, that in no case have the air-passages been found so much blocked by the albuminous secretion as to account for the amount of the obstruction; and in many cases the constriction has appeared greatest, where little or no exudation was found after death. It must not be forgotten, however, that œdematous swelling, like that of erysipelas, may disappear after death. The separation of the concrete matter from the tube, and the prevention of its becoming permanently adherent and organized, is doubtless owing to the mucous secretion and the continued motions of the tube. In cases where the albuminous effusion is less plastic, or the follicular mucous secretion more abundant, the matter may be liquid and purulent; and this generally takes place in the bronchitic variety. The collapse which takes place towards the fatal termination of croup is, like that in bronchitis, to be ascribed to the imperfect state of the function of respiration, and the consequent injurious effect on the vital powers. The lividity, coldness, occasional attacks of convulsions, &c., are the result of the circulation or stagnation of imperfectly oxygenated blood. From the same cause arise, also, the congestions in the lung, which may in parts take on the irritation of inflammation, and become hepaticized. The emphysema occasionally detected in the lungs, is plainly produced by the violent efforts of breathing.

DIAGNOSIS.—The very peculiar sound of the breathing and cough, and altered voice, are generally sufficient to distinguish croup from other diseases; and it is important to know that the stridulous inspiration may often be detected through the stethoscope applied to the trachea, before it is otherwise distinct. A ringing cough, like that of croup, is often present during the early stage of measles, before the eruption has come out, but it soon

becomes catarrhal, and is unattended by the croupy inspiration. In the advanced stages of croup, when the respiration is become so feeble as to lose much of its peculiar character, it may be more difficult to determine whether the obstruction be in the wind-pipe or in the chest; but then the comparatively good sound on percussion of the chest, and the concave state of the intercostal spaces at each forcible inspiration, showing that there is room in the chest for the air if it could find its way in, will generally suffice to distinguish croup from diseases of the chest. Such diseases being, however, a common concomitant of croup, the existence of the signs of bronchitis or pneumonia does not disprove the existence of croup. The loud sound of the tracheal breathing of croup may, in great measure, obscure any signs of disease within the chest; but, as Dr. Stokes has remarked, this is seldom the case constantly, particularly at the early stage of the affection, or after the act of vomiting, when, the tracheal sound being less, the sonorous and mucous rhonchi of bronchitis, and the crepitation of pneumonia, would be heard if they were present. From spasm of the glottis, or purely spasmodic croup, and hysterical affections simulating it, inflammatory croup may be distinguished by the presence of febrile symptoms, the less sudden and more permanent character of its attack, and other points in its history.

CAUSES.—Exposure to cold and damp is supposed to be one of the most common exciting causes of croup. It prevails most generally in cold climates, especially in damp situations exposed to the east. In England, it is a far more common disease near the eastern than the western coast. Nothing is more apt to bring on croup in children predisposed to it, than exposure to a keen east or north-east wind. This wind is remarkable for its dryness; and we are inclined to think that the influence which damp situations seem to have in favouring its occurrence, is that of a predisposing rather than of an exciting cause. There can be little doubt that residence in low, humid, and ill-ventilated places gives to children an increased susceptibility to the influence of cold and other morbid causes; so that this and other inflammatory diseases may be more readily excited in them. Hence it prevails in the clay-bottomed valleys of chalky districts; in the more exposed parts of fenny countries; in some of the deep valleys of Switzerland, through which, low and damp as they are, the cutting winds from the snow mountains sweep in great severity. As it may, from these causes, be endemic in particular situations, so, from the prevalence of cold east winds, particularly after relaxing damp weather, it may be epidemic at particular seasons.

The ages at which croup most commonly occurs, are from one to six years; it is rarely met with before and after these ages. There are very few cases on record, of true inflammatory croup in

the adult. Diphtheritic affections, on the other hand, frequently occur in mature age. We have before mentioned that croup may supervene as a sequel or concomitant of other diseases, such as bronchitis, measles, scarlatina, small-pox, &c. It also comes on from too early exposure during convalescence from febrile disorders. In some families there is a strong predisposition to croup; which fact is not more extraordinary than analogous tendencies to catarrh, quinsy, &c.; and its inflammatory or spasmodic character depends on the prevalence of the phlogistic or nervous diathesis, which may attach to families as well as to individuals.

PROGNOSIS.—Croup is a most serious disease; if not arrested by treatment, it generally leads to a fatal termination, and it often baffles the most active measures. According to the statements of M. Double, the mortality in the present day is nearly one-half of the whole numbers attacked: formerly, when the treatment of the disease was less understood, it amounted to nearly four-fifths. Whenever, therefore, the disease has declared itself by the croupy inspiration and difficult breathing, the patient is to be considered in great danger; and this danger is increased in proportion to the time during which the breathing continues to be oppressed. The supervention of convulsive paroxysms of cough, also, brings the patient into immediate jeopardy, either of sudden suffocation or convulsions, or of speedy and often fatal collapse. The proportionally small size of the larynx in children, compared with adults, no doubt adds, as Dr. Copland remarks, to the danger of the disease; but we cannot admit that it is a predisposing cause, as Dr. Cheyne has supposed. In the confirmed stage of croup, the chief hope is in the removal of the albuminous exudation by coughing and vomiting, or by the free expectoration of muco-purulent secretion. The vital forces are not often sufficient to accomplish this; but cases have occurred, in which by these means children have been snatched from the jaws of death, and recovered speedily or slowly according to the bodily strength and the freedom of the organs of respiration from remaining disease. The co-existence of bronchial or pulmonic inflammation much increases the danger of severe croup; but it does not render the case quite hopeless; and the slighter attacks of croupy inflammation supervening on bronchial inflammation, are less dangerous than the severe forms of the simple disease.

TREATMENT.—The curative indications in croup are well stated by Dr. Copland. 1. To diminish inflammatory and febrile action when present, and to prevent, in these cases, the formation of a false membrane, or the accumulation of albuminous matters in the air-passages: 2. When the time for attempting this has passed, or when it cannot be attained, to procure the discharge of

these matters: 3. To subdue spasmodic symptoms as soon as they appear: and, 4. To support the powers of life in the latter stages, so as to prevent the recurrence of the spasms, and to enable the system to throw off the matters exuded in the trachea. (*Dict. of Pract. Med.*)

If the disease is in its earliest stage, described as that of invasion, the first indication should be pursued with promptitude and energy. An emetic of tartarized antimony or ipecacuanha is the first and best remedy in all cases; and in the slighter ones it may cut short the disease, especially if followed by a warm bath and a dose of calomel [grs. ij—iv.] and James's powder, repeated every two or three hours, and carried off, if necessary, by a dose of castor oil.

[7. R.—Ant. et Potass. Tart. gr. iij.
Pulv. Sacchari, ʒj.
Aquæ, fʒjss.—M.]

Sig.—A teaspoonful of this mixture may be given every fifteen minutes until vomiting takes place.

The vinum antimonii, or vinum ipecacuanhæ, in fluid drachm doses, may, if more convenient, be given in its place, and repeated until full and frequent vomiting is produced. In this country a favourite domestic remedy in croup is the Syrupus Scillæ Compositus of our pharmacopœia, or Cox's Hive Syrup. It is composed of squill, seneka, tartar emetic, syrup and water. There is one grain of tartar emetic to every ounce of the mixture. The dose for children is from ten drops to a fluid drachm, every ten minutes until free emesis is produced.] In general, however, the relief is not complete, and the pulse becomes harder and the countenance more flushed after the operation of the emetic. If there be considerable fever, and the other symptoms of the invasion be pronounced, it is proper at once to resort to blood-letting with as much freedom as the strength of the patient will bear. Dr. Cheyne recommends venesection to be practised (in the jugular vein of very young children) ten minutes after the exhibition of the emetic: by this mode, the loss of a few ounces of blood induces vomiting, followed by faintness, which lasts for some time, a powerful impression being made at a small expense of blood. For severe cases he advises a repetition of the bleeding in two or three hours; and leeches, if necessary, afterwards,—avoiding their application to the larynx, because, in case of excessive bleeding, pressure cannot well be applied there. Dr. Copland thinks that, for town practice, blood-letting by cupping between the shoulders or to the nape of the neck, or leeches to the top of the sternum, is preferable to venesection; and he states that the loss of little more than an ounce or an ounce and a half of blood for each year of the patient's age can well be borne, whilst the nausea from the emetic continues. M. Guersent recommends the bleeding before the emetic, for which

he prefers ipecacuanha. As it appears to be a great object to reduce the inflammatory action without an excessive loss of blood, and as blood-letting alone is rarely sufficient to cure croup, the plan recommended by Dr. Cheyne is to be preferred; but we think with Dr. Copland, Goelis, and other writers, that local bleeding will generally be sufficient in young children, and all that are not plethoric.

In the second stage, when the symptoms are fully developed, and the stridulous dyspnœa permanent, blood-letting is less effectual, and not so well borne: it can, therefore, only be used at the earlier period of this stage, and then with caution: the albuminous effusion having then taken place, which blood-letting will not remove, our endeavours must be also directed to fulfil the second and third indications; and these are, in the first instance, still best pursued by remedies called antiphlogistic. Of these, the most powerful are antimonial and mercurial medicines. Dr. Cheyne first recommended tartar emetic in 1801; and stated, in 1832, that he had found no other remedy worthy of confidence in the second stage of croup. The dose is from a quarter of a grain to half a grain repeated every half hour or hour, until it induces sickness; and then hourly whilst the inflammatory symptoms continue, as long as the strength of the patient will admit. Dr. Stokes and Mr. Porter follow Dr. Cheyne in recommending this remedy as the chief one in croup: the former places it above blood-letting.

The late Professor Hamilton, of Edinburgh, J. P. Frank, Michaelis and others, depend chiefly on calomel in large doses, as first recommended by Dr. Rush, of Philadelphia. The long and extensive experience of the former physician at Edinburgh, where the disease prevails much, entitles his advice to our attention. He recommends larger doses to be given and repeated at intervals of one or two hours, until they cause dark green stools: a very large quantity is sometimes required to produce this effect, relief generally ensuing on their appearance, but not before. The remedy thus given sometimes causes great exhaustion, which is to be counteracted by wine or other stimulants. After venesection and an emetic in the first instance, Dr. Hamilton places implicit confidence in calomel, which he considers to have a specific operation, and not that of a purgative or derivative merely. We have found this remedy a most valuable one, especially in the less sthenic and more spasmodic form of the disease; but we do not consider its operation to be different from that in other diseases of children, such as pneumonia and hydrocephalus, in which, as soon as it affects the system, it causes copious spinach-like evacuations. It probably acts both by derivation and by diminishing the albuminous contents of the blood, as well as by the peculiar alterative or sorbefacient operation which it exerts in inflammatory diseases, when it affects the system, and which is visible in the case of iritis. In all severe inflammatory cases we

confide in tartar emetic, and calomel used conjointly, rather than on either separately.

[8. R.—Hydrarg. Chlor. mit., gr. xv.
Ant. et Potass. Tart., gr. ss.
Div. in pulv. vj.—M.

Sig. One every two hours.]

The tartar emetic may be given in the manner recommended by Dr. Cheyne, taking care to watch in very young children against the symptoms of sudden depression that sometimes come on during its use. The calomel is best given in large doses, once, twice, or thrice in the day, so that it may act freely on the bowels. From two to four grains for children below the age of two years, and from four to twelve grains above that age, according to the strength of the subject, and the violence of the inflammation, are more effectual than smaller doses more frequently repeated. If the bowels are irritable, a minute quantity of opium in Dover's powder, or in the Pulvis Opiatus, should be added; and if there has been diarrhœa, the hydrargyrum cum cretâ in double quantity may be substituted for the calomel, but is much inferior in antiphlogistic power.

[Jadelot combines the tartar emetic with senega, squill and ipecacuanha.

9. R.—Inf. Senegæ, fʒiv.
Syr. Ipecac., fʒj.
Ox. Scillæ, fʒiij.
Ant. et Potass. Tart., gr. iss.—M.

Sig.—A teaspoonful every ten minutes.]

Blisters have been generally recommended immediately after blood-letting; but their application requires caution, particularly in very young subjects, in whom they are apt to cause sloughing. In such cases, silver paper or gauze moistened with oil should be placed between the blister and the skin, and the blister should not be left on for more than three or four hours. The nape or side of the neck is the best place for applying them, and not the throat, for this is too near the inflamed part. In consideration of the deep-seated character of the inflammation, we should anticipate a more effectual result from counter-irritation by tartar emetic, which has a deeper and more permanent operation than blisters. The sides of the neck should be rubbed downwards with a brush or coarse flannel until they are red, and then with a sponge or flannel dipped in a saturated solution of tartar-etic for five or ten minutes: this leaves a vivid erythema, which, in the course of a few hours, forms a great number of small pustules, which discharge a sero-purulent fluid for several days. A more speedy mode of counter-irritation, and one well suited to the spasmodic variety of croup, might probably be found in that by strong liquid ammonia, in the manner described by Dr. Johnson: he found that, by two minutes' application of lint moistened with this liquid, and covered with a wooden pill-box, or a wine-glass,

a number of small vesicles were produced; and by this means a suppurating surface could be quickly obtained. [Turpentine is also an excellent rubefacient—a strip of flannel saturated with the spirits of turpentine may be placed around the neck and maintained there for ten or fifteen minutes, and then renewed subsequently if necessary. The application of a saturated tincture of iodine freely over the throat, has been recently very much commended by an English authority.]

The second indication to procure the discharge of the products of inflammation in the trachea, is to be attempted through the operation of emetics and expectorants. The tartar-emetic before recommended is the most suitable medicine whilst the pulse retains its force and regularity; and it may be pushed to the extent of inducing vomiting two or three times in the day, if the hourly doses should be insufficient to have this effect; but this must not be done without caution and due regard to the strength of the patient. When the inflammatory symptoms have in great measure subsided, and the continued croupy breathing is caused by the false membrane with spasm, a less debilitating emetic, such as tincture of squills, (ʒss. ad ʒj.) with sub-borate of soda (gr. x. ad gr. xx.) in warm decoction of senna or infusion of chamomile, or ipecacuanha wine (ʒij. ad ʒss.) with ammoniated tincture of valerian (℥xv. ad ʒss.) in some convenient vehicle. Looseness and fluidity of the secretion of the air-tubes, and a consequent facility to expectorate it, are materially promoted by alkaline medicines, which seem to possess considerable attenuant power.

[10. R.—Aquæ Ammon., ʒj.

Four drops in a wine-glass of water may be given three or four times a day.

Dr. Caspar Morris, a practitioner of experience in this city, places much confidence in them, and thinks them undoubtedly beneficial.] Hence, probably, the efficacy of warm alkaline baths, which have been recommended by several authors, and which are useful adjuvants to the other remedies both in the early and later stages of croup. In the early stage, the temperature may be about 92°; but when the inflammatory stage has subsided, it should not be less than 96°; and this heat should be kept up during the whole time of immersion, which may be from half an hour to an hour, or even more, if it afford marked relief. It has been advised by some writers to promote expectoration by means of inhalation of the steam of hot water, rendered stimulant and antispasmodic for the after stages by additions of camphor, æther and ammonia. The application of these remedies is not easy in young subjects, especially when the breathing is already so embarrassed; but they may be sometimes advantageously used, particularly in the more spasmodic cases, by holding under the patient's mouth a jug of very hot water with the medicines added. [Sponging the throat with water as hot as can be borne is highly recommended by Dr. Graves, who states that he has often seen it

arrest threatening symptoms.] The use of a sternutatory, in form of strong snuff gently blown into the nostrils, has also been found to aid the removal of the albuminous deposit from the air-passages, and in a measure to relieve the symptoms.

We have already mentioned some of the means calculated to diminish the spasm which so commonly adds to the constriction of the air-passages; and when, from the more remittent character of the croupy breathing, this spasm seems to be a chief cause of the difficult breathing, besides emetics, which are the most effectual, antispasmodics, assafœtida, æther, musk, camphor, and opium, may be employed with some benefit; but they must be given with caution, and still in combination with calomel and ipecacuanha. Counter-irritation of the sides of the neck, by means of flannel wetted with oil of turpentine and æther, or even the strong liquor ammonia, and covered with oiled silk, or a glass vessel inverted over it, to prevent evaporation, is a powerful means of relaxing spasm, and one that causes less risk than internal stimulants.

In the last stage of croup, when the inflammatory symptoms have given place to those of prostration and collapse, the effects of unsubdued disease and of the unsuccessful lowering treatment, the only resource is in stimulants and cordials, by which the powers of life may perchance be excited until the respiration be restored to a better state. Dr. Cheyne remarks, that this is "a time when we may with advantage lay aside all lowering remedies, and give burnt brandy and ammonia, to which may be added calomel with a minute quantity of opium, and the application of spirit fomentations to the surface. Gasping, failure of the pulse, a pallid or livid and clay-cold surface, show that our only faint hope is in cordials: it must be admitted, however, that a clear discovery of the point at which this change of treatment ought to take place, is the reward of clinical experience alone, and cannot be made in the closet." (*Cyc. Pract. Med.*, art. CROUP.)

[The stimulant expectorants must now be resorted to; of these a strong decoction of senega, or the syrup of senega, and the aromatic spirits of ammonia, are the best. Musk, in doses of from ten to twenty grains, has been loudly extolled in this stage of the disease. Assafœtida, given by the mouth or in enema, is highly spoken of by some of the French writers.]

It is unnecessary to dwell on the modifications in the treatment required in the varieties of the disease which have been noticed; they will be suggested by the character of the symptoms. Thus, cases of the asthenic form of croup will ill bear blood-letting, and, should the disease be unsubdued, may very soon require the exhibition of stimulants in addition to the other remedies. Both in it, and in the catarrhal varieties, blisters are more beneficial than in the sthenic form. In catarrhal croup, also, purgatives are useful throughout the disease; and they do not, as in the bron-

chitis of adults, tend in any degree to check the expectoration. The expediency of using antispasmodics, in the more spasmodic form, has been already adverted to.

It is not necessary to discuss the question of the propriety of resorting to tracheotomy in croup; as it has been decisively negatived by Dr. Cheyne, Mr. Porter, and other of the best authorities. The trachea of young subjects is so small, vascular, and difficult to open, and, above all, the obstructing matter of croup so frequently extends into the bronchi, or cannot be dislodged, even from the trachea, through an incision, that the dangers are many, and the chances of success so few, that in general it can scarcely be said that the performance of the operation is justifiable.*

The subjects of croup are very liable to a relapse during their recovery from the disease. The increased vascularity of the submucous tissue, and the augmented irritability of the muscular fibres of the trachea and larynx, may continue, although not to sufficient extent, to cause croupy symptoms; but whilst this is the case, slight exposure to cold, the too early use of animal or stimulating food,^o or the hasty suppression of a free action of the bowels, or of a discharge from a blistered surface established for the cure, may excite the inflammation afresh, and bring back the stridulous breathing. In these relapses, the disease has commonly more of a spasmodic character than in the first instance, the phlogistic condition of the body having been reduced by the previous treatment. It is of great importance to watch patients during their recovery, and to guard against the recurrence of the disease, by continuing to give occasional moderate doses of mercurial purgatives, and an expectorant mixture with an alkali; and to maintain some degree of counter-irritation in the vicinity of the neck, by means of tartar-emetic solution or an ammoniated liniment. Even after apparent recovery, the child should be kept warmly clothed, and not be permitted to venture out of doors, until the season becomes mild, and there is no easterly wind. [The daily use of the warm bath, and daily exercise in the open air, during mild dry weather, should never be neglected in convalescence, according to Dr. Condie.] It may often be requisite to remove to a warmer climate, especially to a southern or western coast. When the season is warm, however, and the complaint entirely gone, relaxing heat is to be avoided; the throat and chest should be daily sponged freely with vinegar or salt and water, and afterwards the whole body well rubbed with a coarse towel.

[TRACHEOTOMY IN CROUP.]

A very valuable communication on the subject of Tracheotomy,

[* The operation of tracheotomy has lately been performed in croup by Dr. Scoutetten, of Strasbourg, on his own child, at the early age of six weeks, with entire success.]

by Professor Trousseau, is appended to the article Croup in the recent work of MM. Rilliet and Barthez on the Diseases of Children. The special attention which Dr. Trousseau has paid to this operation,—(he having performed it himself one hundred and twenty-one times (Dec. 1842),—renders his paper one of high authority, and a translation of it is here offered to the reader.

“ When, in spite of the treatment which we have been led to consider as the most efficacious, we find the disease has invaded the larynx, and that the caliber of the air-passages is becoming diminished, a surgical operation is our only resource. Should we before performing it wait until the patient is at the point of death, or should we undertake it when the symptoms indicate pretty surely that death must ensue? To answer this question we must ascertain the real danger of the operation apart from the disease for which it is performed, and also examine into the chances of cure which confirmed croup presents. Tracheotomy and laryngotomy, performed for the purpose of extracting foreign bodies from the air-passages, are rarely followed by fatal accidents. The operation in itself, then, is not dangerous; but, unhappily, it is common enough to see die, during the first few days after the operation, those who previously had suffered from chronic inflammation of the larynx or trachea; but such cases are complicated. When tracheotomy is performed on a patient suffering under chronic laryngitis, one generally waits until the asphyxia is imminent, and it is natural to think that the impediment to hematosis, the pulmonary engorgement, the passive congestion of the brain observed during the previous days, are not without their influence on the production and aggravation of the pulmonary accidents to which succumb those on whom tracheotomy has been performed. These results demonstrate not that tracheotomy is dangerous, absolutely speaking, but that it can become so, when, before performing it, the phenomena of asphyxia have existed for some time. Consequently, *it is necessary, in croup, to operate as soon as possible, after it has been determined that death is inevitable.* Numerous objections have been made to this proposition; one only is worthy of attention. It is said that confirmed croup is sometimes cured, and that consequently it is culpable to perform an operation when death is not inevitable. If laryngeal diphtheritis has been preceded, and is still accompanied by pharyngeal diphtheritis; if the child has already experienced several paroxysms of suffocation, and if, in the interval of these paroxysms, the respiration remains whistling, metallic, and difficult, death will nearly inevitably occur, whatever [medical] treatment is opposed to the disease. If, then, we establish as a law to operate *as soon as possible*, we do not understand by that, that the trachea is to be opened at the first sign of acute inflammation of the larynx, but that it ought to be done so soon as we are assured of the existence of false mem-

branes in the larynx. By performing tracheotomy early, the chances of success are singularly augmented. 1. The blood has not yet been modified by the asphyxia, nor have pulmonic engorgement and cerebral congestion taken place. 2. The false membranes have extended less deeply, and the treatment that will be employed against their further extension into the bronchi will probably be more efficacious. If it be necessary to perform the operation early upon infants, it is still more so in those approaching adolescence, and in adults; because, in these last, the larynx being larger, the extreme phenomena of asphyxia show themselves much later, and when they appear, the false membranes have, already, in the greater number of cases, invaded the branches of the bronchial tree. This explains why tracheotomy, thus far, when performed on adolescents or adults, in cases of croup, has not been followed by success. So soon, therefore, as we are certain that false membranes exist in the larynx, we should perform tracheotomy.

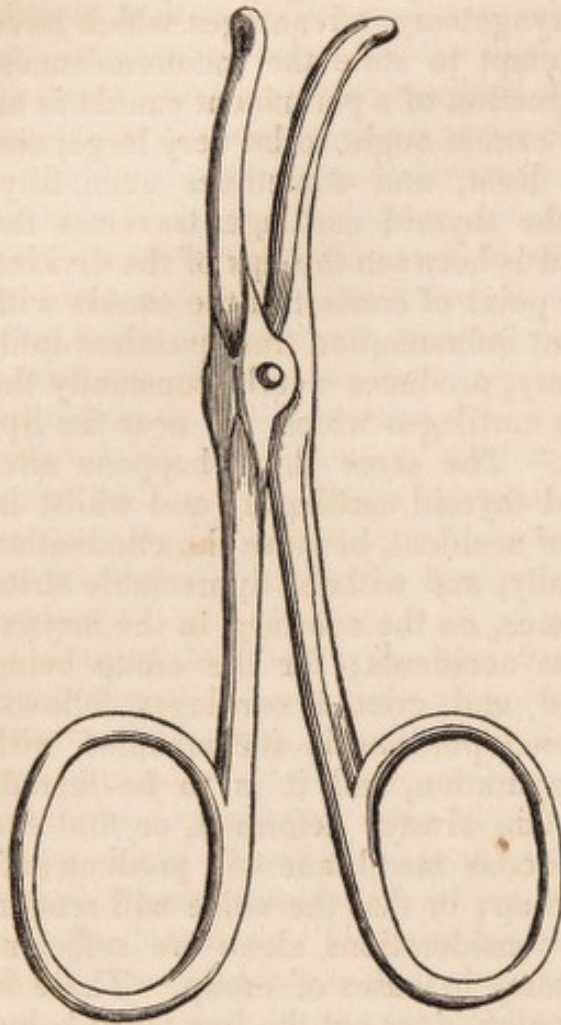
“Having decided on the operation, should it be tracheotomy or laryngotomy? Those who advocate simplicity in an operation prefer laryngotomy, and for the following reasons, viz: fewer parts are involved; there are fewer veins; the air-tube is more superficial, (an inappreciable advantage in children whose neck is short and large;) and there is no risk of wounding the innominata or the left primitive carotid, which, in certain anormal dispositions, cross the trachea. These considerations are not without some value. Laryngotomy is doubtless more easy. As to the immediate dangers of tracheotomy compared with those of laryngotomy, I do not know how to compare them, for having practised one hundred and twenty-one times tracheotomy, I have never had immediate accidents to occur, except in the case of one adult, who died of syncope the moment after I made the first incision into the skin. No doubt it may happen that I will encounter some arterial anomaly, but as I make it a duty to operate with great slowness, and never to make a cut with the bistoury without being directed by the finger and eye, I am persuaded that I should avoid the left carotid even when it arises from the innominata and crosses the superior part of the trachea. As to the innominata, I have several times had it beneath the edge of my bistoury, but by inclining to the left my section, and by pushing it aside with my finger and the blunt hook, I have finished, without accident or fear, the operation so perilous in appearance. Those surgeons who pride themselves on operating with marvellous quickness, and who plunge the bistoury boldly into the trachea, and divide it from below upwards as soon as they have made the incision of the integuments, will finish by deploring this useless and imprudent celerity, when they find beneath the cutting edge of their scalpel, vessels which are so easily avoided, when one

holds more to operating slowly than operating quickly. Alongside of these advantages of laryngotomy, advantages which have not any great value, let us attempt to state the inconveniences. In the case of croup, the introduction of a permanent canula is an indispensable condition. This canula ought to be very large, and ought to remain six days at least, and sometimes even fifty. The canula is placed below the thyroid cartilage, traverses the crico-thyroidean membrane, and is between the lips of the divided crico-thyroid cartilage. At the point of contact of the canula with the wound, there follows violent inflammation from purulent infiltration, which, after tracheotomy, produces nearly constantly the denudation and necrosis of the cartilages which are near the lips of the wound of the trachea. The same thing happens after laryngotomy to the cricoid and thyroid cartilages; and whilst in the trachea, it causes no kind of accident, because the elimination of the necrosed products is easily, and without appreciable stricture of the ærian tube, it becomes, on the contrary, in the larynx, the cause of the most serious accidents; for the croup being cured, necrosis of the thyroid and cricoid cartilages follows. The enucleation of the necrosed portions is accompanied with chronic inflammation and suppuration, and it is to be feared, either that the larynx will remain always deformed, or that the tumefaction of the laryngeal mucous membrane will produce suffocation as severe as that of croup; or that the voice will remain always compromised. These considerations alone are sufficient to cause us to reject laryngotomy in cases of croup. There is another, which though of less value, does not the less merit being noticed, viz: that in tracheotomy you open the air-tube much lower down, and at a point which the false membranes have not yet reached, or at least where they should arrive at a later period; so that by opening the trachea we have a better chance of being able to prevent, by appropriate treatment, the extension of the disease to the bronchi.

“Having decided on tracheotomy, how should it be performed?

“The child being laid on the table, a rolled pillow is placed on the back of the neck, so as to make the anterior portion of the neck quite prominent, which is very essential. The surgeon, aided by at least three assistants, rapidly incises the skin, and then penetrates slowly to the trachea, exposes several rings, and divides it freely. The veins should be as much as possible avoided; if this cannot be done, they should be freely cut, and the operation continued without tying them; the hæmorrhage always stopping on the introduction of the canula. So soon as the trachea is opened, it is necessary to introduce the two branches of a dilator, (fig. 9,) raise quickly the infant, and wait some moments until the respiration is entirely re-established, and the hæmorrhage arrested. If, in spite of the opening into the trachea, the child

Fig. 9.



Dilator of M. Trousseau.

surgeons, and I wish to justify, in a few words, the practice which M. Bretonneau and myself have constantly followed. If you divide slowly and successively the tissues which lie between the skin and the trachea, you perceive in each inspiratory movement the thyroid veins swell in the wound. When they are situated on the sides of the incision, you proceed; but if they are beneath the instrument, you push them aside by the blunt hook, which is done without difficulty. Sometimes, however, the thyroid veins of the two sides anastomose, and form loops or bridges, which are placed before and over the trachea; in such cases, we must decide to divide them. Much blood generally flows, which most often can be arrested by pressure with the finger of the operator and that of his assistant. You continue to cut, directing your scalpel on the nail of the index finger, which is in the wound, being careful to sponge often, and in this manner you reach the trachea; you rapidly open it, and introduce the dilator; and the hæmorrhage instantly stops. Having now, (June, 1842,) performed this operation one hundred and twenty-one times, I have never had occasion to tie the veins once. MM. Bretonneau,

remains in a state of asphyxia or syncope, cold water should be dashed on the face, or the plumed extremity of a pen should be introduced into the trachea, and by these means the contraction of the inspiratory muscles excited. If there is much dyspnœa, you inject into the trachea cold water, and pencil the mucous membrane rapidly with a mop, made of a small sponge attached to the extremity of a piece of extremely flexible whalebone. This manœuvre, which is repeated once or twice, has for its object the expulsion of the blood and false membranes which may exist in the trachea and bronchi.

“ I have just laid it down as a law, that the veins should be avoided if possible, and never tied. This recommendation does not meet the approbation of all

A. Berard and Guersent, jr., who had frequently performed the operation, agree with me. Consequently, I establish this as a precept. The ligature, moreover, is not without risk of producing phlebitis, so dangerous in this part of the body, besides rendering very tedious an operation which is often practised under urgent circumstances when there is no time to lose.

“ACCIDENTS DURING THE OPERATION.—The accidents which occur during the operation, are—1st. Hæmorrhage, which, as has been seen, is rare and not serious. If it is necessary to cut a large number of thyroid veins, and if the blood flows freely, you should fix the trachea between the cubital border of the indicator and the radial border of the medius, thrust as deep as the vertebral column, and incise the trachea neatly and rapidly from below upwards, and at the same instant introduce the dilator, and the hæmorrhage will cease. I do not speak here of the hæmorrhage that might occur from the section of a thyroid artery, or even of the arteria innominata; in such cases it is evident, to save the patient's life, that it will be necessary to tie the cut vessels before proceeding further. I do not know that this misfortune has ever happened, but many times I have felt beneath the index finger the innominata, which I certainly should have divided, if I had heedlessly carried my bistoury into the inferior commissure of the wound.

“I have seen one patient die of convulsions during the operation. It was a man of fifty-two years of age that I operated on at the Hôtel-Dieu for a laryngeal affection which caused great difficulty of breathing. The patient, instead of lying down, was seated in an arm-chair, which was a great oversight on my part. I had hardly cut the skin before an epileptic convulsion occurred; I was imprudent enough to continue, and before I had reached the deep-seated cervical aponeuroses, a second convulsion took place, which was instantly followed by death. I placed the patient on a bed; I opened the trachea, and introduced a canula, but the blood from the divided vessels flowed into the trachea and remained unexpelled, and nothing would reanimate the patient, who was, perhaps, the victim of my inexperience.

“I have several times seen asphyxia occur and the respiration cease during the operation; the patient being in a state of apparent death. In such cases I terminated as speedily as possible the operation, and introduced the canula; then placing the patient on his side, if the blood flowed into the trachea, or if not, on his back, I made alternate pressure on the chest and abdomen, which expelled the air from the chest and caused its re-entrance, and all my patients revived.

“Syncope is a much more common accident. It ordinarily occurs immediately after the operation; at the moment when the respiration becomes free the cerebral congestion suddenly ceases. I once saw it last nearly an hour; I never saw it fatal. I gene-

rally throw cold water in the face, and inject a few drops into the trachea, and sponge it quickly; at the same time I make the patient lie flat.

“With regard to the introduction of blood into the trachea, of which so much has been said, I have never seen this accident at all serious, provided you use immediately a dilator, which will maintain open the lips of the trachea, or, that by some means, a large canula is immediately introduced; for if, after having opened the trachea, the surgeon is awkward, and is unable to introduce the canula, at each inspiration blood will be sucked into the trachea, and as air cannot penetrate at the same time, almost immediate asphyxia will be the consequence; add to which the hæmorrhage, which continues on account of the impeded respiration. If, on the contrary, a dilator maintains the wound in the trachea open, the air will penetrate with facility, expel promptly the little blood which has been introduced, and the return of respiration will cause the hæmorrhage to cease, and blood will no longer flow into the air-tube. If by chance some blood should still escape into the bronchi, the patient can disembarass himself of it, or a few spongings will suffice to aid its expulsion, if this is difficult.

“Ordinarily the respiration becomes very easy immediately after the operation; if it remains embarrassed, it is because some clots of blood or false membranes fill the larger bronchi. If clots of blood, it suffices, whilst the trachea is kept open by the aid of a dilator, or even after the introduction of the canula, to inject two or three times cold water into the bronchi and sponge them. When there are false membranes in the trachea, the dilator must remain in the wound until they are expelled, and their expulsion must be facilitated by injections of cold water into the bronchi, and repeated spongings. Sometimes, however, in spite of these means, the false membranes remain attached to the bronchi, whilst their superior parts are free. In such cases you may sometimes be able to seize them with a forceps between the lips of the wound, and by slight traction disengage them. If the child is vigorous, if he has energetically expelled the false membranes in the air-tubes, and if, after the operation, the respiration is easy, before introducing the canula, you should inject into the trachea, two or three times, fifteen to twenty drops of a solution of the nitrate of silver, (grs. v to f̄j. of distilled water), or, if there is reason to believe that the larynx alone is the seat of the diphtheritis, you pass the sponge only over the trachea, moistened with a concentrated solution (iv gr. of nitrate of silver to aq. f̄j.) The canula is then introduced. In those cases of croup where the operation has been deferred to the latest period, the canula must be introduced immediately, and you must be content to inject a few drops of cold water, and sponge rapidly, returning later to the application of the caustic solutions.

"CANULÆ.—The large, curved canula of Bretonneau, (fig. 10), the bivalved canula of Gendrin, (fig. 11), appear to me preferable

Fig. 10.

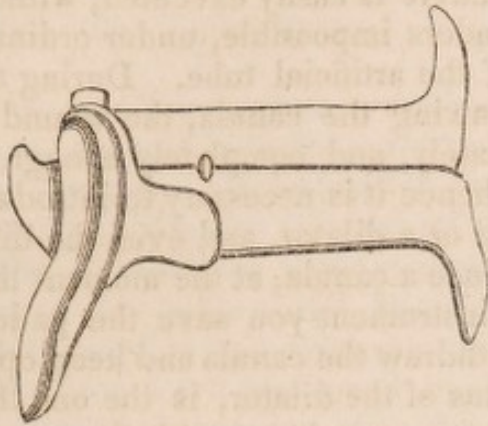
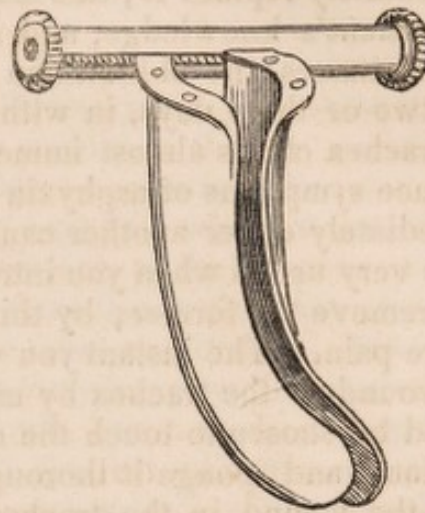


Fig. 11.



Canula of M. Bretonneau, composed of three parts; two form the external tube into which a third is introduced.

Canula of M. Gendrin, composed of two plates, which are separated by means of a vice which passes through the above.

to any others that have been invented. But for infants, children about the age of puberty, and for adults, the double concentric canula must be chosen (fig. 12.) The canula ought to be long enough, so that when it is introduced immediately after the operation, it will penetrate into the trachea by one-fourth of an inch. This condition is indispensable, for on the second day after the operation, the tumefaction of the skin and of the tissues interested in the operation will be such as hardly to permit the canula penetrating from two to three lines. If the canula is not long enough, it is thrown out of the trachea by the spells of coughing, and the infant might be asphyxiated. If it be essential to have the canula long enough, how much more necessary is it to have it wide. For infants from six months to two years the diameter of the tracheal opening of the canula ought to be two lines and a half; from two to four, three lines; from four to six years, four lines; from six to ten years, four lines and a half; for adolescents, five lines; and for full grown men, seven lines. It is necessary to withdraw the canula whenever the respiration is embarrassed, and you have reason to suppose that the embarrassment is seated in the tube. In general it suffices to change the canula twice in twenty-four hours. The expulsion of false membranes which block up the passage, and the abundance of

Fig. 12.



Large-sized ordinary canula for an adult. (Trousseau.)

mucosities, may require its removal more frequently. When in place of a single canula, one with two tubes is employed, it will be necessary every three hours to withdraw the inner tube, and immediately replace it; this manœuvre is easily executed, without the patient's knowledge, and renders impossible, under ordinary circumstances, the obliteration of the artificial tube. During the first two or three days, in withdrawing the canula, the wound of the trachea closes almost immediately, and completely enough to produce symptoms of asphyxia; hence it is necessary to introduce immediately either another canula or a dilator, and even the dilator is very useful when you introduce a canula, at the moment that you remove the former; by this instrument you save the patient severe pain. The instant you withdraw the canula and keep open the wound of the trachea by means of the dilator, is the one that should be chosen to touch the mucous membrane with the caustic solutions, and sponge it thoroughly. At the end of two or three days the wound in the trachea remains open for some minutes after the removal of the canula, which can then be easily replaced without the aid of the dilator. Towards the eighth day the opening into the trachea will remain open for an hour, and later it will remain so for a day or even longer. When, about the fortieth or fiftieth day, the disease seems to approach a favourable condition, it is as well to allow the canula to become somewhat clogged with mucosities, in order that the air may displace the mucus and the false membranes in the larynx, and obtain an exit through the natural passage; and you may thus ascertain the degree of permeability of the larynx. This is even more important than the great precept in tracheotomy of withdrawing the canula as soon as possible. If you discover that air passes through the larynx, a new canula should be introduced, which you stop partially by a small piece of cork. For a few minutes, respiration seems easy, although the passage for the air should be insufficient, but soon the respiration becomes anxious and the child dies of asphyxia if you do not remove the plug. If the respiration is slightly impeded, you leave the plug in the canula, and the efforts of coughing cause the expired air and the mucus to impinge against the larynx, detach the false membranes, and the tube becomes much more free. You daily diminish the caliber of the canula, and you remove it definitely, when the patient can respire completely, the canula remaining closed. So soon as the canula is removed, you maintain the edges of the wound together with court plaster; this dressing which is to be removed two or three times a day, suffices in the greater number of cases. A few days ordinarily suffice for the wound of the trachea to become completely closed; the solution of continuity in the skin and deep-seated tissues alone remain, which are speedily cicatrized and leave a slight cicatrix. Once only I was enabled to remove the canula at the end of four days;

sometimes from the sixth to eighth day; ordinarily from the tenth to thirteenth; once on the forty-second day; and once on the fifty-third day. When no accidents supervene, the larynx regains its functions from the fourth to the thirteenth day. I have never seen a fistula after tracheotomy.

“OF THE TREATMENT AFTER THE OPERATION.—For some physicians, a single indication occurs in a child in the last period of croup—*perform tracheotomy to introduce a canula*. For me tracheotomy is a means to ward off the asphyxia which threatens to kill the patient, and then to apply directly to the mucous membrane of the trachea and bronchia remedies which may prevent the reproduction and extension of the false membranes. Many of my brethren have performed tracheotomy happily, and contented themselves by changing often the canula, and occasionally sponging; but I wished to ascertain myself the real influence of topical remedies. I treated twenty children successively without employing any topical medication, and the results were so deplorable, that I returned to the applications which had previously so well succeeded. The topical application that I employ is that of M. Bretonneau, of Tours, and is as follows. Thus, as I said before, if the child is vigorous, if it has expelled the false membranes from the air-passages with energy, and if, after the operation, the respiration is very easy, before you introduce a canula, you inject into the trachea, three or four times, fifteen or twenty drops of a solution of nit. arg. gr. v to aq. fʒj. This application is repeated four times the first day, three times the second and third days; once or twice the fourth day, and then stop. Concurrently you sponge the passage with a small piece of sponge fixed to the extremity of a very flexible rod of whalebone, moistened with a concentrated solution of the nit. arg. gr. xv to aq. fʒj, if you suppose the larynx only has been invaded. This sponging is continued for the same length of time that the instillations are. If the cough is loose and expectoration easy, there is no use in instilling water. In contrary cases you instil once or twice every hour eight or ten drops of tepid water, which, mingling with the mucosities, soften them and facilitate their rejection. Water must always be injected after the solution of the nitrate of silver, to soften mucus which may have been coagulated. These injections should be made several times an hour; when the inspiration is frequent or serratic, (imitative of a saw-cutting stone,) they should be done before each sponging. It is necessary to sponge wherever the canula or the trachea becomes embarrassed. The sponging will be rendered more efficacious by the previous instillation of water. If a valvular sound or a peculiar whistling is heard in the trachea, giving rise to the idea of floating false membranes, it will be necessary to sponge frequently at short intervals, until the false

membranes are detached and expelled. The sponging will never be more efficacious than when it is made at the moment you withdraw the canula, and when the lips of the wound are kept open by means of the dilator. The sponging is more necessary as the accidents which follow the operation are more serious. It never causes accidents; it is always followed by great calm in the respiration, even when the patient is at his last moment, and the sponging brings away neither mucus nor false membranes.

“ With this method of treatment carefully pursued by M. Bretonneau and myself, the success has not been very brilliant; M. Bretonneau in 20 operations has saved 6 infants; of 112 I have saved 27. M. Le Clerc, of Tours, who has adopted the same plan of treatment, was successful once in two operations; M. Velpeau twice in ten; M. Petel, of Cateau-Cambrésis, who followed the same plan, was successful in three out of six operations. Thus out of 150 operations, 39 were successful—a little more than one-fourth. I am unable to give any exact results of those who do not follow my plan of treatment, but it is well known that there are some 15 persons living in Paris who have had the operation of tracheotomy performed on them, by MM. Gerdy, Robert, Guersant fils, Boniface, Després, Blandin, &c., in which our plan was not followed.

“ I shall conclude by adding several propositions relative to certain prognostic signs of interest.

“ 1st. If the commencement of the disease dates several days back; if, consequently, the croup has advanced slowly, whatever may be the extent of the false membranes in the trachea and in the bronchi; the children either recover or live at least several days.

“ 2d. But if the disease has been rapid, even although, at the time of the operation, we ascertain that the false membranes do not extend beyond the larynx, the children die very quickly.

“ 3d. If, before the operation, the false membranes have been extended to the nose; if they covered the blistered surfaces; if the child is pale, somewhat bloated without having taken mercury, or if he has lost much blood; the operation has little chance of success.

“ 4th. If, before the operation, the pulse is moderately frequent, and if, after it, the pulse remains calm, hopes may be entertained.

“ 5th. If, immediately after the operation, the respiration becomes very frequent, the child either not coughing at all, or but very little, it is a bad sign.

“ 6th. More boys than girls are cured.

“ 7th. Children under two and over six years of age rarely recover.

“ 8th. *Cæteris paribus*, the danger is the greater, the more deeply the false membranes have extended.

“ 9th. If the child is subject to chronic catarrhs, and if he had

been suffering from a cold for some time when he was attacked with croup, tracheotomy succeeds better.

“10th. Even when all is going on favourably, great frequency of the respiration is a bad sign.

“11th. The more rapid and energetic the inflammation is, which attacks the wounds, the better are the chances of cure: the sudden sinking of the wound is a mortal sign.

“12th. There is never any thing to fear, as long as the respiration is silent or the noise is only occasioned by the displacement of mucosities; but if the respiration becomes *serratic*, that is to say, is attended with a sound resembling that of a saw cutting stone, death is certain.

“13th. If a pneumonic or pleuritic attack supervenes, it is no reason to despair of the patient.

“14th. Agitation and sleeplessness are bad signs.

“15th. If the wound becomes covered with false membranes, if, after withdrawing the canula, it remains gaping for a long time; if, after having entirely cicatrized, it reopens largely, the child is in danger.

“16th. The sooner the larynx is disembarrassed after the operation, the sooner may we remove the canula, and the more certain and rapid is the cure.

“17th. If the croup supervened upon rubeola, scarlatina, variola or pertussis, although there is not ordinarily any connection between the malignant angina and these different pyrexia, tracheotomy does not succeed.

“18th. If, the third day after the tracheotomy, the expectoration becomes mucous and catarrhal, the children recover. If there is none, or it is serous, or like little half-dried pieces of gum-arabic, they die.

“19th. If the patients react vigorously against the injections of water or of the nitrate of silver, and against the spongings-out, we should not despair, however fatal the other signs may be.

“20th. Children attacked with convulsions die, and the convulsions supervene oftener as the patients are younger, and as they have lost more blood before or during the operation.

“21st. When, after the tenth day, the drinks pass almost entirely from the pharynx into the larynx and trachea, even if they are easily rejected, the children most generally die.

“22d. The increase of the fever after the fourth day, agitation, sinking of the wound, and dryness of the trachea, frequency of the respiratory movements and attempts to cough, announce the invasion of pneumonia, which, at first lobular, becomes sometimes pseudo-lobar, and should be treated by the same means usually employed against the pneumonia of children: we should exclude, however, blisters from the treatment, because they too often become covered with false membranes.”]

SECTION IV.

LARYNGISMUS STRIDULUS.

OF spasmodic affections of the larynx, the most remarkable is that which affects infants, and has been called *Laryngismus Stridulus*—*Asthma Infantum*—*the Crowing Disease*—*Spasm of the Glottis*—*Spasmodic Croup*, &c.

SYMPTOMS.—In the first instance, the attacks generally come on during sleep: the child starts suddenly, and, instead of crying as usual, struggles for breath, the face becoming flushed, swollen, and even purple: after repeated efforts a long inspiration takes place, often accompanied with a hooping or crowing noise, and the child then recovers its breath and voice, and generally bursts into a fit of crying, sometimes remaining dull and heavy for two or three hours after. [In the greater part of the observations collected by Jurine, and in nearly all of those analyzed by MM. Rilliet and Barthez, the signs of commencing coryza, with a little fever, and sometimes a hoarse cough, preceded the attack.] These attacks are apt to come on more frequently during sleep, [about eleven o'clock at night] and whilst the child is awake, particularly on being irritated, or too suddenly tossed in nursing, or on being exposed to a cold wind. The infant will then throw his head back, and struggle for breath, recovering it with the noisy inspiration before described. This noise is not, however, constantly observed, and depends on the partial opening of the rima glottidis; in some cases, it is opened completely, and there is no crowing, just as the hooping is occasionally absent in pertussis. In the intervals there may be no disorder of the breathing or of the general health, but more commonly it attacks children that are delicate and irritable with disordered bowels. It is apt to occur during the period of dentition in children who are badly fed and much confined in too warm or ill-ventilated rooms. In severe cases it may return several times in the day, and as the fits become more frequent, they last longer, sometimes pass into general convulsions, and have in many instances proved fatal.

CAUSES AND ANATOMICAL CHARACTERS.—According to Drs. J. Clarke, Cheyne, and Marsh, this affection is often accompanied with a convulsive contraction of the hands and toes, the hands being clenched on the thumbs, and the great toes drawn in: these circumstances, together with the fact that general convulsions sometimes succeed, have induced these writers to consider the crowing disease as symptomatic of incipient disease of the brain. Dr. Cheyne relates three cases in which examination after death dis-

covered such lesion : in one, scrofulous tumours in the brain : in another, venous congestion and serous effusion ; in the third, induration of the brain and obliteration of the convolutions. In two fatal cases, Dr. Merriman found no trace of cerebral lesion, but only a collection of enlarged glands in the lower part of the neck, which appeared to have pressed on the par vagum. The late Dr. Ley was led by these and similar cases to ascribe the crowing disease to the influence of enlarged glands or other tumours compressing and partially paralyzing the recurrent or inferior laryngeal branch of the par vagum. Frank and Copp, in Germany, have found an enlarged state of the thymus gland in some cases of this disease ; and the latter has therefore named it *asthma thymicum*. They appear to refer it to direct pressure on the air-tubes, but it is more probable that an enlarged thymus gland would at first act by compressing the recurrent nerves. It had long been known that the section of this nerve or of the par vagum above its source occasioned a permanent contraction of the glottis, sufficient to suffocate quickly. Magendie and others concluded from this experiment that this nerve supplied the muscles which open the glottis, and that those which close it are influenced by the superior laryngeal nerves. Dr. J. Reid has, however, lately shown that the latter are chiefly sensitive, and not motor nerves, and that nearly all the motions of the larynx are affected by the recurrent nerves. We cannot then explain the closure of the glottis on the division of the recurrents, without referring it to a reflex action on the constrictor muscles through the sensitive nerves. The facts, however, that division of the recurrent nerves causes closure of the glottis, and that aneurisms and other tumours pressing on them have been known to occasion fits of difficult laryngeal breathing, form so far a fair ground for the view of Dr. Ley, that we may admit that enlarged lymphatic glands may sometimes have a similar effect. It has been objected by Dr. M. Hall, that were paralysis the cause, the affection ought to be permanent and not in fits ; but this objection is not valid, for the paralysis is not supposed to be perfect, but that the muscles which it affects are unable to antagonize the constrictors of the glottis only when these are unduly excited by the immediate cause of the paroxysm. The effect of such a pressure as can be exerted by the enlarged glands would be a weakening of the motory power of the recurrents, rather than a paralysis ; and its influence would be manifest in the power to keep the glottis open, failing only when the act of crying, vomiting, a sudden fright or the like cause, tends to close it with more force than usual. But although disposed to admit the condition described by Dr. Ley as a common cause of the crowing disease, particularly in its milder forms, we think that there is sufficient evidence to show that it is sometimes symptomatic of cerebral disease and the forerunner of convul-

sions, or some other formidable symptom of cerebral disease. The cases of Dr. Cheyne point to this conclusion; and we may mention one of a child long under our care, which, after being subject to attacks of this affection for nearly two years, became idiotic. The muscular apparatus of the glottis is so nicely adjusted, and the aperture so narrow in children, that any disease of the nervous system affecting the motory apparatus is very likely to be manifested first here; afterwards, as it becomes further advanced, by contraction of the hands and feet; and ultimately by more general convulsions or by paralysis, according to the nature of the lesion. But we do not consider that slight attacks of the croupy inspiration are always to be referred either to pressure on the recurrent nerves or to any permanent lesion of the nervous system. The crowing noise which many quite healthy children make on being too abruptly tossed in the air, or on being exposed to a high wind, obviously proceeds from a momentary contraction of the glottis under the excitement of the sudden motion. This shows how readily this contraction may be excited; and it is rational to suppose that other causes of mere irritation to the nervous system, such as dentition, disordered bowels, and worms, may occasionally produce the same effect, without inducing any further mischief. Like other spasmodic affections, spasm of the glottis may be induced by temporary irritations as well as by permanent changes of different parts of the nervous system.

DIAGNOSIS.—The absence of fever, the suddenness of the attacks and of their cessation, and the freedom of the respiration in the intervals, distinguish this affection from croup. The absence of cough prevents it from being mistaken for whooping-cough. The character of the crowing sound, and the absence of signs of any disease of the chest, distinguish it from all other affections of the respiratory organs.

[Laryngismus Stridulus.

1. Sudden, or preceded by a slight cold; voice slightly hoarse; pharynx healthy.
2. The attack of suffocation comes on suddenly in the middle of the night.
3. The attack over, the child appears well; the fever disappears; if it persists, it is not intense. Rarely extinction of the voice.
4. If the spells return, they diminish gradually in intensity; no whistling breathing in the interval; the hoarseness and momentary aphonia disappear.

Croup.

1. Always preceded by angina pharyngitis, or slight catarrh, with more or less fever.
2. Gradual increase of the catarrhal symptoms; the cough becomes hollow, and subsequently there are attacks of suffocation, often accompanied with the rejection of false membranes.
3. The febrile movement continues after the spell; aphonia persists, or comes on; the cough is hollow or extinct.
4. The dyspnoea and suffocation increase steadily; laryngo-tracheal whistling in the intervals; the voice and cough are extinct.]

PROGNOSIS.—From what has been stated as to the nature of the affection, it may be inferred that it varies greatly in its importance. When it proceeds from teething or disorder of the bowels, it may cease as soon as the source of irritation is removed. The fits themselves may prove fatal by lasting so long as to cause asphyxia; but we apprehend that this will rarely happen unless there be some permanent disease or great weakness of the system. But if the fits recur frequently and are excited by slight causes, there is considerable danger of cerebral congestion or effusion and convulsions being induced by the frequent interruptions to the respiration and circulation. For this reason the frequent recurrence of the fits is dangerous, even if there be no sign of permanent disease in the system. If there be contraction of the fingers or toes, the case is still more formidable, but still not hopeless; for even this symptom may be caused by temporary irritation of the nervous centres. If the affection can be traced to glandular swellings in the neck, or to similar or thymous tumours within the chest, it may generally be removed by prompt and judicious treatment; but if neglected and allowed to become habitual, it may soon destroy the general health, and prove fatal either of itself or by inducing other disease.

TREATMENT.—The paroxysm is of so short a continuance, that there is scarcely time for the application of remedies to remove it. If it threaten suffocation before the crowing inspiration announces its decline, it may be useful to dash cold water in the face, or to blow forcibly into the ear of the little sufferer: these impressions will often succeed in relaxing the spasm, although they are sufficient to excite it when not present. [The application of a sponge wrung out of hot water, applied frequently to the front of the throat for a minute at the time, has been strongly recommended during the paroxysms. It produces redness of the throat, favours perspiration, and relieves the spasm.] Antispasmodics have very little effect. [An enema of turpentine or assafoetida will, however, sometimes be useful.] When the fits come on very frequently, the warm bath may be used, if it can be done without fretting the child, which must be avoided as much as possible, as tending to excite the fits. Dr. Marsh mentions a case of a child two years old, in which very frequent attacks complicated with general convulsions were stopped and suspended for a month after the administration of a tobacco enema (v. gr. infused in fʒj. of water.) [If there be evident signs of cerebral congestion, a few leeches applied behind the ears, and cold lotions to the scalp, are advantageous.]

The most important part of the treatment is that directed to remove the causes of irritation, to improve the general health and the tone of the nervous system, and thus to prevent the recur-

rence of the paroxysms. When the affection is connected with teething, the gum should be divided in any part where it is hot or swollen, whether a tooth be pressing or not. Teeth often irritate long before they are cut; and although the incision of the gum over them do not effect their extrusion, and may by taking blood from their capsules even retard this process of dentition, it relieves the irritation which they occasion. A judicious course of purgative medicines will be found useful in almost every case, beginning with mercurials followed by castor oil, and keeping up their action by daily doses of rhubarb and magnesia or sulphate of potash, or by some of the stronger purgatives if the bowels are torpid, recurring occasionally to the mercurials whenever the excretions are clay-coloured or too dark.

[9. R.—Hydrarg. chlor. mit. gr. xij.
Pulv. ipecac., gr. iij.
Extract. hyoscyam., gr. iv.
M.—Div. in pulv. xij.

Sig. One three or four times a day, to be followed by some mild aperient, as rhubarb or tartrate of potash.

Dr. Marshall Hall recommends in strong terms repeated enemata of warm or barley water when the evacuations are clay-coloured.] Dr. Merriman recommends that aperients be used so as to produce at least two full evacuations daily. Dr. Joy mentions a case in which, after purgatives and change of air had failed, the affection was removed on the occurrence of a spontaneous diarrhoea. Whenever there is any appearance or suspicion of the existence of glandular swellings as a cause of the disease, it will be proper to exhibit a course of alkaline medicines with small doses of the hydriodate of potash.

[10. R.—Potass. iodidi, gr. xx.
Aquæ distil., fʒj.
M.

Sig. A teaspoonful three times a day in a tablespoonful of sarsaparilla syrup.]

Dr. Merriman found that the continued use of soda, or a strong infusion of burnt sponge, materially contributed to the cure of the complaint; and this is quite in accordance with the view that he and Dr. Ley have taken of its nature. In case of convulsions or an approach to them shown by contractions of the fingers and toes, strabismus, &c., it may be necessary to draw blood from the temples and nape by leeches or cupping, and to apply cold to the head, while the lower extremities are bathed in warm water. But it often happens that there is an atonic or anæmic state of the system rather than plethora: in such cases blood-letting is eventually hurtful; and much benefit may be derived from the judicious administration of tonics, preceded by and combined with aperients.

All writers agree in considering the management of the regimen and food of the greatest importance in this disease. Change of

air is often of more avail than any system of medication; and the child should be carried out into the open air as much as possible, only avoiding cold winds; and its apartments should be well ventilated without exposure to partial currents. If it do not bring on the attacks, free sponging of the body with cold salt water every morning should be practised; or if the child be very delicate, it may be used tepid. The clothing also requires particular attention; in cold weather, a sufficiency of warm woollen clothes must be worn, and on no account should the arms and chest be left uncovered from October to June; the neglect of this precaution through the vanity of mothers, has occasioned the sacrifice of many children. The food should be nutritious but simple, given at regular hours and not more in quantity than the stomach can digest: if the child is under twelve months of age, it is by far the best plan to nourish it by the breast only to the sixteenth or eighteenth month, due attention being paid to the health of the nurse, and changing her if necessary; but when this cannot be accomplished, the best first substitute is asses' milk or cows' milk, a little sweetened and diluted with half its bulk of lime-water or pearl-barley gruel. For children above the age of two years, milky and farinaceous food with a little meat or broth alternately once a day, will generally be most suitable.

SECTION V.

NERVOUS AFFECTIONS OF THE LARYNX IN THE ADULT.

1. SPASMODIC AFFECTIONS OF THE LARYNX IN THE ADULT are generally connected with some inflammatory or organic disease there, or by the presence of a foreign body; but occasionally they occur as the result of more distant spinal or nervous irritation, under the garb of hysteria. The sensation called *globus hystericus* is sometimes distinctly attended with a spasmodic constriction of the glottis, which is probably excited by wind in the stomach or even in the œsophagus, for it is generally relieved by flatulent eructation. The choking sensation produced on swallowing too large a morsel is also in part owing to spasm of the glottis: all these associations of symptoms are rendered more intelligible by the experiments of Dr. Reid, which prove the sensations and motions of both pharynx and larynx to depend on the same nerve—the vagus. More rarely the constriction is of a more enduring kind, and accompanied by fits of croupy breathing and a convulsive ringing cough. Like the crowing inspiration of infants, this may arise from temporary irritation, or from more permanent disease of the nervous centres. Dr. Stokes mentions cases in which spasmodic affections of the larynx terminated in inflammation of,

and effusion under, the membranes of the brain. The same writer describes another case in which a patient, long tormented by all kinds of hysterical disease, with occasional obstinate fits of laryngeal spasm and cough, died suffocated by an abscess involving the cricoid, without any other organic lesion. May this abscess have originated in a tumour, which caused by reflected spinal irritation the long train of spasmodic symptoms from which this patient had suffered? Nervous affections of the larynx chiefly affect females, and may present all the degrees of inconstancy and intractability which disorders called hysterical often exhibit. If not rendered inveterate by indulgence or habit, they may sometimes be resisted by an act of the will: we have known a most violent form of convulsive cough with stridulous breathing, which had resisted every kind of treatment, cured through the patient's hearing the actual cautery prescribed for the next attack. [Dr. Graves mentions an interesting case of neuralgia of the larynx in a young lady of originally a vigorous constitution, but latterly suffering from menstrual irregularity and hysteria. The laryngeal affection had been considered as inflammatory, and been treated with purgatives, leeches, blisters, antimonials, and free mercurialization. No relief was obtained. When Dr. G. first saw her, the pain had become almost constant, but was by no means violent, except during sudden paroxysms, when it was more distressing than violent, producing a most annoying feeling of distress about the whole region of the larynx. There was no external tenderness, and the fauces were healthy. There was a remarkable change of tone in the voice, which was also very weak during the paroxysms, showing that the *rima glottidis* and the *chordæ vocales* were the parts chiefly implicated. The pain was probably derived from the branches of the superior laryngeal nerve, which Dr. Reid has proved to be chiefly sensitive. Large doses of carbonate of iron were first administered which had the effect of rendering the attacks periodic. Every morning at ten o'clock to the minute the paroxysm commenced. The dose of iron was now increased, afterwards sulphate of quinine, and subsequently arsenic were employed, but without any corresponding improvement. All active treatment was desisted from, and change of air, scenery and chalybeate mineral waters were recommended.*]

TREATMENT.—The treatment of spasmodic affections of the larynx is to be generally conducted on the usual principle, of giving antispasmodics to remove or prevent the attacks, and improving the tone of the muscular system and diminishing nervous irritability by tonics, regular exercise in the open air, and other suitable means. Foreign bodies in the larynx and

* A System of Clinical Medicine, Dublin, 1843.

even in the œsophagus may excite violent and fatal spasms in the glottis. The treatment of this subject belongs rather to surgery than medicine.

2. ATONIC OR PARALYTIC AFFECTIONS OF THE LARYNX are chiefly known by the symptoms of aphonia, hoarseness, or some other alteration of the voice. This symptom is commonly connected with inflammatory or structural disease of the vocal apparatus: but even in these the sudden exacerbations show that much of it is nervous: and in nervous and hysterical subjects we not unfrequently find affections of the voice independent of any other disease of the larynx. [Aphonia sometimes occurs as a consequence of the poison of lead on the system, and is no doubt due to paralysis of the intrinsic muscles of the larynx. It is generally conjoined with paralysis of other parts of the body.] Some persons not unfrequently lose their voice from sudden mental emotion, taking particular articles of food, menstrual irregularities, and other causes which operate on the nervous system; and the sudden manner in which they often regain as well as lose the voice, sufficiently points out the nature of the affection. We had the care of a lady, who, from such causes, is liable to lose suddenly not only her voice but also her power of articulation for days together, and to regain them as suddenly. For some time relief was instantaneously given, merely by her taking an electric spark with her fingers. This at last lost its efficacy, and even shocks failed; subsequently it was found that holding a lump of ice in the mouth was quite effectual. The complaint originated in a low fever, and the liability to its recurrence has diminished with the improvement of the general health under the use of mild metallic tonics with change of air. At present the attacks are rare, of short duration, and may be removed by drinking a little wine. [*Hysterical aphonia*, or loss of voice, occurs suddenly, may last for several months or even years, and then disappear as suddenly. A patient in this state who for some time has been unable to speak above a whisper, may, under the influence of strong moral excitement, recover his natural tone of voice. Recovery may be permanent, or a relapse may take place. This affection is most commonly met with in women, but according to Sir Benjamin Brodie, it is not unfrequently seen in the male sex, especially in those of the clerical profession, probably because they often lead very sedentary lives, and also because, in their profession, they are called upon to speak in public in a tone raised above the ordinary standard.*] The affections of the speech often preceding and accompanying general paralysis, are those of articulation rather than of the voice. But the voice is often changed or suppressed in

* Lectures Illustrative of certain Local Nervous Affections, London, 1837.

attacks of violent palpitations, and particularly in cases of aneurism involving the arch of the aorta, the innominata, or right subclavian artery; and this circumstance is obviously referable to the manner in which the recurrent nerves are stretched or compressed by these tumours.

TREATMENT.—Nervous aphonia is generally symptomatic of some other general or local disease: its treatment therefore must vary according to the nature of the primary affection. In the purely nervous or hysterical cases, the fetid gums and other stimulants as temporary means, and a course of steel and other tonic medicines, with free exposure to a healthy air, the shower or plunge bath, and corresponding regulation of the mode of living, comprise the measures most likely to be successful. But sometimes either with or without those more remote causes, the local affection depends in great measure on relaxation or weakness of the muscles concerned in the formation of the voice. In such cases stimulant and astringent gargles, as of port wine, alum, infusion of rhatany root, or even a weak infusion of galls, will prove useful. The injection of a solution of sulphate of zinc or of nitrate of silver, in the manner recommended by Trousseau, and described in the treatment of chronic laryngitis, would probably be still more efficacious. We have known several instances of clergymen, whose vocal organs have been weakened and relaxed by over-exertion, in which much benefit was derived from the use of astringent gargles. A piece of camphor kept in the mouth for some time before speaking is also of use. In some cases, the relaxation may be removed by the internal use of the balsams of copaiba or Peru. But unless there be a temporary suspension of all extraordinary exertions of the vocal organs, the effect of all these remedies will be very transient. [In saturnine aphonia, if galvanism and electricity have been used without benefit, sulphurous baths, into which the patient may be placed daily for an hour, together with strychnia, have been employed with success.]

[SECTION VI.]

MORBID PRODUCTIONS IN THE LARYNX AND TRACHEA. POLYPI, SYPHILITIC VEGETATIONS, CANCER, HYDATIDS, CALCULOUS CONCRETIONS, ETC.

The lesions of the larynx and trachea that we are cursorily to notice are of rare occurrence, are generally beyond the resource of art, and are indeed only important with reference to their diagnosis which is sometimes very embarrassing.

POLYPI.—Dessault, Lieutaud, Trousseau and Belloc, Senn, Girardin, &c., mention authentic cases of polypi in the larynx and trachea. With one exception they all occurred in adults; that of Lieutaud was in a child of twelve years of age. The polypi are pyriform tumours attached by a slim pedicle to the ventricles of the larynx, smooth or rough externally, usually not exceeding in size a filbert; internally the structure is white, fibrous and resisting.

The most constant symptom is a sensation of suffocation; this symptom Dessault says is intermittent, which may be easily accounted for from the movable nature of the tumour allowing a change of position relatively to the glottis. In all the other observations on record, however, this symptom was persistent. The voice at first is hoarse, and finally becomes totally extinguished. There is nothing peculiar in the expectoration. There is no local pain, nor is there any produced by pressure, although there is a constant feeling of uneasiness in the larynx, as if a foreign body were lodged there. Towards the close of the disease the dyspnoea becomes very urgent; inspiration is attended with great efforts, and with a whistling noise: the respiratory murmur ceases to be heard in the chest, and the patient dies with all the symptoms of asphyxia.

The following interesting case of warty growths on the lining membrane of the larynx, is recorded by Dr. Watson in his Lectures:

“George Tenon la Font, aged eleven, admitted March 4, 1828. He speaks in a whisper; complains of difficult breathing, and of cough. Inspires with a loud wheeze. Coughs with a sort of whistling sound, as through a narrow tube. The cough is most troublesome at night. Expectoration mucous, and inconsiderable in quantity.

“Has been ill, in this way, all the winter—having had hooping-cough in the preceding autumn. There are marks of cupping on his throat. Little can be heard in the chest, the loud wheeze of his respiration obscuring all other sounds. In about a fortnight his gums were brought under the influence of mercury. No perceptible improvement ensued. A careful examination was again made of the thorax, and the conclusion arrived at was, that the obstacle to his respiration lay in the larynx, or upper part of the trachea, and that the lungs themselves were not concerned. After this, a blister to the throat, a seton near the thyroid cartilage, small doses of ipecacuan, emetics, and iodine were successively tried—but in vain. Towards the end of the month he began to suffer occasional, very violent, and apparently spasmodic attacks of extreme dyspnoea. He died during the night, two months after his admission. For some days before he had been manifestly worse than usual, was more feeble, wandered somewhat, and complained that his vision was imperfect. No noticeable increase,

however, had taken place in the difficulty of breathing, except during the paroxysms of aggravation already mentioned. The death was sudden, and probably took place in one of these paroxysms.

“When the body was examined, the lungs were found sound as to structure, but copiously infiltrated, especially on the left side of the thorax, with serous fluid. At the very top of the larynx, involving the base of the epiglottis and the vocal chords, was a considerable warty growth, closing the rima glottidis almost entirely. The excrescences sprung *chiefly* from one continuous base, and branched out precisely after the manner of what is regularly called a seedy wart. There were, however, several distinct smaller growths or warts; the main excrescence, having several heads, passed upwards from and through the rima, and so came to act partly as a valve during inspiration, which was always sensibly more difficult than expiration.

“Ought tracheotomy to have been performed in this case? I now think so. But supposing it to have been done, and to have been successful, the boy would have been under the necessity of breathing through a tube for the remainder of his life.”*

The progress of the disorder is slow, and its duration indeterminate.

We have nothing on the subject of treatment to recommend. Laryngotomy or tracheotomy should be performed when suffocation is imminent, and Dessault recommends that we should seize and extirpate the tumour. M. Hermann, of Strasbourg, recently performed laryngotomy in order to remove a polypus, which had developed itself on one of the chordæ vocales. This fibro-cellular excrescence had protruded between the lips of the glottis, and would have caused suffocation, if the trachea had not been opened and a canula introduced. The next day, the patient being quite calm, the thyroid cartilage was divided, and the foreign body removed.

SYPHILITIC VEGETATIONS.—Andral (*Anat. Pat.*, t. ii. p. 472,) cites a case in which the upper opening of the glottis was in great measure obstructed by a white mammillated vegetation, having an exact resemblance to a cauliflower, and which at the base was continuous with the mucous membrane of the larynx. M. Ferrus (*Archives Générales, tre. series*, t. v. p. 559) has detailed an observation of the same kind with great exactness. In this case the glottis was occluded by a tumour the size of an almond, which adhered by a broad base to the left ventricle. Its surface was irregular, mammillated, and of the ordinary consistence of fungous tumours; its colour was identical with that of the mucous mem-

[* Watson's Lect. on Prac. of Physic. Am. Ed., p. 451.]

brane of the larynx. M. Rayer in his *Maladies de la Peau* (Atlas, p. xv. fig. 21) figures a large syphilitic vegetation in the larynx.

The symptoms are similar to those just described for polypi of the larynx. The voice becomes feeble, rough, and finally extinct; the breathing is difficult, the face injected, the eyes large and brilliant; and the patient has the appearance of one about to suffer from an attack of asthma.

The diagnosis must be established from the history of the case and other testimony, and is very important. The progress of the disease is slow. The only treatment which promises any prospect of success is an antisyphilitic one, commenced early.

CANCER OF THE LARYNX—is extremely rare. For the following description we are indebted to Louis and Trousseau and Belloc. It usually commences with hoarseness, which is of very long duration; this is followed by aphonia, oppression, dyspnœa, great uneasiness in the region of the larynx, and finally by signs of imminent asphyxia. At the same time there is progressive emaciation with the yellow earthy hue of the skin. In one case portions of the laryngeal cartilages were expectorated. In Louis' case there was nothing remarkable in the expectoration. It was grayish, semi-transparent, or greenish and opaque. It varied only in quantity. During expectoration the sensation conveyed to the patient was that the sputa were detached from the throat, near the upper portion of the sternum. In the cases reported by Trousseau and Belloc there was no pain, and in that of Louis there was neither pain in the throat, nor dysphagia. The progress of the disease is slow. In two cases death was caused by the extension of the disease to the œsophagus, thus presenting an invincible obstacle to deglutition. In the other acute phthisis carried off the patient.

The anatomical characters of the tumours resemble those of cancer in other parts of the body.

The treatment can only be palliative. When suffocation is imminent, tracheotomy may be resorted to, to prolong life.

HYDATIDS.—Examples of this production, as well as those of calculous concretions in the ventricles, are cited by M. Pravaz, (Thèse, Paris, 1824,) and from him copied by other writers.

GENERAL CONSIDERATIONS.—All the diseases just mentioned have certain symptoms in common; viz:—continued hoarseness, aphonia, and suffocation, which finally ends with asphyxia.

1. Their slow progress distinguishes them sufficiently from acute laryngitis, laryngismus stridulus, and croup.

2. The continually increased dyspnœa prevents their being confounded with simple chronic laryngitis.

3. The slow progress of the dyspnœa does not resemble the violent paroxysms of œdema of the glottis.]

[SECTION VII.]

FOREIGN BODIES IN THE LARYNX AND TRACHEA.

CAUSES.—The entrance of foreign bodies into the air-passages is by no means of rare occurrence, especially in children. This accident may happen in various ways; laughing or talking vehemently when the mouth is full of food is a common mode of its occurrence. The manner of its occurrence under these circumstances is this. Preparatory to speaking or laughing a deep inspiration is necessary, and the air is very commonly drawn through the mouth; the edges of the glottis are, at this moment, widely separated from each other; the mind, interested in the subject of conversation, is off its guard, and, therefore, whatever the mouth contains, is easily carried with the current of air into the larynx or trachea. A fit of laughter, when the mouth contained a filbert; a blow upon the back of a child whilst he was eating chestnuts; the slipping of a ladder from under the feet of a man who was eating cherries at the time, are some of the means by which foreign bodies have been introduced into the larynx and trachea. A child, whilst eating apricot kernels, fell down with half a one in his mouth, which found its way, during the child's hurry, into the trachea. An individual, whose case is detailed by Mr. Lescure, was pretending, in sport, to throw a louis d'or into his mouth, when it unfortunately fell into the air-passages. The recent interesting case of Mr. Brunel, hereafter to be referred to, was precisely similar; whilst amusing some children, a half sovereign, which he had in his mouth, accidentally slipped into the wind-pipe. The act of vomiting when the mouth is closed, or the endeavour to take a full inspiration whilst vomiting, also favours the introduction of foreign substances into the air-passages. A nurse at the Hospital de la Charité, at Paris, having drunk a quantity of wine, was about to relieve himself by vomiting, when he perceived Corvisart; he instantly closed his mouth, but the contents of his stomach passed into his larynx, and he was immediately asphyxiated. Ryland relates the following case: A strong, hearty labourer died suddenly whilst eating his Sunday dinner of boiled beef and cabbage. At the autopsy the stomach was found enormously distended with the above-mentioned aliments; the œsophagus and pharynx were equally full; a piece of meat occupied the rima glottidis, and a quantity of masticated beef and cabbage was found in the trachea and bronchi, even to the most minute ramifications of the latter. It seems probable that this unfortunate man had filled his stomach so much as to produce vomiting, and that

he had endeavoured to perform the act of inspiration at the time that the superabundant food was being rejected.*

The number of foreign bodies which may accidentally enter the air-passages is very great,—amongst the most common we may mention beans, peas, fruit stones, beads, pins, small coins, pebbles, teeth, tacks, fragments of bones, morsels of food, &c. &c.

SYMPTOMS.—The symptoms indicative of a foreign body having passed into the air-passages are, a violent convulsive cough, with great difficulty of breathing, occurring very suddenly; there is pain somewhere along the course of the wind-pipe, with great anxiety and a frothy pituitous expectoration. Intervals of comparative calm, owing to a change in the situation of the extraneous substance, occur, and the patient is entirely free from all unpleasant symptoms, except a slight feeling of uneasiness. A paroxysm of cough, laughter, or any sudden movement will cause an immediate return of the urgent symptoms, or they will recur without any appreciable cause. Towards the close the patient becomes agitated by convulsive movements, the face is discoloured, the eyes become prominent, and wild in their expression; the veins of the forehead and neck swell; a marked tumour in the course of the wind-pipe, which increases in size with each expiration, is visible; emphysema appears about the clavicle, which extends over the throat, the extremities become cold, there is loss of consciousness, and he dies suffocated. Sometimes the violent efforts at cough expel the foreign body, and instant relief follows. The emphysema is caused by the rupture of the air cells, from the excessive accumulation of air in them and the smaller bronchi; the air passes into the mediastinum, and from thence into the cellular tissue of the neck. Sometimes the pleura is ruptured and pneumothorax follows.

The varieties which the air-tube offers in its diameter, form and sensibility, and the differences in the size, shape and seat of the extraneous substances explain the sudden exacerbations and remissions in the symptoms. Thus the glottis being very narrow and sensible, a body lodging there will produce very urgent symptoms, if not immediate suffocation. A small body may remain for some time in the ventricles of the larynx without causing any serious inconvenience. The trachea is not very sensitive, and there is more room. If the foreign body lodges in one of the bronchi, but little immediate disturbance will ensue if it becomes fixed. The extraneous substance usually falls into the right rhonchus, owing to its being larger, and lying more in the axis of the trachea.

The external qualities of the extraneous body will materially influence the position it may assume in the air-passages, and the

* A Treatise on the diseases and injuries of the Larynx and Trachea, p. 198.

symptoms it will occasion. When round, solid and small, it is movable and may pass from the bronchi or trachea into the ventricles of the larynx, and according to its situation will the symptoms be urgent or trivial. Sharp, angular substances, on the contrary, are not usually displaced by the efforts of cough, or at least not until ulceration has occurred. Some substances, moreover, undergo considerable modification in size during their sojourn in the air-passages; pills, pieces of sugar, &c., are gradually dissolved; peas, beans, &c., absorb moisture, swell, and occupy more space. A case is mentioned where a leech, which had been swallowed, passed into the larynx, and becoming gorged with blood, produced immediate asphyxia.

DIAGNOSIS.—Occasionally the diagnosis of a foreign body in the air-passages is very difficult. The symptoms of suffocation with a convulsive cough, coming on with great suddenness in a person previously free from pectoral disease, generally indicate its occurrence, especially if there is much local pain; but if the body has passed into the trachea or bronchi, these symptoms may not exist. By introducing a probang and passing it through the œsophagus, we may assure ourselves that it has not lodged there. Physical exploration will often assist our inquiries. When the extraneous body is loose, it is frequently heard to strike against the sides of the trachea with a peculiar rattling noise. This is most clearly heard when the patient makes a forced expiration, and the foreign body is driven upwards towards the larynx. A child of eight years of age swallowed a bean which passed into the trachea; Dupuytren, by applying the ear to the anterior part of the neck, heard a peculiar rattling sound caused by the shock of the substance against the trachea. The sound was audible during the respiratory murmur. Mr. M'Namara heard distinctly the movement of a small stone up and down the trachea. Boyer mentions the case of a young child who swallowed a glass bead; by applying the hand to the throat, the motion of the bead in the air-tube was perceptible. If the body has passed into either bronchus there will be feebleness or entire nullity of respiration in the corresponding lung. The evidence is stronger when, after severe coughing, the air is heard to penetrate the lung, and symptoms of laryngeal irritation supervene, thus showing that the foreign body has passed from the bronchus into the larynx or trachea.

PROGNOSIS.—The consequences of this accident may be, 1st, instant death, if the foreign body become impacted within the rima glottidis, or in the larynx immediately below this point; 2d, pain somewhere in the course of the air-tube, severe dyspnœa, frequent convulsive cough, followed by death generally three or four days after the accident, if the foreign body be light and small,

and move with the air in respiration backwards and forwards along the trachea; and 3d, symptoms resembling those of asthma and suffocative catarrh, which may terminate eventually in death, or in the expulsion of the irritative substance during a fit of coughing. In such cases the foreign body is commonly heavy, and has fixed itself in one of the bronchi. The prognosis is therefore always serious. The age of the patient, as well as the actual state of health, the nature and size of the extraneous body, and its location, are all to be taken into account. In children, the air-tube being narrow and very sensible, the accident is one of greater comparative danger than when occurring in an adult. A body which has passed the glottis is less immediately dangerous than when lodged there. A substance that readily imbibes moisture and swells, is more dangerous than one whose volume is not liable to such change. Death, as we have seen, may be instantaneous, or the patient may survive for some time, and eventually die or recover. Cases are on record of foreign bodies remaining in the air-passages from a few months to one, two, or even seventeen years. M. Royer Collard has mentioned a case of an insane person, in whose bronchus a nail was found at the end of six years. When the body has lodged in the bronchus, it generally produces some pulmonary disease, under which the patient eventually succumbs, though its immediate effects may be trifling, and almost unobservable.

TREATMENT.—The proper treatment of *choking* (that is, when a morsel of food or other substance remains in the pharynx, at the entrance of the glottis) is as follows: the remedy must be *immediate*. Pressure being made on the abdomen, to prevent the descent of the diaphragm, a forcible blow should be made by the flat hand on the thorax. The effect of this is to induce an effort similar to that of expiration; the larynx being closed, œsophageal vomiting takes place, and the morsel is dislodged. If this plan fail, not an instant being lost, the pressure should be kept up on the abdomen, the finger should be introduced into the throat, and the same smart and forcible blow made on the thorax as before. By the irritation of the fauces, the cardia is opened, and, by the blow on the thorax, (firm pressure being made on the abdomen,) an effort similar to that of expiration, with a closed larynx, is made, and a direct vomiting occurs, and the morsel of food is carried away.*

If we are satisfied that the foreign body has passed into the air-tube, we should set about removing it, and Sir Benjamin Brodie advises strongly not to trust to nature. The foreign body may be coughed up through the glottis, but it may stick in

* Diseases and Derangements of the Nervous System, &c. &c. By Marshall Hall, M.D, p. 79. London, 1841.

the glottis, and the patient die. Many surgeons recommend an emetic to be immediately administered; the same eminent authority considers this practice as useless, and founded altogether on a wrong physiological notion. Tracheotomy should be performed, and the earlier it is done the greater the chance of success. It is the complete intermission of all the symptoms, and the perfect calm which the patient often enjoys, that induce surgeons to temporize so long, and postpone an operation until it is too late. It should be borne in mind that the operation is not in itself dangerous, and that the greater number of the cases which are left to nature perish. If the cessation from all unpleasant symptoms is complete, if there is any doubt of the body having been swallowed, and if we have been unable to examine the expectoration, it is in such cases permitted to wait until a return of the paroxysm confirms our suspicions. The following highly interesting case of Mr. Brunel, the celebrated English engineer, as related by Sir Benjamin Brodie, is highly instructive.

“This gentleman, in playing with a child, flung a half sovereign into his mouth, and it slipped down the windpipe. In the first instance it produced sickness, and as he drew his breath, previously to vomiting, it descended into the bronchus, and occasioned coughing every now and then. When his head was placed down it could be felt rolling along the trachea. We attempted to remove it by placing him on a movable platform, so that his feet were up and his head down nearly at right angles. The half sovereign descended and stuck in the glottis so as nearly to choke him. We, therefore, determined not to repeat this experiment till we had got an opening in the trachea which would act as a safety valve. We made an opening some few days afterwards below the thyroid gland, but the half-sovereign was not coughed up as a cherry-stone would have been, because it was too heavy. We made some attempts to use the forceps, but found it so dangerous that we desisted. When he had recovered from the effects of this operation,—in the mean time passing a probe every now and then,—we again placed him on a movable platform, his back was struck with the hand, and the half-sovereign escaped from the bronchus. He could feel it rolling along the trachea till it came to the glottis, and now, instead of sticking there, it passed through, just as you could roll it through the dead body, and came out of the mouth. There was no spasm of the glottis, and the absence of it was to be attributed to the opening in the trachea; for blood came out with the half-sovereign which had evidently passed in from the external wound, and where blood went in you may be sure that the air went in also.”*]

* Clinical Lectures, by Sir B. C. Brodie. London Lancet, 1844.

CHAPTER III.

DISEASES OF THE NASAL FOSSÆ.

By Catarrhal Inflammations of the air-passages is meant, those affections which are attended by an increased and altered secretion from the mucous lining of the tubes. From their most frequent cause they have received the common name of *colds*; and they are further distinguished according to their seat. Thus, in the nasal canals, the complaint is called *a cold in the head*, *coryza* or *nasal catarrh*: in the fauces, it is *catarrhal sore throat*, or *cynanche*; whence it may branch off by the Eustachian tube, causing *deafness* and *ear-ache*; or by the lachrymal duct, causing *catarrhal ophthalmia*, or *a cold in the eyes*. In the larynx and trachea, and its branches, it constitutes a *catarrh* or *cold in the chest*; in which case, from its most prominent symptom, the complaint is called a *cough*. Although, by a few writers, this affection of the mucous membrane of the air-passages has been considered not to be essentially inflammatory, we do not hesitate to class it as such, for its course and phenomena are undoubtedly those of inflammation; and to reckon it otherwise, because there may be something specific and non-inflammatory in its origin, would be to follow a doubtful hypothesis rather than plain fact.

The divisions which we purpose to adopt are made with a view to important practical distinctions, rather than because they exist naturally; for the different affections, thus separated, pass by imperceptible gradations into one another. The more acute catarrhal inflammations of the air-tubes present especially two forms, which vary greatly in their severity, on account of their difference in extent and the situations which they occupy. 1. *Acute Catarrh*, which in the nasal passages is *Coryza*, and in the upper parts of the air-tubes a form of *Mild Bronchitis*; and, 2. *Bronchitis*, which affects the air-tubes more extensively, and by its effects interferes with the function of the lungs.

SECTION I.

ACUTE CATARRH.

SYMPTOMS.—The first symptom of catarrh, or, as it is popularly termed, *a cold*, is generally a feeling of fulness or obstruction in

one or both nostrils, or a sense of tickling or relaxation in the throat, with an uncomfortable sensation in the stomach, approaching to nausea, and attended with flatulence; or, in those more liable to cough, it may begin with tightness and uneasiness in the chest, with slight hoarseness, and irritation of the glottis. Any of these are commonly accompanied by some feeling of chilliness, occasionally with slight rheumatic pains, which are sometimes the first symptom, and indicate the general disturbance which precede the localization of the disease. As yet it may be uncertain what form the complaint may assume, although most individuals know from experience the course which it is likely to take in their own persons.

When it becomes developed as a *Coryza*, or cold in the head, there is a sense of fulness and obstruction of one or both nostrils, accompanied by the secretion of a thin colourless fluid. This flux comes on from time to time in an increased quantity, and the increase is always attended by an aggravation of the uncomfortable feelings of fulness and tickling, with frequent sneezing, and copious flow of tears from the eyes, which are full and injected; these effects show an acrimony in the discharge, as well as an increased sensibility of the pituitary membrane lining the nasal fossæ: this is further evinced in the progress of the disease, by the redness and excoriation of the end of the nose, and the skin above the upper lip. The senses of smell and of taste are always impaired, the latter often quite destroyed; there is often headache, or a sense of weight and heat over the brows, supposed by some to be occasioned by the catarrhal inflammation affecting the lining of the frontal sinuses. The partial or complete obstruction of the nasal passages, although caused entirely at this stage by the swelling of the membrane, gives the feeling of their being plugged up: and the same obstruction often renders the voice thick and nasal: subsequently it becomes husky from the swelling of the laryngeal membrane. If the attack be severe, there are fever, with loss of appetite, and pains of the back and limbs: and in almost every case an unusual degree of chilliness and sensibility to cold. The disorder is at its height generally about the third day, and then begins to decline; the flow from the pituitary membrane becomes more scanty and viscid, and less acrid, the lachrymation ceases, the swelling and obstruction diminish, while the headache and other symptoms proportionately abate, and between the fifth and seventh day the disorder may be entirely removed. Not unfrequently, however, fresh cold is taken from the slightest cause, and the coryza, with its attendant symptoms, is kept up for a longer time; and so long as the secretion is copious and thin, no amelioration of the other symptoms takes place. Still more commonly, as the irritation of the nasal passages subsides, that in the throat and larynx begins. The inflam-

mation seems to be of the creeping or erysipelalous kind; and may wander along the Eustachian tube, causing dulness of hearing, perhaps with ear-ache; along the fauces, causing sore throat; and down the œsophagus into the stomach, occasioning slight gastritic dyspepsia. Its more common course, however, is down the air-tubes, giving rise to the bronchial form of catarrh to be presently described.

Coryza not unfrequently attacks infants, and so obstructs the nostrils as to interfere with the process of sucking, in which nasal respiration is necessary. The child leaves off repeatedly, becomes fretful, and sometimes purple in the face, in a few seconds after each time of taking the nipple. In children predisposed to convulsions, these efforts, and the disturbed circulation ensuing from them, sometimes prove the exciting cause of a fit.

[The peculiarities of coryza in young infants are due to the narrowness of the nasal fossæ in them. The child who before slept with his mouth shut, now keeps it widely open; his respiration is nasal and noisy, and attended with whistling. The accumulation of mucus in the nares increases, the respiration becomes more difficult, and even impossible when the infant wishes to suck; if he persists in his efforts, the face becomes violet, swollen, and he is menaced with asphyxia, and the little sufferer suddenly quits the nipple, throwing his head backwards, opening widely his mouth to breathe, and crying with impatience and fatigue. The obstruction to the free passage of air in the nasal fossæ is evidently the cause of all these distressing phenomena. The perpetual agitation from the feeling of hunger, and the impossibility to satisfy it, may induce serious consequences, although happily they are rare; still it is proper to admonish the practitioner of the danger of a disease in young children which is so slight in adults.

MM. Rilliet and Barthez describe a form of catarrh in children, to which they have given the name of purulent or pseudo-membranous; it is generally, if not always, secondary, being most frequently consecutive to croup. The earliest symptoms are snuffling, with the discharge from one or both nostrils of a yellow mucous or serous fluid, which becomes thick, and exhales a peculiar fetid, stale and sickening odour. Later, the nature of the discharge changes; it becomes more liquid, ichorous and even sanguinolent. This discharge is not constant, and its abundance is in inverse ratio to that of the false membrane. On opening the nares you perceive very thin, pellicular, adherent false membranes of a white-yellowish colour. The *alæ nasi* are red and swollen, and the tumefaction finally extends to the nose, which becomes red. The skin covering the nose is shining, tense, erysipelalous, the sub-nasal region becomes swollen, excoriated, and sometimes false membranes are developed there. The respiration is

noisy, nasal and snoring; the mouth is open in respiration; the teeth, lips and tongue are dry. Cough is generally present; its character is dependent on the obstruction of the nose. As the disease was usually secondary to croup, scarlatina, typhoid fever, pneumonia, etc., fever accompanied it in all the cases observed. Its duration is from one to three days. It is a very grave affection. The younger the infant the more dangerous is it. If the child is robust, and inflammatory symptoms are present, blood may be drawn by leeches applied to the mastoid processes; if feeble, calomel and purgatives may be given internally. The nostrils must be carefully syringed with warm water, or warm milk and water, and afterwards a powder of equal parts of alum or calomel, and gum arabic blown into them. Or a small dossil of lint dipped in a solution of alum or lunar caustic may be carefully introduced by means of delicate forceps, or calomel ointment; besides their action on the inflamed surfaces, they induce sneezing and dislodge the false membranes.]

When catarrhal inflammation extends to the upper bronchial tubes, constituting a form of *mild bronchitis*, it commences with coryza, or sore throat, and increases as the latter affections diminish; but in persons who are liable to coughs, it often is the first effect of exposure to cold. The first symptom is sometimes a feeling of coldness at the top of the sternum, with roughness or dryness in the throat, which occasions frequent attempts to scrape the throat. Then follow sensations of heat, tightness, soreness, or pain in the same part, with a cough, which is at first short and dry, but soon becomes longer, more urgent, and accompanied by the expectoration of a glairy, saline tasted, transparent mucus. This secretion, so far from relieving the cough, obviously aggravates it by tickling and irritating the glottis, and probably possesses somewhat of the same acrid quality with that of coryza. This acrimony may be owing to the increased proportion of saline matter, which not only is evident to the taste, but has been chemically shown by Messrs. Brett and Bird to exist in the expectoration of bronchitis. The full development of catarrhal inflammation in the air-tubes is usually attended, especially towards evening, with quickened pulse, hot skin, and scanty high-coloured urine, with some degree of fever, and some shortness of breath.

The *physical signs* more clearly mark the condition of the bronchial membrane. In the earliest stage, perhaps, before any cough or other symptom of pectoral disease, various dry *rhonchi*, the *sonorous* and *sibilant*, with a diminution of the respiratory murmur, announce the narrowing of some of the air-tubes. More rarely, a total absence of sound in a part of the chest shows that the obstruction there is complete; while the unimpaired sound on percussion proves that the vascular structure is free. These ob-

structions, no doubt, arise chiefly from the swelling of the mucous and submucous tissues, as we find the same take place in the nasal canals, when they are the seat of the kindred affection—*coryza*. Dr. Stokes supposes that a spasmodic constriction of the circular fibres, rendered irritable by the inflammation, contributes to the coarctation of the tubes. The bronchial tubes do not remain long in this dry state; the secretion commencing first gives a roughness to the other sounds, then adds to them a sound of bubbling, which is the *mucous rhonchus*; but this is seldom so loud as the other sounds, and when the disease occupies only the deep-seated tubes, it may scarcely be heard at all. According as the liquid is in the large or the small tubes, the bubbles and the crackling which they produce will be coarse and unequal, or fine and more uniform. The usual seat of all these sounds, in the milder forms of bronchitis, is in the middle parts of the chest, whether in front, behind, or at the sides, where the larger bronchi lie. The lower tones imply an affection of the larger tubes; but the acute notes do not indicate that the finer tubes alone are diseased, for they may be produced in the large tubes also, when the obstruction is considerable; and when there is heard an acute or whistling note prolonged through the whole act of inspiration or expiration, it may be known not to be produced in the finer tubes, because the air is not so long a time passing through them. The deep sonorous rhonchus, like the note of a violoncello, is probably seated at the branching off of a large bronchus; and so strong are its vibrations, that it may be often felt by the hand applied to the exterior, or by the patient, who can point out the spot where it is produced. These various sounds may accompany either the inspiration, expiration, or both.

The decline of this mild form of bronchitis is announced by a looser character of the cough, and a change of the expectoration to an opaque, thick, less coherent phlegm, which is generally first perceived in the morning, that being the time when most inflammatory and febrile diseases show a tendency to remission. With this change, there is a general amelioration of the symptoms. The constriction of the chest is diminished or removed, the pulse loses its frequency, the skin becomes cooled by perspiration, the urine more copious, and deposits an abundant sediment, and the decline of all the troublesome symptoms very generally corresponds with the altered character of the expectoration. This seems to have lost its irritating quality; is more tasteless; and comes up by easy coughing, in distinct pellets of opaque yellowish-white or greenish-white mucus, to which the soot and smoke of the air in large towns often give a gray tinge. Sometimes the sputa assume a consistent form without opacity, which renders the cough and expectoration easier, but it is not accompanied by the general improvement so remarkable when the sputa become simply

opaque. In either case, the inspissation of the bronchial secretion causes some change in the physical signs; the bubbles are heard to break more rarely, and give more of a whistling or ticking sound; and the sibilant and sonorous rhonchi become remarkable; but they change with every cough or forcible act of breathing. The same clots of mucus that by this partial obstruction to the air cause these rhonchi, sometimes block up entirely one or more of the tubes, and stop the sound of respiration in the part to which the tubes lead. But this stoppage is seldom permanent; and a cough or deep inspiration will often open it or shift it to another situation, and the air is then heard to enter with a whistling or a clicking noise, where all had been silent before. The sound on percussion is still uniformly good; and this circumstance, with the varying respiration and rhonchi, characterizes bronchitis in this stage.

Such is the ordinary course of the slighter cases of mild bronchitis, which may last from a few days to two or three weeks, but if neglected, may continue for a much longer period, and assume a chronic form.

CAUSES.—The most common *exciting cause* of acute catarrh, whether affecting the nasal passages or the air-tubes, is exposure to cold or sudden transitions of temperature. This cause is always more effectual when it is partially applied, as by standing or sitting in a draught of air, especially if the body be heated; by wet feet, or wearing damp clothing. Acute catarrhal affections often prevail epidemically, probably depending on sudden atmospheric changes, some of which are, obviously enough, those of temperature, but in other cases they are of a less intelligible kind, being perhaps connected with electric conditions of the air that elude our scrutiny. Certain it is, that the most severe and universal forms of epidemic catarrh have occasionally appeared without being preceded by equally remarkable transitions of temperature. An opinion prevails among many persons, that catarrh is infectious; this rests on the equivocal evidence of their so frequently affecting, consecutively, the different members of a household. A catarrhal affection of the eyes, nostrils, and upper portion of the air-tubes, very generally accompanies measles, and more rarely small-pox and scarlatina. Irritating gases, vapours, or dust, may excite catarrhal inflammation of the pituitary and bronchial membrane; but it is of a slight kind, and soon passes away, unless the cause be reapplied.

The only complication of acute mucous catarrh of the air-passages, which it is necessary to notice, is that with disorder of the gastro-hepatic function; in which, in addition to the catarrhal symptoms, there are headache, thirst, a loaded tongue, loss of appetite, occasionally nausea, or even vomiting, sometimes with

tenderness at the pit of the stomach, or in the right hypochondrium; sometimes a slightly jaundiced skin and conjunctiva; and bowels constipated or irregularly loose, with dark or clay-coloured dejections. Dr. Copland mentions rheumatism as a disease with which catarrh is sometimes complicated, to which, he thinks, it bears some affinity. We have not observed this complication; and although there are occasionally slight wandering pains, like rheumatism, in the early stages of catarrh, they rarely take the course of true rheumatism.

TREATMENT.—"A cold," which is one of the most common of all diseases, is rarely considered an object of more than domestic treatment; yet, trivial as it is, it is often formidable in its consequences. The ordinary method of treating a cold is, certainly, rather palliative than positively curative; but it generally mitigates its severity, and hastens its termination. A brisk purgative, conjoined, if there be febrile disturbance, with a moderate dose of calomel and James's powder, or tartarized antimony, (the mercurial being increased and repeated in case of gastro-hepatic disorder,) a hot pediluvium at night, confinement to a room of moderate temperature, or to bed in order to increase the perspiration, which may be promoted by warm diluent drinks, will generally serve to moderate the complaint. Temporary relief may sometimes be given to the headache and severe catarrhal irritation of the nasal passages, by holding the face, with the head covered with flannel, over a vessel of hot water; and, in the case of the coryza of infants, the repeated application of a sponge squeezed out of hot water will often succeed in freeing the air-passages for a time, and in thus enabling the infant to suck. [The infant should not be placed to the breast during a severe catarrh, but should be fed with the spoon on fresh cow's milk, diluted with barley water, or rice water. The vapour of tar often facilitates the secretion from the nostrils in such cases, and may be used by placing a cup half filled with tar in a bowl of boiling water; hot vinegar or hot water is also useful.]

When the catarrh extends to the air-tubes, the same mild anti-phlogistic plan may be pursued, with the addition, in more severe cases, of leeches above the top of the sternum, or a blister or tartar emetic liniment to the upper part of the chest, and the frequent use of a cough mixture, to diminish irritation and promote expectoration. Various combinations may answer for this purpose. Mixtures containing antimonial or ipecacuanha wine (℥x. to ℥xx.) with tincture of hyoseyamus or conium (℥xx. to ℥xxx.) or hydrocyanic acid (℥j.), for the early stage, and with tincture of squill (℥x. to ℥xx.) and compound camphor tincture (℥xx. to ℥xl.), for the subsequent periods, generally answer well. But the efficacy of these remedies is decidedly increased by combining

them with an alkali. From ℥x. to ℥xx. of the liquor potassæ, or an equal number of grains of carbonate of soda, or in more asthenic cases ℥xx. or ℥xxx. of the sp. ammoniæ arom., are sufficient: in the greater number of cases, such alkaline remedies quiet the cough and promote expectoration far better than the oxymels and acid linctus or lozenges that are commonly in use. To have their full effect, cough medicines should be taken frequently, at least four or five times a day; for, besides that their object is to increase continually the secretion of the bronchi through the circulation, they seem to act, in some measure, directly on the glottis and its neighbourhood; and in the intervals it is useful to have in the mouth a demulcent substance, such as gum arabic, the solution of which tends, also by continuity, to sheathe these same irritated parts.

In order to insure the success of this mode of treating catarrh, more or less nursing and confinement are essential. To give diaphoretics and diluents, and at the same time to expose the body to transitions of temperature, which are almost unavoidable without confinement, will tend rather to increase a cold than to diminish it; yet few persons think it worth while to confine themselves for the sake of a cold, and thus either let it run its natural course, or make an even worse compromise, by nursing and sweating during one part of the day, and exposing and chilling themselves at another. Now, as these ordinary antiphlogistic means are inconvenient, and do not succeed in cutting short a catarrhal inflammation, there are other measures, which, if used at the outset of the disease, within a day or two of its commencement, often prove prompt means of arresting it altogether, or of bringing it to a speedy termination.

One of these methods is, by taking at bed-time, at the earliest stage of the cold, (whether the affection be felt in the nasal passages, the throat, the chest, or in the system generally,) a full dose of opium in some form, following it the next morning by a brisk cathartic. From ten to twenty grains of Dover's powder, or two grains of opium with two of ipecacuanha or a quarter of a grain of tartar emetic, or half an ounce of compound tincture of camphor, are the most eligible forms of opiate. It is safer to add a few grains of calomel or some milder mercurial, to prevent the restraining effect of the opium on the secretions. [To this a mustard foot-bath may be advantageously added.] When the remedy acts well, the patient sleeps soundly, generally perspires freely, and awakes in the morning free from his cold, but often with some headache and nausea. These are generally relieved by a brisk purgative, and no further ailment is felt than a degree of languor which another night's rest may remove. This remedy seems to operate by deadening the morbid sympathies, and thus breaking the chain of actions on which the process of inflamma-

tion depends; as we find it cut short, in some cases of more serious inflammations, after the general vascular action has been reduced by blood-letting. Somewhat in the same way may be supposed to act the hot, spirituous and vinous remedies which are popularly employed to check a cold; and which, hazardous as they are, were in some measure commended by Laennec. This kind of treatment may, however, prove injurious, where the digestive organs are weak, or where a tendency to other inflammations exists; and, by suppressing the expectoration, may change a bronchial catarrh into pneumonia.

Another method of stopping a cold is by abstinence from all kinds of liquid. This plan originated with the writer, who has practised it in his own person for the last twelve years, with such success, that colds and coughs that used to continue for several weeks, have been generally cured in two or three days. It was first adopted especially in the treatment of coryza, in which, as the earlier stage of catarrh, it is the most successful; but it was soon found to be of great utility in catarrhal bronchitis. About six years ago, M. Piorry also recommended this plan as a means of diminishing the expectoration in various forms of bronchial disease; but it does not appear that he adopted it with the view of removing catarrhal inflammation. The great effect of abstaining from liquid food is promptly to reduce the mass of the circulating fluids. The natural fluid secretions continue, although in diminished quantity; the urine is still excreted, but its watery part is decreased; the skin continues to perspire, either insensibly, or obviously under the influence of increased warmth or exercise. This is not the case with the morbid secretion from an irritated membrane: the irritation is lessened with the decreasing fulness of the blood-vessels; the scantier circulating fluid being now taxed for the habitual and necessary secretions too closely to supply it, the morbid flux soon ceases, and the diseased membrane, no longer irritated by its own secretion, is restored to a healthy condition. If liquid be freely taken too soon, before the membrane has lost its diseased action, the discharge will return, and the complaint be as severe as ever. But if, when the discharge has ceased after twenty-four or thirty-six hours of abstinence from liquids, means be taken to keep up the natural secretions, as by exercise, with a warm state of the surface, a little liquid may be taken with impunity, the bulk of the circulating fluid being still below the amount at which it can readily supply any demand from the irritation of the diseased membrane. This is probably the physiological principle of the curative influence of the *dry treatment* on catarrh. It is very essential for its success, that it should be applied in the early irritative stage of the complaint; and it is most effectual when the catarrh affects chiefly the nasal membrane. If there be any fever, and especially if the state of

the bowels requires it, an aperient with an antimonial should be given; for this favours that free state of the secretions on which, as we have seen, the efficacy of the dry plan depends. In milder cases, this is not necessary. For similar reasons, it is desirable that the solid food be not of a too rich or heating kind; for this, undiluted by liquid, might be apt to disagree. Bread, or any consistent farinaceous food, with a little butter, vegetables, white fish, white or gelatinous meats, light puddings, and dried fruits are suitable articles for a dry diet. Although a total abstinence from liquids is the most effectual, yet, taking about a tablespoonful of tea or milk with breakfast and the evening meal, and a wineglassful of water on going to bed, does not prevent the success of the plan, whilst it diminishes its discomfort. But the suffering from this voluntary privation is trifling in comparison with that from a severe cold; in fact, except with those who are habitually thirsty, it is rather negative than positive, arising from the imperfect enjoyment of eating without drinking. A great advantage of this plan is, that it does not interfere with common active pursuits, and needs no nursing or confinement. In fact, if care be taken to prevent the surface from being chilled, exercise in the open air promotes the success of the plan, by favouring the natural secretions. On the other hand, those who treat their colds by slops and diluents, which act chiefly by increasing the perspiration, will suffer from the least transition of temperature, which will have a greater influence on a freely perspiring surface. The time necessary to effect a cure by the dry plan will vary in different individuals, according to the present quantity of their circulating fluid, the activity of their secretions, and the intensity of the catarrhal disease; and also, somewhat according to the hygrometric state of the air, longer time being always required when the weather is cold and damp. On the average, forty-eight hours of abstinence will be sufficient. We have known thirty-six hours enough; but some severe and obstinate cases require three days. The period may generally be somewhat shortened by exercise and warm clothing, or lying in bed, or by commencing with a purgative, or by any other dry means of increasing the natural secretions. The catarrhal affection is generally much relieved at the end of the first day, and only troublesome at times; but the cure is not complete till all *stuffing* is gone, and nothing but a consistent mucus is formed, without irritation in the nasal or bronchial passages. Sometimes this secretion continues for a few days; but, unless fresh cold be taken, it causes no inconvenience, and soon ceases. In these cases, it is generally prudent to take an aperient and diaphoretic on returning to the use of liquids, which it is always best to begin at night, when there is less risk of relapse from fresh exposure.

[Many persons are liable to catch cold on the slightest exposure,

with every variation of the atmosphere. To such the use of the cold shower is highly beneficial as a prophylactic.]

SECTION II.

[CHRONIC CATARRH.]

The catarrhal inflammation of the nasal passages does not often present itself in a chronic form. If it continues, it loses the character of inflammation, and rather tends to become a kind of gleet or pituitous discharge,—a disease of secretion, coming on at intervals under the influence of various constitutional causes, in the manner of pituitous catarrh, which we shall afterwards describe. Sometimes we find persons complaining of an habitual stuffing or cold in the head, occasionally accompanied by a discharge of a sanious or puriform fluid; and, on inspecting the nostrils, the membrane is found red and thickened; but generally there is something to keep up this irritation, such as polypous growths or small ulcerations, which render the affection distinct from catarrhal inflammation, although it may occasionally originate in repeated attacks of this complaint. When the discharge has a fetid odour, it falls under the description of the disease called *ozæna*. This is, however, more commonly of specific origin, frequently depending on ulcerations, or changes in the membrane of a syphilitic or herpetic character, from which, together with the continued action of the air, the fetor of the discharge probably arises. In young children, the coryzal inflammation shows more tendency to become chronic. It generally terminates in the formation of a thick, sulphur-coloured mucus, which may continue for a considerable time, now and then becoming more liquid, and either glairy or puriform. In infants, this complaint often causes great inconvenience and mischief, by interfering with the process of sucking.

[There is usually but little pain in chronic coryza, there being generally only a sensation of uneasiness and obstruction of the nasal fossæ, with heaviness at the root of the nose; sometimes there is some tingling, with slight burning and repeated sneezing. The nasal secretion is more or less increased; in the majority of chronic catarrhs there is a constant discharge of mucus, serous, acrid, and excoriating the nostrils. Sometimes the mucus is thick, yellow or greenish, or slate-coloured, and there is a sense of tension and heaviness at the root of the nose, with stuffing of the nostrils, and constant uneasiness; the nostril is filled with small pieces of concrete mucus, which are detached with difficulty, and which the patient is sometimes obliged to draw through the nostril into the pharynx, and from thence reject them with the sputa. There

is also a form of coryza to which the name of *rhinorrhœa* has been given, in which there is simply a serous discharge, not acrid, and accompanied with no unpleasant sensations. The odour in some cases is very offensive, and this may exist independent of ozæna or ulceration. The voice is often sensibly affected, having a nasal twang, and persons labouring under chronic catarrh are easily fatigued by speaking.

Individuals of scrofulous habits are peculiarly liable to chronic coryza, and it is most commonly met with in children and young persons. It is frequently found combined with chronic pharyngitis. The suppression of habitual perspiration in the feet is also not an uncommon cause. (*Mémoire sur la sueur habituelle des pieds et les dangers de la suppression. Par M. Mondière. Jour. de l'Expérience, 1838, p. 487.*) A case is related of a young lady who was subject to acrid perspirations limited to the feet and left hand; whenever they were accidentally suppressed, a very acrid discharge occurred from the left nostril. The use of snuff is also another cause of this affection. Valleix relates a curious example in an old woman who had been in the habit of taking snuff for forty years, and who, at the age of sixty-five, was attacked with coryza, which lasted several months, and which suddenly ceased on the discontinuance of the tobacco. Some time afterwards resuming her old habit, an obstinate coryza reappeared, and again disappeared on relinquishing her snuff.

The mucous membrane is usually thickened, with patches sometimes of a slaty colour, giving to it a mottled appearance.

Chronic coryza may be confounded with impetigo of the nostrils, with ulcerated coryza or ozæna, and with polypi and cancer of the nasal fossæ. The differential diagnosis is exhibited in the following table.

<i>Chronic Coryza.</i>	<i>Impetigo of the Nostrils.</i>
Symptoms persistent.	Intervals of apparent cure.
No pustules at the commencement of an exacerbation.	Pustules of impetigo at the debut.
No scabs. (Concrete mucus should not be confounded with scabs.)	Thick scabs obstructing the nostrils.
<i>Chronic Coryza.</i>	<i>Ozæna.</i>
Mucus rarely tinged with blood.	Blood in the mucus.
No ulceration on inspection.	Ulceration of the pituitary membrane.
The blunt probe bent discovers no ulcers.	Ulcers felt.
<i>Chronic Coryza.</i>	<i>Syphilitic Ozæna.</i>
Inspection as before.	Inspection as before.
Nose preserves its form.	Nose deformed; depressed at the root.
No crepitation.	Crepitation of the bones.
No portions of bone in the mucus.	Portions of necrosed bone in the mucus.
History of the case—no constitutional symptoms.	Other constitutional symptoms of syphilis present.

Chronic Coryza.

Stoppage of the nose, often diminishing after the expulsion of concrete masses of mucus.

Polypi.

Obstruction of the nasal fossæ not diminished by expulsion of mucus; increased in damp breath, and by cerebral congestion. Subsequent exploration detects the presence of polypi.

Chronic Coryza.

Little or no tumefaction of the nose. No redness of the tegument of the nose, except at the anterior nares.

Little or no pain.

Cancer.

Tumefaction of the nose either in part or whole.

Redness of a portion or of the whole skin of the nose.

Pain at times intense.

TREATMENT.—In ordinary scrofulous chronic coryza, after detaching the crusts by soothing inhalations of boiling water, to which some mucilage may be added, slightly stimulating injections of myrrh and water, or weak blue wash, or a solution of alum, will be found highly advantageous. The vapours of tar, or hot vinegar, or chlorine, or iodine, have also been recommended. The administration of iodine, or iodide of potassium, internally, with sarsaparilla and tonics, should also be employed. Powdered cubebs has also been highly recommended, as well as the balsams. Cauterization with the nitrate of silver may be in some cases of service. Whenever the disease has succeeded the suppression of habitual perspiration of the feet, woolen stockings should be worn, and over them socks made of gummed silk, lined with linen. If this does not succeed, a warm sand-bath should be resorted to. The feet and legs should be covered with several folds of woolen, and placed in a bucket of warm sand, and allowed to remain a half an hour to an hour; and then enveloped as above. In a case which had lasted twelve years from this cause, six baths were required to affect the cure.

CHAPTER IV.

DISEASES OF THE BRONCHI.

SECTION I.

ACUTE BRONCHITIS.

THE more intense form of acute bronchitis differs from the milder kind already described, in the greater extent of the bronchial tubes which it occupies, rather than in pathological character. Its local nature and signs are the same; but its general symptoms differ, inasmuch as the system suffers more from the greater intensity and extent of the inflammation and of the functional disorder. This disease presents itself under two forms, long distinguished by the terms *sthenic* and *asthenic*.

In *sthenic bronchitis*, inflammatory symptoms are marked from the commencement: there are generally pain and constriction across the sternum; hard, severe cough, with glutinous expectoration; much fever, heat of skin, thirst, headache and scanty urine; white tongue, with red edges; quick and often hard pulse; hurried breathing, often accompanied with a feeling of great oppression; and cough on the least exertion. The pain in the chest is commonly referred to the sternum, and is more obtuse than the pain of pleurisy. [Pain in the middle sternal region is generally the first symptom complained of; at first there is only a sensation of uneasiness and tightness, but its progress is rapid, and in the efforts of cough it becomes agonizing. Its seat is limited, generally, to the middle sternal region; but in very sensitive persons it irradiates to the lateral portions of the thorax, and even to the back. Dr. Valleix has seen intercostal neuralgia developed in persons liable to it, and resemble closely the stitch in the side of pneumonia and pleurisy. The pain often reaches the larynx and trachea, where there is a tingling, burning sensation, provoking paroxysms of cough.] The expectoration is usually scanty at first; afterwards it becomes more copious, glairy, frothy, sometimes streaked with blood, and its expulsion gives but little relief to the cough and breathing; it is compared by Andral to white of egg in different degrees of dilution, and from chemical analysis appears to contain free albumen, which is not present in healthy mucus: its quantity increases in the evenings, when there is a general aggravation of

all the symptoms, more especially of the fever, dyspnœa, and cough. The physical signs are similar to those of the mild form; but they are here heard more extensively throughout one or both sides of the chest. The rhonchi are at first sibilant and sonorous; afterwards mucous and submucous, reaching to the inferior portions of the lungs, with a weakened respiratory murmur, announcing the presence of the inflammatory mucus even in the smaller tubes; but the clear sound on percussion declares the vesicular structure still free. [On applying the hand, distinct vibration may be heard if the rhonchus be seated superficially. It is more distinct at the middle and inferior parts of the chest than the superior, in inspiration than expiration, and in children and females than adult males. Dr. Walshe has found it very remarkably developed in children of from six to twelve months old. Both orders of sound are frequently heard in the second stage, and sometimes mucous rhonchus is audible from the first, owing to the rapid secretion.]

If relief be not afforded by expectoration, perspiration, or prompt remedial measures, the disease soon shows a change of character, from the increased dyspnœa and symptoms of partial asphyxia that ensue. Then come on feelings of great depression: the pulse is weak, as well as very quick, and often irregular; the functions of the sensorium are impaired or disturbed; the muscular strength is much reduced; the countenance becomes anxious, and pallid, or partially livid, according to the quantity of blood in the system; partial sweats appear; the pulmonary congestion becomes evident, by the slightly diminished resonance on percussion in the postero-inferior regions of the chest. [This dulness, produced by the accumulation of mucus, occurs only in debilitated subjects, or when the bronchitis is secondary, and is often connected with œdema of the lungs, or passive congestion. The unimpaired resonance on percussion in simple bronchitis is so constant that, except in the instances just mentioned, we are enabled, when it is present, to infer with certainty its idiopathic nature, and its independence of tubercles.] The continuance of this state, and the imperfect arterialization of the blood, further disturb other functions; the secretions become more scanty and vitiated; the tongue is loaded with a brown fur; the thirst is intense; and all these disorders concur in reacting on and aggravating the original disease, and in injuring the natural powers. Such is the loss of balance that results from the disturbance which severe bronchitis makes on the important function of respiration. The share which this function has in giving character to the constitutional symptoms, is seen in the fact, that very similar effects are met with in persons who have been subjected to an asphyxiating influence. The step from this condition to death is but a short one. In favourable cases, the disease declines

between the fourth and the eighth days; the dyspœna is diminished, and is confined chiefly to the evening, when there is almost always some tendency to exacerbation. The expectoration becomes opaque, [yellowish, greenish, or dirty white, the sputa are heavy and fall to the bottom of the vessel of water, and are not aërated,] and less glutinous and frothy; and on being voided, gives more relief to the cough and dyspnœa. The breathing becomes less laboured; the countenance improves, and resumes its proper colour; the symptoms of fever abate; and the disease either entirely subsides, or passes into a chronic form. [According to Watson and Latham the disease sometimes when general over the whole or greater part of the bronchial membrane, will linger for a considerable period in its first stage, and even subside without passing into the second stage. There is much fever and great dyspœna. The chest is everywhere resonant, but there is no vesicular respiration, which is replaced by a slow wheezing, whistling sound, heard in both inspiration and expiration.]

The chief difference presented by the *asthenic* or *humid* form of bronchitis (*peripneumonia notha*, as it was formerly termed,) is, the early appearance of signs of depression, generally attended with gastric derangement; quick, wiry, often irregular and unequal pulse; hot skin towards evening; headache and thirst. Oppression of the breathing is here one of the earliest symptoms, accompanied by a peculiar wheezing; and, on auscultation, we find in the universal mucous rhonchus the proof of the early presence of a profuse secretion in all the tubes. [True sub-crepitant rhonchus is generally first heard at both bases posteriorly, and extends from below upwards, as the disease advances; it generally, however, invades a greater extent of one side of the chest than the other, and this is, nearly always, the right side. Fine mucous rhonchus is heard higher up. The progress of the disease is generally rapid, rarely extending beyond a week.] The dyspnœa is liable to temporary exacerbations, which are often so severe as to prevent the patient from lying down, and are accompanied by extinction of the voice. During these attacks, there is sometimes some dullness on percussion, and occasionally even bronchophony in the posterior region on one side, which is removed with the decrease of dyspnœa. These probably depend on the quantity of liquid mucus in the bronchial tubes and cells; and on a temporary pulmonary congestion. The expectoration may be scanty at the outset, but afterwards becomes very copious and frothy. This form of bronchitis commonly attacks elderly people, those of a lax, phlegmatic habit, and such as have habitually a cough with copious thin expectoration. In young children, a very fatal kind of bronchitis of the asthenic kind sometimes comes on in a most insidious manner. It may at first present the aspect of a common catarrh with coryza, without pain, much fever, or marked derange-

ment of the functions. On attentive observation, however, the breathing is observed to be frequent, accompanied with wheezing, particularly before and after the fits of coughing; while the pallidity of the countenance, and heavy state of the child's spirits, indicate something more than a common cold. The cough is not always present; and as children do not expectorate, the disorder in the chest may escape remark, until the dyspnœa suddenly comes on and renders the danger imminent. [This form of bronchitis is almost always more or less connected with lobular pneumonia, and will be treated of under that head.]

CAUSES.—The most common exciting causes of severe bronchitis are the same as those of the milder form of the disease, from which, as we have before observed, it differs rather in degree than in kind: cold, particularly conjoined with moisture, applied locally or generally, as by wearing damp clothing, or exposure to a cold, moist, variable atmosphere, especially after the body has been heated by exercise or crowded rooms. Particular conditions of the atmosphere may excite sthenic bronchitis in those of an inflammatory habit; and the humid form of the disease in those of a more relaxed constitution. A severe kind of bronchitis often accompanies some of the eruptive fevers, measles, erysipelas, small-pox, and scarlet fever, and causes the chief danger that accompanies them. In some cases, the recession of the rash is followed by great increase of the bronchial affection, which is announced by sudden and oppressive dyspnœa. From the suddenness of the production and disappearance of this symptom, which is occasionally observed in these cases, it is very probable that they are rather congestive than inflammatory; although, if the congestions continue, they take the form of bronchitis. Of the same character is the symptomatic bronchitis of continued fevers, in which the symptoms of the local disease are often so obscured, that it may run on to a fatal termination without being discovered, till its nature has been revealed by dissection after death. Auscultation in such cases, however, generally reveals the lesion—the sibilous, sonorous, and submucous rhonchi being heard in every part of the chest. Bronchitis supervening on erysipelas sometimes depends on the propagation of the inflammation by continuity, and may prove rapidly fatal. Erratic gout may manifest itself also in the form of bronchitis, which may be dangerous if the attack be sudden: in general, it vanishes quickly on the appearance of gout in an extremity.

ANATOMICAL CHARACTERS.—The pathological and anatomical characters of acute bronchitis, as far as they present themselves, correspond with the indications of the physical signs. The lungs do not, in general, collapse on opening the chest, the escape of air being prevented by the obstructions in the bronchial tubes.

These tubes, in most instances, contain a quantity of frothy fluid, similar to expectoration, before death: not unfrequently it is sanguinolent; but as this appearance is not often observed in the sputa, even at the last, it probably arises from an exudation of the colouring matter from the congested pulmonary plexus of vessels at the time of, and after, death. Purulent matter is frequently mixed with the mucus, especially in very acute sthenic cases, which have proved fatal in a few days. The bronchial mucous membrane presents various shades, from a light pink or crimson to a deep or brownish-red, either generally diffused, or in patches. It is occasionally found granular, partially thickened, but much less commonly than might be expected from the character of the physical signs, which so generally indicate constriction of the tubes; but it is to be borne in mind, that the vascular injection and effusion, which chiefly constitute these constrictions, probably resemble those of erysipelas, which, it is well known, disappear after death. Occasionally the mucous membrane is somewhat softened, so that it may be easily abraded; but this change is found by no means so frequently as in the gastro-intestinal mucous membrane.

[In capillary bronchitis the same alterations of the mucous membrane are observed, whilst the bronchi are entirely or nearly obliterated by a thick, adherent, puriform matter, but little, or not at all, aërated. The bronchi are uniformly, or partially, or generally dilated. In the cases observed by Fauvel and Rilliet and Barthez, there was vesicular emphysema of the superior lobe of both lungs, and in two instances interlobular emphysema. The bronchial glands are red, friable and swollen, in young subjects. Purulent granulations are found scattered over the lung. This lesion was first pointed out by Rilliet and Barthez, and has since been studied by Fauvel. On cutting into the lung a number of gray or yellowish granulations of the size of a millet seed are seen, which, at first sight, resemble crude miliary tubercles. Instead of being solid masses, however, they contain a liquid. On incising a lung containing miliary tubercles, the divided tubercles are seen on a level with the surface, or if they have escaped the cut, round in form; on cutting into the granulations, they give issue to a drop of puriform fluid, and collapse. This lesion is no doubt due to dilatation of the bronchial vesicles.]

DIAGNOSIS.—The distinctive characters of acute bronchitis are to be found in the leading general and physical signs of the disease. Its most important symptoms arise from its interfering with the function of respiration, and occasioning the circulation of dark blood through the system, with corresponding changes in the hue of the lips and cheeks, which result sooner from bronchitis than from other inflammatory affections of the chest. It should be kept in view, that more or less bronchial inflammation always accom-

panies these other pulmonary affections in their more serious forms, and is often the immediate cause of death. One of the most rapidly fatal forms of tuberculous disease, is that of abundant miliary tubercles, attended by a general bronchial inflammation, the secretion from which is the chief cause of the dyspnoea and suffocation which ensue. So also in continued fevers, as it has been pointed out, a secondary bronchial inflammation or congestion and effusion become a chief source of danger, although it may be difficult to distinguish it among the symptoms of the primary disease.

On the character of the sputa, a diagnostic between bronchitis and pneumonia has been founded: those of the former, although sometimes very viscid, wanting the rusty tinge which is presented by the expectoration of peripneumony. We shall see, hereafter, that hæmorrhagic engorgement, or a highly congested state of the lungs from organic disease of the heart, may add even this character to the sputa of bronchitis. But in bronchitis the air is not expelled from the vesicular structure, as in the effusions of pneumonia and pleurisy: hence, although, from temporary congestion, the sound of the chest on percussion be sometimes impaired, it is not so to a great extent, or for a continuance; neither is there such condensation of the tissue, as to transmit the sound of bronchial respiration or bronchophony. The absence of the fine crepitation of pneumonia is a more equivocal test; but if observed, for two or three days, without dulness on percussion and rusty tinge in the sputa, it may be considered as pretty surely indicating that the parenchyma is not influenced. It is important to bear in mind, notwithstanding the artificial distinctions insisted on by Laennec and others, that the physical conditions of a congested lung with acute bronchitis, and of a lung in the first stage of pneumonia, are the same as far as regards their signs, and can be distinguished only by the different courses which they take, and which will depend on the degree of inflammatory tendency present, as indicated by the cough and general fever. [The febrile movement, although present, is usually much less intense in bronchitis than in pneumonia. The subcrepitant rhonchus, when present in bronchitis, is heard on both sides. This last sign, on which great stress is laid by Louis, should be noted with great care. Acute phthisis may sometimes be mistaken at the commencement for bronchitis. Pain, more or less violent at the summit of the chest, dulness under one or both clavicles, the subcrepitant rhonchus at these points, and the rapid emaciation, with hæmoptysis, soon elucidate the case. According to Fauvel, the differential diagnosis of capillary bronchitis and lobular pneumonia may be established by the difference in the intensity of the symptoms; the dyspnoea is less intense, anxiety less, and the diffuseness of the subcrepitant rhonchus, in capillary bronchitis, and its limited

nature in lobular pneumonia. As has been observed, the co-existence of the two diseases is so general, that the diagnosis is of but little importance.]

PROGNOSIS.—The tendency of acute bronchitis may be judged by the extent and stage of the disease, and the general strength and condition of the patient. When the inflammation is partial, affecting a few bronchi only, as in common mild cases, and without much dyspnœa and fever, it may terminate in a period varying from six days to three or four weeks; and its disposition to pass off is indicated by the expectoration becoming opaque and more clotted, and gradually diminishing in quantity. This change is always first seen in the morning; the evening exacerbations often restoring the thin glairy character to the sputa, even in cases tending towards convalescence. A relapse is marked by the expectoration resuming this condition, which is always accompanied by an increased hardness of the cough and fever. In the more extensive attacks of inflammation, where the dyspnœa is oppressive and constant, and particularly where the fever is high in the beginning, the prognosis must be very doubtful. If the acute symptoms have already yielded to the state of collapse, it may be feared that the power of the system will be insufficient to restore a function on which the disease has made a serious inroad. The extreme anxiety of the pallid countenance, with more or less lividity of the lips, of the face and hands, coldness of the surface, and a rapid fluttering or thready pulse, announce the asphyxiating effects of this stage of the disease; and the universal mucous rhonchus becoming coarser and more gurgling as expectoration fails, with little or no respiratory murmur heard on applying the ear to the chest, gives direct evidence of impending dissolution.

In the severe bronchitis of children, the real amount of danger can seldom be estimated by the general symptoms, in time for the effectual application of remedies; but where auscultation discovers, from a widely diffused mucous rhonchus, that the inflammation is extensive, and occupies both lungs, great danger may be apprehended, whatever be the amount of dyspnœa and other symptoms at the time; for frequently these come on in paroxysms only, or are scarcely remarked in the somnolent state in which the child lies during the remissions.

The chief danger in asthenic bronchitis arises from the weakness or age of the patient. As long as expectoration continues free, and the strength keeps up, the lungs may be cleared of the secretion fast enough to maintain their functions; but the disease is often fatal to the weak, and especially the aged, whose lungs are generally more or less emphysematous, and therefore can ill afford any infringement on their function. One of the most fatal

forms of bronchitis is that supervening on a suppressed eruption, or on erysipelas.

TREATMENT.—As long as the *sthenic* character of bronchitis continues, there can be no doubt of the propriety of bleeding, more or less freely, by venesection, cupping, or leeches, according to the intensity of the symptoms, and the strength of the patient. In bronchitis, occasional moderate blood-letting (from 12 to 20 f $\bar{3}$) generally gives speedy relief, by removing the congested state of the lung; and in this respect, bronchitis differs from pneumonia, in which this congestion is a more fixed part of the disease. It is desirable, however, to produce an impression on the pulse, which often increases in fulness as the blood flows, while the temporary congestion is relieved. But inflammation of a mucous membrane is rarely removed by bleeding alone; it involves a certain structural change, probably interstitial effusion, that can be relieved only by a free secretion from the inflamed membrane. Expectoration is a necessary process during the remainder of the disease, and the strength should be saved for this purpose. [It should be constantly borne in mind that the great danger in bronchitis is from debility in the more advanced stages of the disease, and that from this cause the patient is unable to disembarrass the air passages of the mucous accumulation there. Copious bleeding in bronchitis also tends to induce effusion into the bronchi, and hasten death. Blood-letting is much less well borne in bronchitis than in pneumonia. One large bleeding in a vigorous subject is usually sufficient. It should be remembered that the immediate symptoms are almost always relieved by the bleeding, but that the pulse should be our guide in the further prosecution of blood-letting.] In many cases, the local is preferable to the general abstraction of blood; and often they may be combined with advantage. The local abstraction of blood should be performed on the side in which auscultation discovers the greatest obstruction to the passage of the air. [The free application of cups over the front of the chest, or between the shoulders, is often accompanied with great mitigation of the symptoms; or leeches may be applied over the seat of the rhonchus.]

In the earliest stage of the disease, the exhibition of a brisk purgative, containing calomel, is useful in assisting the antiphlogistic effect of the bleeding; but at a later period, strong purgatives do not act so favourably, and seem in some degree to check expectoration; a mild mercurial aperient every night is, however, generally useful.

To aid the antiphlogistic measures already named, certain internal medicines, which act especially on the vascular system, are of considerable efficacy. Tartarized antimony, in doses of from one-eighth to one-half of a grain every three, four, or six hours,

with a drop or two of hydrocyanic acid, ten or fifteen drops of tincture of digitalis, or twenty drops of colchicum wine in camphor julep or other more agreeable vehicle, greatly contribute to reduce the intensity of the mucous inflammation, and to hasten its termination by expectoration. The efficacy of tartarized antimony in bronchial inflammation is much insisted on by Cheyne, Badham, Stokes, and others. If the cough is very hard and harassing, and is not sufficiently allayed by the remedies just named, it may be expedient to add something to diminish the nervous sensibility, such as hyoscyamus, conium, or belladonna. These drugs produce little effect unless given in pretty large doses. Opium and the salts of morphia are not well suited to the early stage of bronchitis, as they tend to check expectoration. [If there be signs of venous congestion, a dusky complexion or blue lips, opium is dangerous. It will increase the disposition to coma, and perhaps prove fatal. When the first violence of the disease has abated, then it is highly serviceable.] This objection does not, however, apply to the combination of opium with calomel, which is so efficacious in various inflammatory diseases. We have not found it equal to tartarized antimony, as a remedy for acute sthenic bronchitis; but it is a valuable resource where the latter disagrees on account of irritability of the stomach or great debility, and is more eligible where the bronchial affection is complicated with hepatic congestion and intestinal disorder. From one to three grains of calomel, or double that quantity of blue pill, or hydrargyrum cum cretâ, with from one-fourth to one-half of a grain of opium, and a grain or two of ipecacuanha, every three, four, or six hours, according to the symptoms, may in such cases be substituted for the liquid remedies; using, in addition, merely a little mucilaginous mixture, or some mild slightly alkaline linctus, for the cough, in which, if there be fever, a few grains of nitrate and citrate of potass may be dissolved. The mercury may be withdrawn as soon as the gums show signs of its having affected the system, or it may be confined to a single dose at bed-time.

Blisters are not eligible for the early stage of sthenic bronchitis from their liability to excite the whole vascular system before they rise, and consequently to increase the fever and bronchial inflammation. This effect is less likely to be produced by the tartar-emetic applied externally, the operation of which, by particular management, may be so hastened as to be made available in acute diseases. For this purpose, the vessels of the surface should be excited by friction with a coarse flannel or a flesh-brush, or by the application of cloths rinsed out of hot water, or by a short application of a mustard poultice. The tartar-emetic should then be immediately rubbed in, either in the form of a warm, saturated aqueous solution, or in that of an ointment composed of one part of tartar-emetic and two or three of lard; and the application may

be repeated in an hour, if a strong effect is desired. In this way, a full pustular eruption may generally be excited in as short a time as that required for the rising of a blister. We have often seen produced, in two hours, an intense exanthematous redness, which in another hour or two became a thick crop of pimples, speedily running into vesicles and pustules. This form of counter-irritation is more intense and lasting than that from a blister, and is especially suited to give relief in the more sthenic form of bronchitis with very viscid expectoration. It is probable that a minute quantity of the antimony enters the circulation, for nausea is sometimes felt; this result, instead of proving injurious, may be highly salutary. [Or Croton oil may be substituted for the tartar-emetic.]

When free secretion from the bronchial tubes has been fully established, and especially if it be more or less opaque, we may venture on remedies which are hazardous at the onset of the inflammation,—blisters and expectorants even of a somewhat stimulating kind. The propriety of this change in the treatment has been ably pointed out by Dr. Stokes. Expectoration now becomes the chief mode of relief; and to facilitate this, the decoction of senega, [or syrup,] with acetate or muriate of ammonia and tincture of squills, may be added to the tartar-emetic or ipecacuanha mixture before in use. Should a state of collapse come on, or symptoms of increasing debility threaten inability to expectorate, it is necessary to resort to more decided stimulants. Of these, the carbonate of ammonia is the most appropriate, as it rapidly enters the system, and seems peculiarly to assist expectoration. It may be given in doses of from two to five grains in decoction of senega, as frequently as the urgency of the symptoms indicates; and it should be withdrawn if there be a return of hardness of the pulse, or heat of skin. The tincture of the lobelia inflata may sometimes be advantageously added, in the dose of ten or twenty minims; but its action is uncertain, both in kind and in degree.

The good effects of the treatment will be apparent in the general symptoms, before they are evinced by the physical signs. The breathing becomes less laboured, the countenance improves, the pulse becomes more steady and full. On observing and listening to the chest, we may perhaps find that the air enters more freely into the lungs; but the mucous and other rhonchi are still present, and continue for some time; and it is only when the improvement is considerable, that we perceive that they diminish, and that the obstructions become less general; that, instead of bubbling over the whole, or a considerable portion of the chest, the respiratory murmur is heard, still mixed with clicking, whistling, and humming sounds.

In the *asthenic* form of bronchitis, the antiphlogistic treatment

can be employed only to a limited extent; and the measures for the after stages of the sthenic disease may be used from the first. Blood-letting is scarcely borne, or only by leeches and moderate cupping. Dry cupping is occasionally useful; but the most available external remedies are blisters, which should be of large size. The mercurial or antimonial remedies, used in moderation, together with decoction of senega, an ammoniacal salt, squill, and compound camphor tincture, constitute the chief internal remedies useful in such a case. Where the depression is great, and the power of expectoration fails, besides the carbonate ammonia, it may be necessary to give other stimulants, such as æther, brandy, or hot coffee. In these cases, likewise, a certain degree of abstinence from liquids is expedient, not only by diminishing the mass of blood that has to pass through the clogged lungs, but also, as in acute catarrh, by reducing the quantity of the bronchial secretion. Dr. Badham recommends assafœtida in the occasional aggravations of the dyspnœa, which he supposes to arise from a temporary spasm in the bronchi. The asthenic form of bronchitis

[11. R.—Mist. Assafœt., fʒij.
 Aquæ Ment. Pip., fʒij.
 Tinct. Opii Camp., fʒij.
 Syr. Tolu, fʒiv.
 M.

Sig. One tablespoonful every three hours.]

often leaves great weakness; and it is generally necessary to use tonics. If an irritable cough remain, it may be allayed by opium. Change of air will sometimes answer both purposes.

In the bronchitis of young children, emetics and mercurial purges are peculiarly serviceable. The former must not be too frequently used, as they cause considerable determination to the head, and exhaustion; but they are eminently successful in emptying the bronchial tubes of their secretion; and they probably do this, not only by the action of the external muscles of respiration, but also by exciting the bronchial muscles to contract, as we know that the glottis is forcibly closed during the act of vomiting.

[In the treatment of the bronchitis of children it is very important that position should be attended to. Dorsal decubitus favours accumulation and prevents expectoration. Young patients should be carried about or kept sitting, or lie on their side or face, and their position constantly changed. The abdomen should be moderately bandaged to promote contraction of the abdominal muscles. When the child coughs, it should be placed in the most favourable position to promote expectoration. In the bronchitis of old persons the same precautions are to be observed; they should be made to sit up, and lie on the face and side.]

It is generally necessary to be particularly energetic in the treatment of bronchitis supervening on suppressed discharges and eruptions. Extensive counter-irritation with tartar-emetic [or croton oil] is especially indicated in these cases.

In case of retrocedent gout, means should be taken to bring back the inflammation to the extremities, by hot pediluvia and mustard poultices; but these measures alone are not to be depended on; and it is proper to use colchicum with other internal medicines.

The bronchial affections occurring in the course of continued fever, are often rather congestive than inflammatory; and although they may greatly embarrass the breathing, the depressing tendency of the general disease prevents the employment of blood-letting to any extent. Leeches to the chest may be used in the early stages; but subsequently, when the low fever requires wine and other stimuli, the chest affection can only be treated with dry cupping, sinapisms and blisters, and with moderate doses of tartarized antimony, or of mercurials, according to the symptoms.

SECTION II.

CHRONIC BRONCHITIS.

Before entering on the consideration of chronic bronchitis, we shall make a few general observations on chronic inflammation of the air-passages. These are not separated from the acute by any very distinct line; although, when well marked, they differ much from each other. The two forms may pass gradually into each other, and are often conjoined; for although acute bronchitis frequently exists alone, chronic bronchitis is rarely free from an admixture of acute inflammation. Neither is the long duration of the disease always a proof that it is not acute; for, in some cases, attack may succeed attack for weeks and even months, yet never lose the acute character. The character of the expectoration gives some proofs of the state of the membrane; and by its heterogeneous nature in chronic bronchitis, we may form a notion of the different pathological conditions simultaneously affecting the bronchial tubes in different parts of the lung. Perhaps the best test of the existence of chronic inflammation is that proposed by Andral—the continued presence of opaque matter in the expectoration, such as we have classed under the head of *albuminous*, whether it be muco-purulent, purulent, fibrinous, or caseous; whether these occur separately, or, as is more usual, are variously combined, of different degrees of consistence and colour, and occasionally mixed with a thinner and more transparent liquid of a mucous or serous quality.

SYMPTOMS.—The slighter form of chronic bronchitis is indicated only by habitual cough and expectoration, which are increased by sudden changes of the weather, and generally prevails

most in winter and spring. It is most common in advanced life; in fact, few old people are perfectly free from it: in its slighter degrees, it may continue for many years, without materially injuring the constitution of the patient.

The more severe forms may succeed to an attack of acute bronchitis, which has lasted long enough to injure permanently the vessels of the bronchial membrane, its effects not having been controlled by treatment, or various causes having kept up a local irritation at the stage in which the membrane was relieving itself by an unusual secretion. In such cases, although the sputa have become partially opaque and clotted, (or *concocted* as the old writers termed it), and the usual mitigation of the fever and other symptoms have accompanied this change, yet the complaint then becomes stationary, with a lower febrile and inflammatory character, but with unsubdued and more paroxysmal cough, often with dyspnœa, soreness, tightness, and wandering pains in the chest, and more or less derangement of the general health. The sputa become diffluent, or of different degrees of consistence, and mixed with opaque clots of a yellowish or greenish colour, often with decided pus; sometimes they are streaked with blood, or of a dirty gray or brown colour, and partially transparent. When the expectoration is purulent and copious, there is usually much prostration of strength, and some loss of flesh; in some instances, with evening hectic, night-sweats, and other symptoms resembling those of pulmonary consumption,—but the physical signs are wanting. The chest, in simple chronic bronchitis, still expands equally, and sounds well on percussion: the respiration and cough are heard with various rhonchi,—mucous, sonorous, sibilant and clicking,—which are continually shifting and changing. There is no bronchial or cavernous respiration; no permanent absence of respiration in a part: no unusual resonance of the voice; and, in spite of the continuance of the copious and puriform expectoration, on listening day after day, there are found no signs of a cavity, viz., cavernous rhonchus or pectoriloquy. Under these circumstances, whatever be the general symptoms, it may be pretty confidently pronounced that the disease is not tuberculous consumption, but simple chronic bronchitis. It is not, however, always very easy to get this perfect degree of negative evidence; and it requires much experience in auscultation, as well as repeated examinations, to pronounce confidently the diagnosis. In such and all doubtful cases, we should take also into consideration the history of the attack, the constitution of the patient, and such of the general symptoms as may serve to throw light on the prevailing tendencies of the system. The more profuse the expectoration, particularly if it be very purulent or otherwise albuminous, the less likely is the case to be one of phthisis, if no signs of this disease be found; and it may be the more readily

inferred, that the sputa only proceed from a diseased membrane. But there may be another change induced, in consequence of long-continued inflammation of the bronchi, namely, dilatation; and this may produce physical signs, which may imitate those of phthisis.

CAUSES.—Chronic bronchitis commonly arises from long-continued or repeated attacks of the acute disease, in the way already mentioned: but in old persons it may originate without any distinct prior acute attack.

An inveterate and formidable kind of chronic bronchitis is excited by the habitual inhalation of air loaded with dust. Needle-pointers, stone-cutters, those who powder and sift the materials for making porcelain, leather-dressers, and workers in artificial hair and feathers, are particularly liable to this affection. In these cases it begins with dyspnœa, which may continue for a considerable time before the disease declares itself. In the course of a few months, however, the dyspnœa is increased, and accompanied by severe cough and copious expectoration, sometimes mixed with pus and blood. Not unfrequently the cough is accompanied with a profuse hæmoptysis. At this time the constitution suffers much: the pulse becomes quick; thirst and fever come on; the tongue is loaded; and the dyspnœa is more and more urgent, often attacking in paroxysms, attended by swelling and lividity of the face. The lesions in these cases, although beginning as chronic bronchitis, generally affect the structure of the air-tubes and pulmonary tissue, and terminate ultimately in various forms of pulmonary consumption. Unless the disease be early relieved by remedies, and a total abandonment of the unhealthy occupation, they become worse; the expectoration increases to a great extent, and becomes more purulent; hectic, with night-sweats, succeeds; and the patient ultimately dies with most of the symptoms of tubercular phthisis.

When chronic bronchitis occurs in early life, it generally follows hooping-cough, measles, small-pox, or some cutaneous eruption, and does not often succeed to the acute disease. It is generally a serious affection, in young subjects, and is probably always accompanied or followed by considerable changes of structure in the bronchial tubes.

ANATOMICAL CHARACTERS.—The mucous membrane of the air-tubes is frequently found of a deep red colour, which is either diffused or in patches, and of a more livid or violet tint than in the acute disease. Not unfrequently, however, there is very little redness: sometimes the membrane is even paler than usual; and this in cases where there has been copious purulent expectoration. It is often thickened, particularly at the branching

of the tubes, and the longitudinal and circular fibres under it irregularly enlarged in the manner to be afterwards described. Ulceration is not common in the smaller bronchi, except in cases of the disease arising from the habitual inhalation of dust, in which the whole mucous membrane of the air-passages is both ulcerated and thickened to a greater degree than in any other case.

PROGNOSIS.—The prognosis in chronic bronchitis depends very much on its origin, and on its being complicated or not with other disorders. When succeeding to an acute attack, and when unattended with much derangement of the general functions, it does not tend to a fatal termination. Even should there be purulent expectoration and some signs of hectic, a strong constitution and favourable circumstances often bring about a cure; and slighter forms of the disease, though obstinate and lasting for years, seem scarcely to abridge life. But in its worst character, with constant dyspnoea, copious purulent expectoration, hectic and emaciation, especially if attended with symptoms of confirmed disease in the abdominal mucous membrane, in the liver, or in the heart, it is nearly as fatal as tubercular phthisis. In complicated cases, the bronchitis is often secondary; and there are abundant examples which prove that it may disappear entirely, if the primary disease be of a tractable nature and yield to treatment. In many instances, the prognosis must in great measure depend on the physical signs: the disease is itself an attendant on phthisis; and if these give the least suspicion that tubercles are present, the case must be considered of doubtful issue. The cases of simple bronchitis that prove fatal are those in which the mucous membrane and other structures of the tubes have become so altered in texture and function, that the oxygenation of the blood is permanently impeded, whilst the copious secretion, and the perpetual wearing efforts to expectorate it, waste the body and reduce the strength. Such cases generally occur in aged persons, and in those already reduced by fever or some other severe disease. The imperfect oxygenation of the blood that results from extensive chronic bronchitis, occasions congestions in the lungs and heart: hence organic diseases of the heart, with effusions of serum and of blood, not unfrequently supervene on its long continuance.

TREATMENT.—In the administration of remedies in this, as in all chronic diseases, regard must be paid to the time required for the cure, and the strength economized accordingly. Unless in case of a temporary increase of pulmonary congestion or aggravation of the inflammation, blood-letting is not necessary, for it has little power to control the action of vessels under

the influence of chronic inflammation. Where needful, a few leeches under the clavicles, to the top of the sternum, or cupping between the shoulders, will generally suffice; or the existence of pain on either side may direct the place for blood-letting. The most generally useful class of remedies are counter-irritants conjoined with mild alterative tonics. Friction of the chest with an oily liniment containing various proportions of tartar-emetic, tincture of cantharides, the essential oils, ammonia, or acetic acid, or a diluted mineral acid, according to the effect desired, or a succession of mild blisters; or, in less severe cases, wearing an ample pitch or mercurial plaster, with a small portion of cantharides in it, will furnish a choice of means applicable to every case. The methods by friction are preferable to the use of plasters, for they tend to promote the respiratory movements; whereas plasters, unless they be supple and carefully applied, may somewhat restrain the expansion of the chest. To avoid this, the patient should be desired to take long deep inspirations when the plaster is first applied; and if its material be rigid, long cuts should be made in it, from the middle to the margin, corresponding with the intercostal spaces from the sternum to the sides. Dr. Stokes strongly recommends the following liniment as a rubefacient in chronic bronchitis:

12. R.—Sp. Terebinth., $f\bar{z}$ ij;
 Acid. Acetici, $f\bar{z}$ ss;
 Vitellum Ovi, j;
 Aq. Rosar., $f\bar{z}$ iiss;
 Olei Limonis, $f\bar{z}$ j.
 M.

We have used it with good effect; but have found a combination of ammonia with similar ingredients a still more permanent and energetic counter-irritant, such as the following:

13. R.—Liquor Ammoniaë, $f\bar{z}$ ss ad $f\bar{z}$ j;
 Olei Amygdal., $f\bar{z}$ ss;
 Olei Terebinth., $f\bar{z}$ iiss;
 Aquæ Font., $f\bar{z}$ ij;
 Olei Rosmarin. vel Limonis, $f\bar{z}$ j.
 M.

We have sometimes employed with benefit a counter-irritant lotion, composed of a saturated solution of tartarized antimony with hydriodate of potash, in the proportion of half a drachm to the ounce, adding a little oil of turpentine or lemon to distinguish it as a liniment.

With external counter-irritation it is generally expedient to join such internal remedies as may seem best calculated to improve the condition of the diseased membrane, and of the functions generally. These must vary in different individuals; and although, in all these cases, the same local disease—chronic bronchitis—exists, yet they may be relieved by the most opposite means.

Mild tonics, such as columbo and cascarilla with nitric acid, sarsaparilla, and taraxicum, are very commonly useful to improve the state of the secretions and functions in general; and where the expectoration is profuse and even purulent, without much vascular excitement, the mineral acids and metallic astringents in some cases, in others myrrh, copaiba, the balsam of Peru, or benzoic acid, prove occasionally useful. Many of these are safe and beneficial only when combined with external counter-irritation. With this safeguard, we have found that even steel medicines, particularly that most valuable preparation, the iodide of iron, may be borne, and have sometimes been very salutary in improving the general health and strength, without increasing the cough. The hydriodate of potash has been also found of service in some instances: it seems to restrain low degrees of inflammation affecting the fibrous parts of the air-tubes, and probably may, in some degree, retard the processes of induration to which they tend.

Of late years much has been said for and against the direct application of remedies to the bronchial surface, particularly of the vapour of iodine and chlorine by inhalation. This treatment, proposed some years ago by M. Gannal, a French chemist, has been used with some advantage by several practitioners. The chlorine or iodine is put in a liquid state into an inhaler containing hot water, and the air drawn into the lungs through a thin layer of this water is impregnated with an amount of chlorine varying according to the proportion of the ingredients used. In several cases in which we have seen this plan tried, the result has been unfavourable, the stimulating properties of the vapour exciting fever and cough, and the effort of inhaling fatiguing the patient. For this method of inhalation might be substituted the diffusion of iodine or chlorine combined with aqueous vapour, either in the apartment of the patient, or, what would be more practicable, in a small room or closet, cleared for the purpose, in which half an hour or an hour could be spent twice a day. This plan has been also proposed by Dr. Murray. Iodine or chlorine may be readily dispersed in any quantity through a room, by placing a few grains of the former, or a solution of the chloride of lime or soda, in a saucer floating on hot water. The quantity should be determined by the effect on the patient, always keeping it below that which causes much coughing or acceleration of the pulse. The inhalation of tar vapour has had repeated and extensive trials, since Sir Alexander Crichton first directed the attention of practitioners to it, and there has been some evidence in favour of its beneficial effects in certain cases of chronic bronchitis. As it is of a stimulating nature, like the balsams, it proves useful only in cases free from irritability or tendency to active inflammation: it is important to watch its effects when first

employed, and to diminish or withdraw it altogether, if it continue to aggravate the cough and quicken the circulation.

The utility of expectorants in the chronic form of bronchitis has been questioned, because it is supposed that they might increase the secretion that is already redundant. But they probably exert, in many instances, an alterative rather than a stimulant operation on the bronchial membrane. Thus ipecacuanha, which seems to increase the expectoration in acute bronchitis, modifies and facilitates it in the chronic disease. In some cases, it may be given with great advantage in emetic doses repeated every two or three days: in some obstinate examples of the milder form of the disease attacking persons of robust habit, this practice has effected a cure. As an expectorant, it may be given in the dose of a grain or two of the powder or twenty or thirty drops of the wine, repeated several times a day, combined with squill, colchicum, camphor, and opium, or any other combination that the symptoms of the case may indicate. Squill is very useful in chronic cough unattended with purulent expectoration; and, in combination with colchicum, ipecacuanha, and a small quantity of opium, are often very serviceable in facilitating the expectoration and quieting the winter cough of old people. When the expectoration is viscid, an alkali should be added; and with a feeble state of the circulation, the carbonate of ammonia is the best. The tincture of the *lobelia inflata* has sometimes proved very beneficial in the occasional aggravations of chronic bronchitis, by relieving the breathing, and facilitating expectoration: but its operation varies greatly, sometimes causing giddiness and faintness in a dose of ten minims, sometimes giving relief only in doses of a drachm.

To diminish morbid sensibility, and allay that mobility of the muscular system on which the length and frequency of the fits of coughing depend, narcotics must often be combined with the preceding remedies. Unless for the sake of procuring a night's rest, opium should not be given alone, but combined with ipecacuanha, colchicum, or some of the other drugs which, in some measure, prevent its astringent effect on the secretions. The salts of morphia, *liquor morphiæ bimeconatis*, or the *Tinct. Camphoræ Co.*, are in many cases more suitable than solid opium or its tincture. Conium in its extract is a very useful narcotic in chronic bronchitis, particularly combined with ipecacuanha, and, if the secretion be excessive, with benzoic acid also. The extract or tincture of conium has been sometimes used by inhalation: Dr. Stokes recommends ten or fifteen grains of the extract to be added to hot water in an inhaler, and the inhalation practiced for a quarter of an hour once or twice a day. The extract or tincture of henbane, and the extracts of stramonium and of belladonna, are likewise

- [14. R—Ext. Conii,
 Pulv. Scillæ, āā ℥ss.
 Ammoniaci, ℥iss.
 M.—Div. in pil. xxx.
 Sig.—One every four hours.]

occasionally beneficial. The latter is particularly serviceable where the cough has a convulsive character; and it should be given in large doses, such as a grain or two. In these convulsive cases, assafoetida and valerian have been found very serviceable. Hydrocyanic acid, the oil of bitter almonds, and laurel-water, which seem to owe their power to the same principle, also sometimes give great relief to the cough of nervous subjects; but we have found them very uncertain.

- [15. R—Acid. Hydrocyan., gtt. x.
 Mist. Amygdal., f ℥iv.
 Syr. Amygdal., f ℥j.
 M.
 Sig.—A tablespoonful three or four times a day.]

Besides the means directed against the bronchial disease, it is of great importance to attend to the state of the functions in general. In febrile cases, the daily exhibition of a saline purgative is advisable. Should there be any complication with abdominal disorder, it is obvious that this should be attended to. Thus, when pain of the right side and shoulder, with perhaps fulness and tenderness in the right hypochondrium, stools of unnatural colour, a loaded tongue, and turbid urine, indicate disordered function of the liver and alimentary canal, it will be desirable to put the patient under an alterative course of blue pill and mild aperient medicines, in order to improve the functions of these important organs. Again, where a florid tongue, tender epigastrium, frequent thirst, dry skin, and nightly accessions of fever, indicate that the disease extends to the mucous membrane of the stomach and bowels, it is quite apparent that many of the remedies directed against the bronchial disease will not be borne, or will prove injurious, until the gastric disease be relieved by leeches and blisters to the epigastrium, followed by the mildest alterative aperients, with small doses of castor oil, and rigid regulation of the diet. Until this gastritic affection be subdued, the action of most internal remedies, even colchicum or opium, may be irritating. If due attention be paid to the removal of such complications, and if the disease do not present a decidedly inflammatory character, the weakness of the system may be combated by tonics, such as the sulphate of quinine, and the others before named.

DIET AND REGIMEN.—The diet, in all cases of chronic bronchitis, should be mild and simple, and as nourishing as can be

borne without disordering the digestive organs, or increasing the bronchial disorder. Farinaceous and milky food, with a little chicken or white fish, is best adapted to the plurality of cases; but those whose frames have been much weakened by age or by excesses, generally require more substantial animal food, with a certain proportion of wine, which, like tonics, may be allowed with most safety where a counter-irritant is habitually used. It is scarcely necessary to insist on the importance of avoiding extremes and sudden changes of temperature, insufficient or damp clothing, and all those circumstances that are frequently in themselves exciting causes of the disease: when re-applied, they must necessarily prolong it; and not a few instances are met with, in which, owing to the nature of our climate, it is impossible entirely to avoid them. In these cases, in spite of the most careful administration of remedies, the disease persists; but a perfect cure may be effected by simple removal to a more genial climate. A warm sea-coast residence is the most beneficial, especially if the patient use regular and moderate exercise in the open air. When the circumstances of the patient do not permit the measure to its full extent, a change of air to the distance of a few miles may often do good, always preferring a sheltered situation with a dry soil. The careful regulation of the air in the apartments to which he is confined during the winter months, must be the resource of many in this country; and this can now be effected with the greatest precision and economy by means of Dr. Arnott's stove, one of the most valuable inventions of the present age. There must, however, be additional means to insure the ventilation of the rooms, which may be safely effected by a small fan-wheel in a window or door, so placed as to direct the current of fresh air to the ceiling, where it would mix with the warm air of the room, and occasion no draft.

In those predisposed to bronchial inflammation, the practice of daily sponging the chest freely with vinegar, or salt and water, contributes much to diminish the susceptibility to cold; and in the winter, the chest should be well protected by a leather vest, as well as a long-sleeved flannel waistcoat.

SECTION III.

BRONCHORRHŒA.

THE mucous membrane of the air-tubes may be disordered in its function of secretion, independently of the process of inflammation; and, by the effects of the altered secretion as well as by the condition of the membrane itself, various groups of symptoms are induced. The most remarkable are those accompanied by

excess and defect of the watery part of the secretion, constituting *Bronchorrhœa*, or *Bronchial flux*. That with excess is the *Humoral Asthma* of the older writers, and the *Pituitous Catarrh* of Laennec.

SYMPTOMS.—Bronchorrhœa generally comes on without any fever, in paroxysms of asthmatic or oppressed breathing, with cough, and the subsequent expectoration of an abundant thin frothy liquid, which appears to be the natural mucus diluted with a considerable addition of the watery part of the blood, with some portion of its saline matter. In some instances the affection extends to the nasal membrane, causing sneezing and a discharge from the nostrils, similar to that of a cold in the head; sometimes the bronchial and nasal affections alternate. The attack generally comes on rather suddenly in the evening, sometimes twice or oftener in the day, and may last from a few minutes to several hours: the dyspnœa is sometimes extreme; but the strength of the respiratory forces being unimpaired, the fluid is discharged by violent coughing as fast as it is secreted, and comes up clear, slightly viscid and frothy, to the amount of a pint or more, leaving the patient almost free from complaint. On applying the ear to the chest at the commencement of the attack, various kinds of whistling, cooing, and sonorous rhonchi are heard; a little later, these become mucous and crackling or bubbling, and very little of the natural respiratory murmur is heard. The sound on percussion is generally pretty good; but in severe cases this is also impaired by the profuse quantity of liquid, which, from the sub-mucous and sub-crepitant rhonchi, may be known to extend even to the smaller bronchial tubes. As the coughing discharges this fluid, the respiratory murmur gradually returns; but even after the paroxysm is over, a good deal of whistling and wheezing may be heard in the chest.

CAUSES.—This affection commonly occurs in persons of a relaxed habit, who have a languid circulation, and are little disposed to inflammation. It appears to be frequently connected with long-standing disorder of the digestive or biliary organs. Laennec remarks that it is common in gouty subjects advanced in age, in whom the gout has become irregular and slight in its effects on the extremities. The causes which generally excite an attack are, exposure to sudden transitions of temperature, especially when the body is perspiring, disorders of the stomach and bowels, particularly from acid or acescent drinks, and other circumstances that tend to disorder the balance of the secretions and of the circulation. It sometimes arises from the unknown atmospheric influences, which develop common catarrh or bronchial influenza: in these diseases the pituitous catarrh often forms

a most prominent and important pathological part, and it may remain after the febrile symptoms have subsided.

After one attack, pituitous catarrh is very apt to recur; very slight causes, such as peculiar odours, close rooms, and trivial irregularities of diet being sufficient to re-excite it. In many cases, however—from our own experience, we should say in a considerable majority—bronchorrhœal discharges are secondary of organic disease of the heart, tubercles of the lungs, or some other organic lesion, causing obstruction in the circulation through the lungs, the flux being a natural mode of relief to the over-distended vessels. Not unfrequently it accompanies or follows dry catarrh or bronchial congestion; and we shall presently find that the pathological difference between the two affections is not great.

ANATOMICAL CHARACTERS.—The examination of the air-tubes of those who have died during a paroxysm of pituitous catarrh, discovers little or no trace of inflammation in the bronchial membrane. It is sometimes a little thickened and softer than natural, from the infiltration of serum; sometimes it is perfectly pale; sometimes a few lines or patches of vascularity are seen. The heart is commonly found more or less diseased, especially at the left auriculo-ventricular orifice; sometimes there is merely thinning of the walls. More rarely miliary tubercles are found in great abundance; and we have seen an instance of pituitous catarrh in connection with malignant disease of the bronchial glands, which seemed to press on several of the great pulmonary blood-vessels. These several results, together with the transitory character, but long-continued recurrence of these attacks, the nature of the discharge, the absence of febrile and inflammatory symptoms in the subjects, whom it affects, lead us to consider pituitous catarrh as a *profluvium* depending on a laxity, want of tone, or a mechanical obstruction of the pulmonary and bronchial vessels, rather than on an inflammation.

PROGNOSIS.—The importance of this affection varies much according to the state of the individual. When it attacks a subject enfeebled by age or disease, it may prove fatal in a few hours, there not being sufficient strength to discharge the suffocating accumulation of fluid in the air-tubes. Again, its long continuance, when it has by habit become established in the system, may waste the body, and by the struggle caused by its frequent attacks, it may aggravate or induce disease of the heart, and lead to dropsical effusions and other serious symptoms of a breaking-up of the constitution. In other cases where the body is strong or the disease slight, it may go on for years, impairing the comfort rather than destroying the general health of the individual. Its occa-

sional occurrence may even prove salutary in cases of diseased heart, by unloading the engorged pulmonary vessels, and averting more formidable evils. Andral records an instance in which a sudden temporary attack of pituitous catarrh with very profuse discharge was attended with the removal of hydrothorax. In all cases the condition of the general health and of other organs, especially the heart and lungs, must be duly considered before a prognostic of the probable issue of the case can be safely given; and if there be found by physical examination that there is considerable disease of the heart, or a probability of the presence of tubercles in the lungs, the case will assume a proportionately unfavourable aspect.

TREATMENT.—This affection is sometimes very obstinate, particularly when it has become established in the habit. The treatment should be considered in relation to the attacks of dyspnœa and expectoration, and to the condition of the system, and the pulmonary and general circulation, with a view to prevent the recurrence of the attacks. The chief indication, when an attack comes on, is to shorten its duration by diminishing the pulmonary congestion as far as possible by means of derivatives, and promoting the relief of what remains by measures which assist expectoration. From what we have already said of the nature and subjects of the disease, it may be inferred that blood-letting is rarely indicated. Immersing the hands and feet or even the whole body in hot water, or still better in a vapour bath, will sometimes, by deriving freely to the surface, much relieve the paroxysm of dyspnœa, and diminish the quantity of secretion which accompanies it; but to take effect, such measures should be employed at the earliest feeling of the asthmatic attack, and before the secretion commences, otherwise they only weaken the patient and scarcely shorten the attack. An emetic will often relieve an attack by determining freely to the surface, and by facilitating the discharge of any fluid which may have already been secreted in the air-tubes; and some cases have been signally benefited by the repeated use of this remedy. Its violent and disagreeable action, however, precludes its employment in many cases; particularly in the weakly, and those labouring under organic affections of the heart. Laennec found tartar-emetic in large doses effectual in two cases in which suffocation was threatened. Ipecacuanha is, however, on the whole, preferable, and when it cannot be borne as an emetic, it is sometimes useful in equalizing the circulation and in promoting expectoration and perspiration. When the cough is very violent, it may be advantageously combined with hyoscyamus, conium, or small quantities of opium. In a few cases we have known great relief from the tincture of the *lobelia inflata*, in the dose of from twenty to thirty

drops every hour or two hours, and increased according to its effects; but it is a very uncertain remedy, sometimes causing a most unpleasant giddiness and sickness in the dose of ten drops. In subjects that are very weak, with languid circulation, it may be necessary to give stimulants to support the powers of expectoration during the paroxysm. Of these, a strong hot infusion of coffee is the best and the most harmless, but it is apt to lose its effect; and it may be requisite to substitute combinations of ether, ammonia and camphor, with one of the remedies before named.

The most important object of the treatment is to prevent the recurrence of the attacks; and for this purpose constitutional measures are of more avail than those directed particularly to the lungs. Of the latter it may, however, be mentioned, that the habitual promotion of moderate expectoration by small doses of ipecacuanha and the balsam of copaiba or Peru, with alkaline attenuants and other remedies, recommended for bronchial congestion, may sometimes prevent that accumulation in the vessels that is apt to end in an asthmatic paroxysm. The occasional application of a blister will sometimes withdraw the irritation and flux from the bronchial surface. A course of aperients may also give temporary relief, particularly where the complaint originates in a torpid state of the bowels; but drastic purgatives should be avoided, for although they may for the time remove the pulmonary symptoms, they injure the tone of the digestive organs and insure the recurrence of the disorder. In gouty subjects it is useful to increase the urinary secretion by a moderate use of colchicum with alkalies. But these measures are of little avail, unless attempts be made to improve the tone and balance of the vascular system by a mild but tonic diet and regimen. The diet should be mild and nutritive, consisting chiefly of farinaceous food and plain meat taken at regular hours and in moderate quantity. Spirituous and fermented liquors should be taken as sparingly as the previous habits of the patient and the present strength will allow. Liquids of all kinds should be used with limitation, and with due regard to the activity of the renal and cutaneous excretions. These should be promoted by regular exercise in a bracing but not a too cold air, care always being taken that the clothing is sufficient to maintain the temperature of the surface. Such measures will generally do more than drugs; but where they prove insufficient or cannot be fully adopted, benefit may sometimes be derived from a course of some mild tonic, such as columbo, cascarilla, or even quinine with a mineral acid, or the sulphate of zinc in small doses, or one of the milder preparations of steel.

SECTION IV.

BRONCHIAL CONGESTION.

BRONCHIAL CONGESTION, or *congestive asthma*, inaccurately termed by Laennec *dry catarrh*, is another affection which exemplifies altered secretion of the bronchial membrane without inflammation. It is known more as an asthmatic than as a catarrhal affection.

SYMPTOMS.—The symptoms vary much according to its extent. In its slightest degrees it is experienced by many individuals, who only in the morning on waking feel their breath rather short until they have coughed up a little thick, tough, gray, semi-transparent or dirty-looking mucus. In its severer degrees, that is, when more of the bronchial membrane is affected, the shortness of breath may amount to asthma, which comes on in paroxysms ending with hard dry cough and the expectoration of the scanty mucus before mentioned. Occasionally there may be also a thin mucous secretion; but this is not constant, and is obviously not the general cause of the dyspnœa. Sometimes there is little or no cough; and the dyspnœa or rather shortness of breath is not in fits, but may last for months and even years without other pectoral symptoms. If an attack of bronchitis supervene, there is a great aggravation of the dyspnœa, often amounting to severe asthma, and the symptoms of the two complaints are conjoined. But in simple bronchial congestion, there is no fever, or sign of inflammation, but sometimes a sense of heat and constriction, or rather of stuffing, in the chest. There is often, however, much gastric disorder, with swelled and slightly furred tongue, relaxed uvula, and congested tonsils.

The *physical* sign of this disease is a more or less complete suspension of the respiratory sound in the part affected, whilst the chest at that point sounds well on percussion. This suspension is caused by the tumefaction of the bronchial membrane, which either of itself, or assisted by the scanty thick mucus before mentioned, obstructs the passage of the air in ordinary respiration.— Sometimes during coughing, or violent efforts of respiration, a clicking, wheezing, or sibilant sound announces that the obstruction is not quite complete; and some of the tubes will generally yield some of these rhonchi in common breathing. These signs, together with the character of the expectoration, will suffice for the diagnosis.

CAUSES.—Excesses in diet, the sudden removal of cutaneous eruptions, suppressed gout, and sudden checks given to perspira-

tion or any other free secretion, occasionally excite this affection. These causes operating on systems not much disposed to inflammatory reaction, such as those of a torpid habit of body, destroy the balance of the capillary system, and occasion an undue distension or congestion in certain parts of it. The same kind of passive congestion is sometimes more directly occasioned by organic diseases of the heart, particularly those in which there is some obstruction in the left ventricle; and these cases frequently are accompanied by the symptoms of dry catarrh.

ANATOMICAL CHARACTERS.—The membrane of the air-tubes is generally found of a deep red or violet colour, and sometimes partially tumefied, but without softening or ulceration. These circumstances, together with the sudden and intermitting character of the disease in some instances and its long stationary duration in others, seem to indicate that the affection rather belongs to the class of passive congestions which may be produced and removed, or endure for an uncertain period without that tendency to definite terminations which inflammations manifest. This congestion may doubtless sometimes originate in inflammatory affections of the same part; but according to our experience it is more commonly, as already stated, the result of disorders of the digestive or other organs, which tend to injure the tone of some other part of the capillary system; and when from prior tendency the bronchial membrane becomes its seat, its secretion is impaired and the symptoms above described are induced. Occasionally bronchial congestion is conjoined with bronchorrhœa; but according to the view which we have taken of that affection, the pathological causes of the two do not very widely differ, the same circumstances which cause a loss of tone in the capillaries being capable of either relaxing their exhalations, or dilating their caliber; or, what is more usually the case, some parts of the membrane are affected with one, and some with the other, and the result is the expectoration of much thin glairy fluid with little pellets of tough mucus in it. So, too, by a modification in the properties of the congested vessels they may be excited or relaxed, and relieve themselves by the exhalation of their watery contents; and we accordingly sometimes find an attack of catarrh or asthma, at first quite dry, and devoid of any but the tough expectoration, suddenly relieved by a copious discharge of a thin frothy fluid. This happens commonly where the congestion is a mechanical result of organic disease of the heart.

PROGNOSIS.—Dry catarrh, although sometimes severe and difficult to remove, is rarely a dangerous disease, except in so far as it may be connected with organic lesions of the heart or extreme general debility. According to the extent of the bronchi affected,

the disease varies from a degree not interfering with the general health, to one amounting to severe asthma. Andral records two instances in which fatal asphyxia was caused by tough mucus that plugged up one of the great bronchi, and which no efforts of coughing were able to remove; but these are to be considered as accidental cases; and generally the expectoration comes at last, to the temporary relief of the breathing even in the most severe cases. But the continuance of the disease tends to induce permanent lesions of the pulmonary texture, particularly dilatation of the tubes and cells, which tend more constantly to injure the function of respiration, and sometimes eventually to destroy life.

TREATMENT.—Depending as this affection generally does, on constitutional causes, it requires general treatment as well as measures calculated to improve the condition of the affected membrane. A due management of the diet, avoiding all acid, rich and irritating articles of food, the promotion and regulation of the excretions by the appropriate combinations of mild aperients and diuretics, such as blue-pill, ipecacuanha, rhubarb, aloes, nitre, colchicum, &c., followed by mild alterative tonic medicines and suitable exercise, are the measures best calculated to restore and maintain that balance and tone of the sanguiferous system, which is incompatible with the congestive distensions of its parts.

With regard to the remedies directed to the congested membrane, it is not found that those useful in bronchitis are of much avail here. Blood-letting produces little impression. Dry cupping and other means of derivation are occasionally of more use. Stimulating applications to the surface of the chest, such as turpentine and vinegar or ammonia embrocations, or pitch plasters, or even dry rubbings are frequently of temporary advantage. There are, however, means of increasing the bronchial secretion, and thus reducing the congestion, which, as temporary remedies, have considerable efficacy. We have before noticed the property which alkalies seem to possess, of determining to the bronchial surface; and we have now to notice, in addition, their attenuant or dissolving power, which diminishes the tenacity of the bronchial secretion, augments its quantity, and thus facilitates its expulsion. Their action is probably in great measure chemical. We know that alkaline remedies render the urine alkaline, and therefore increase the alkaline quality of the blood. Now there is no solvent of mucus more powerful than alkalies; and it is easy to conceive that an alkaline state of the blood can scarcely be compatible with the formation of tough solid mucus. Having followed the example of Laennec in using this class of remedies, we have found them very beneficial in promoting the expectoration, and relieving the dyspnoea of dry catarrh. The *Liquor Potasse* (℥xx. to xl.) carbonate of soda (gr. x. to xx.) or carbonate

of ammonia (gr. iij. to vj.,) may be given three or four times a day, with squill, ipecacuanha, or colchicum, and some narcotic, according to the general state of the system and the prevalence of particular symptoms. Laennec recommended also the use of alkaline baths, and of sulphur baths in cases complicated with cutaneous eruptions. The inhalation of the steam of hot water, alone or with camphor, tar vapour, ammonia, or any other volatile matter which may render it slightly stimulating, is sometimes of use. Some patients derive benefit from smoking tobacco or stramonium, particularly when there is also a tendency to spasm in the bronchi.

SECTION V.

[HAY ASTHMA.]

THIS peculiar affection, called also *summer bronchitis*, *rose catarrh*, &c., and occurring in the summer and autumn, has been recently described by British writers, particularly Dr. Bostock and Dr. Elliotson.

SYMPTOMS.—It commences with uneasiness, heat and itching in the eyelids, particularly severe along the tarsi and carunculæ lachrymales. The membrane is red and injected, but the inflammation does not extend to the eyeball. These symptoms are accompanied with increased lachrymation, a sense of fulness in the eyeball, intolerance of light, and weight or pain in the region of the frontal sinuses. The irritation soon extends to the Schneiderian membrane, and is attended with itching and stuffing of the nostrils, increased secretion of mucus and violent paroxysms of sneezing. If the attack be severe, the mucous membrane of the fauces and larynx becomes involved, causing a sense of dryness, and extreme itching or constant tickling in the throat, slight cough, tightness across the chest and difficulty of breathing; but there is little or no expectoration. Several paroxysms may occur in the course of the day. There is usually an exacerbation soon after rising in the morning.

CAUSES.—The causes of this singular affection are generally regarded as due to some emanation from new cut hay. Many persons suffer annually severely from this disorder; and cannot go into a hay-field without being attacked. There is probably some idiosyncrasy which acts in these cases. Some individuals are affected in the same manner by smelling powdered ipecacuanha, a common garden rose, the bean flower, &c. &c. A case is related in which the symptoms of this affection were produced

in the son of a lady who was subject to hay asthma herself, by the smell of the Guinea pig; and of another individual, in whom the fur of a hare immediately brought on an attack.

TREATMENT.—But little can be done for this disorder, the attack usually subsiding in a short time. The sulphate of iron and quinine, with the cold shower bath, have been recommended as the best means of prophylaxis. During an attack, the treatment should be palliative and the diet not too rigid. Dr. Elliotson suggested the use of the chlorides of lime or soda as disinfecting agents, and the result in several cases was satisfactory. Much yet remains to be studied, both concerning the nature and treatment of this disease.]

SECTION VI.

NEURALGIA, OR PAINFUL SENSIBILITY, OF THE AIR-TUBES.

A PAIN in the larynx, or under the sternum, is sometimes produced independently of inflammation or any other affection. It is most commonly excited by breathing cold air, but sometimes comes on independently of any such cause. This morbid sensibility, although often, is not invariably accompanied by increased contractility. Spasmodic asthma, or spasm of the glottis, may be unattended with any other pain than that common to dyspnoea; and, on the other hand, the weak or relaxed state of the bronchial tubes, marked by difficult or imperfect expiration, is sometimes accompanied by an increased sensibility of the bronchial membrane, so that the breathing of cold or irritating air becomes unusually painful. Under such circumstances the pain may be considered as nervous, depending on an excessive sensibility of the sentient filaments of the par vagum, like the gastrodynia and morbid sensibility of its gastric branch.

TREATMENT.—The direct application of narcotics, by inhaling their vapour or smoke, will sometimes relieve nervous pain of the air-tubes. The vapour of hot water charged with camphor or conium with an alkali, smoking a cigar, or even holding in the mouth a lump of camphor or a warm aromatic lozenge, a bit of ginger, or a clove, will, in some cases, remove the pain, and enable the individual to take breath freely. Where cold air only excites the pain, a respirator, or some warm porous material held to the mouth will prevent it. But it is better to attempt to reduce the morbid sensibility by the daily use of the shower-bath, or by freely sponging the throat and chest with vinegar or salt water, at first tepid, but after a few days quite cold.

SECTION VII.

STRUCTURAL LESIONS OF THE AIR-TUBES.

A. HYPERTROPHY AND INDURATION OF THE AIR-TUBES.

CHANGES of structure in the bronchial tubes are most commonly the result of inflammation, or of some kindred modification of the nutritive process. Frequent recurrence or long continuance of inflammation of the bronchial membranes, as in other structures, changes their condition, and the mechanical forces to which they are subjected in the function of respiration may variously modify this change. The most simple change of structure is a mere thickening of the mucous and submucous tissues. This, generally, in some degree, accompanies acute inflammations, but is then only temporary, and subsides as the secretion becomes free and albuminous; being caused, probably, by only an infiltration of the pores of the tissue with soft lymph, which, as the inflammation subsides, is eliminated and expectorated with the mucus of the membrane. The deposits that are the most readily produced by inflammation in highly vital tissues, are also the most readily removed; and thus it is that the soft albuminous matter that is effused by acute inflammation in cellular textures and in parenchymatous organs in general, if it be not so abundant as to compress the vessels, becomes absorbed as the inflammation subsides.

But it is otherwise when the inflammation recurs frequently, or lasts long; for it then causes an effusion less susceptible of absorption, involves the less vital structures; and as the changes induced are slow, so they are more permanent, because they become identified with the nutritive or reparative functions of these tissues. A degree of hypertrophy is then produced of some or all of the various tissues composing the tubes. Sometimes there is extraordinary thickening of the mucous membrane, so that it forms projections within the tube. More commonly, however, it is the harder and less vital textures that undergo the change, and its effects is to increase the rigidity of the tubes, so that there is a diminution of their expansibility and contractility. Nothing is more common than to find the air-tubes of persons who have long suffered from bronchitis, presenting an unusual development of the longitudinal elastic fibres. In other cases, the outer cellular coat of the larger bronchi is thickened and indurated, and their cartilages are sometimes partially ossified. Any of these changes has the effect of rendering the lungs less easily expansible in respiration: the first in particular is a common cause of the short breath from which persons frequently affected with bronchitis generally suffer; and although not often serious in itself, yet it

may so abridge the sphere of the function of respiration as to make its increased exertion, during bodily exercise, a matter of difficulty and disorder, and to render it ill able to bear any other disease, to which the lungs can in general adapt themselves by supplementary efforts.

SYMPTOMS.—The chief sign of hypertrophy of the longitudinal fibres, and of increased rigidity of the tubes generally, is difficulty of inspiration, which is short, quick, and performed with an effort, especially on making any exertion; whilst the expiration is comparatively easy; but both acts are often accompanied by wheezing sounds from irregularities in the caliber of some of the tubes, and frequently from partial congestion or inflammation, from which tubes thus diseased are rarely free. The vesicular murmur is impaired, and the expansion of the whole chest is perceptibly limited. These signs resemble those of spasmodic asthma, except that they are permanent, and are not removed as the latter may be, for an instant, on breathing after holding the breath in the manner before described.

TREATMENT.—Inasmuch as these lesions seem to arise from continued inflammation, it becomes of the more importance to direct remedies against those forms of bronchitis that are habitual or frequently recurring. An imperfectly cured cough will often harass a patient for months, and even for years. In process of time the breathing becomes permanently shortened, and an irritation is often fixed in some of the tubes, manifesting its effect on their secreting function by habitual expectoration, generally thin and mucous, sometimes muco-purulent. This affection varies greatly in degree. We have known several cases of habitual dyspnoea, presenting the characters now described, ultimately prove fatal, and after death no other lesion discovered than a general redness of the membrane lining the larger tubes, and an extraordinary development of the longitudinal fibres. There is one point with regard to treatment particularly suggested by a knowledge of this change of structure, that not only should the practitioner persevere in the use of the means which tend to eradicate the low degrees of inflammation that produce it, especially alkaline expectorants and counter-irritants, but he should also endeavour to countervail, by *mechanical* means, that mechanical limitation which this change induces in the size of the tubes. If the patient use no exertion and give his lungs little play, any increase in the rigidity of the tubes will more readily fix them in their present contracted state; but if he take moderate exercise, increased as habit improves his power, the lungs will be kept in that free mobile condition that is least favourable to rigidity or deposition of any kind. Probably special efforts of inhalation would be useful with the same view; and as

this might be combined with some mildly stimulating vapour, such as that of water impregnated with tar or camphor, it might be also serviceable in improving the secreting properties of the membrane. It is obvious, however, that great discretion is necessary in the employment of these mechanical means, for if they strain the tubes beyond the due limits, they may cause a morbid yielding of the walls, and increased inflammation; and if exertion be used beyond what the function of circulation can readily support, it will occasion congestion in the lungs, which may aggravate the original disease, and induce lesions of other kinds. These mechanical measures are more adapted for young than for old subjects; because in the latter the change is more likely to be permanent, under the influence of that general law by which, as age advances, fibrous tissues tend to assume a cartilaginous hardness, and cartilage becomes rigid with osseous matter.

B. DILATATION AND OBLITERATION OF THE AIR-TUBES.

On examining the lungs of patients who have long suffered from complaints of the chest, it is not uncommon to find the bronchial tubes, when laid open by a pair of scissors from the large to the smaller branches, exhibit dilatations of different kinds, the enlargement being usually most apparent in those parts of the tubes where the cartilaginous plates are small and few; but occasionally the larger tubes are also dilated, their rings only here and there limiting their dilatation. Sometimes the dilatations are pretty uniform through some length of a tube. [This affection is, in a large majority of cases, if not invariably, consecutive to, chronic bronchitis; but when established, it has special signs, and peculiar symptoms, and besides, its diagnosis and prognosis are important from the liability that there is of its being confounded with phthisis pulmonalis. It is by no means a frequent disease. Laennec cites four cases, of which he saw two; Andral five, one doubtful; and Louis eight or nine during his service at La Pitiè, in about ten years. The majority of patients afflicted with this disorder are usually over forty, but children sometimes suffer from it; Laennec records a case in a child three years and a half old, and M. Legendre another, quoted by Valleix, in a child of seven, of general dilatation of an entire lung. Males seem much more liable to it than females, six out of seven cases occurring in males; a result corresponding to the greater frequency of bronchitis in males than females.] In other cases they form irregular roundish cells or pouches, freely communicating with each other, from which other tubes arise either dilated or undilated. [Thus tubes of the fifth or sixth division of a bronchus may equal in size the bronchus itself, and tubes naturally no larger than a crow-quill may become as large as the finger. This dilatation may be confined, (though but rarely,) to a single bronchus, or to a single

branch, or it may extend to all the bronchial ramifications of an entire lobe, and sometimes terminates in a cul-de-sac on the surface of the organ. The same bronchus may be dilated at intervals, so as to form a series of alternate dilatations and contractions, giving the bronchus a *beaded* appearance.] The tissues surrounding the tubes are generally more or less altered. They are least so in the uniform or tubular form of dilatation, in which the coats are often quite thin, and the longitudinal fibres distinct, although occasionally enlarged. But in the more globular or cellular dilatations, the walls of the tubes are commonly much altered; they are irregularly thickened, the thickening being formed in part by hypertrophy of the mucous and submucous tissues lining the tubes, and partly by a dense tissue on their outsides, probably consisting of the parenchyma of the lung compressed by the encroaching tube. There is little or no trace of the longitudinal or circular fibres in this form of dilatation, and the lining membrane is generally in a softened state and of a red colour, whilst some parts of the tubes are quite rigid. [The walls of the dilated bronchi are for the most part thickened and scattered over with irregular cartilaginous fragments, even in those portions near the periphery of the lungs. The mucous membrane is thickened and granular, not transparent, of a more or less red colour, sometimes brown, and more or less softened. Cases have also been related by Barth, Andral, and Guersant, in which the walls of the dilated portions were thin, transparent, and globular, resembling blisters; these were noticed especially in young children, and from the absence of all inflammatory signs, they considered them congenital. The matter contained in dilated bronchi resembles the sputa which is expectorated during life. In a case observed by Louis, of globular dilatation, there was found a yellow, friable, unorganized matter, which could be mashed under the finger like cheese, and was evidently tuberculous. The pulmonary tissue, around the dilatation, sometimes retains a certain degree of elasticity. It is in such cases that percussion is of no value. But ordinarily, if the bronchi are much dilated, the pulmonary tissue is condensed, as if the cells had been forcibly and mechanically compressed; but it does not lose its elasticity; and will subsequently expand, thus differing from that which surrounds tubercular caverns. It is impermeable to air, and presents no granulations on being cut into. In a case reported by M. Legendre, the pulmonary tissue was of a scirrhus consistence, and resembled, in colour and density, the tissue of the uterus. These are the cases in which dulness on percussion exists.] We shall better understand the pathology and signs of these lesions by examining a little into their causes.

CAUSES.—Laennec, who first described dilatation of the bronchi, ascribed it to the frequent accumulation of mucous in the tubes, causing their mechanical distension. He considered that they were

formed especially by long-continued chronic bronchitis, and that the continual recurrence of the same distension of the tubes led to their permanent dilatation. But this view is by no means sufficient to account for the remarkable changes which we frequently see in the structure of the dilated tubes; nor do these lesions constantly occur where the bronchial secretion is copious, and most calculated to cause distension. M. Andral takes a more rational view in ascribing these lesions to a modification in the nutrition of the textures composing the tubes; but he does not attempt to explain the mode in which the change is effected. If, however, we bear in mind the details of the internal mechanism of respiration, and the manner in which they may be deranged by disease in the various textures concerned in them, we shall find no difficulty in tracing several causes of dilatation of the air-tubes, as well as an explanation of the changes in their tissues and those of the surrounding parts. A mutual pressure is continually exerted between the interior of the bronchial tree and the air: in inspiration, by the air which enters to distend the tubes; in expiration, by the tubes contracting to expel the air. In forcible acts of respiration, such as coughing or energetic breathing, this pressure is increased; but in the normal condition of the tubes, when they all equally and freely convey the air to and fro, and meet the pressure with a well-proportioned degree of elasticity and contractility, this pressure is balanced and borne well. But if in any way the equality of this pressure be disturbed, or those elastic and contractile properties that are opposed to it be deranged, it becomes converted into a cause of unnatural distension in some parts, while it does not reach others with sufficient force. There are several conditions which may cause these disturbances, and they are especially to be met with in those diseases which are known to lead to dilatation of the air-tubes. Bronchitis may act in both these ways: by thickening of the membranes or by viscid secretions, it may cause partial or complete obstructions, which, by preventing the free entry of air into some tubes, increase its pressure into others, which become distended in consequence; and it may alter the condition of the tissues composing the tubes, so that, losing their elastic and contractile properties, they yield to the pressure and become fixed in this dilated condition. Perhaps, as Dr. W. Stokes has suggested, the mere loss of contractility may in itself be sufficient to cause dilatation of the bronchi; but our view will be more satisfactory if we take into consideration that this distending force is applied to textures softened and otherwise modified by inflammation, and that the change may thus become perpetuated and combined with other alterations in the textures affected. Hence the lesions are often not simple dilatations of the tubes, but comprehend also irregular softenings and indurations, atrophy and thickening of their several textures: so that when the lung

is cut open after death, it may be at first difficult to discover that the irregular cavities and indurations which it presents are formed by dilated tubes. Then, in the production of these dilatations, we are not to forget the influence of violent acts of respiration. They have been observed to succeed to whooping-cough, and other bronchial affections in which the cough is particularly violent and long-continued. But we have met with cases of dilated bronchi in which there had been very little cough, and none of any violence; and here we must suppose that the other causes, the irregular introduction of air, and the partial yielding of the tissues, were more exclusively concerned in the production of this lesion. Of this kind are the following cases. In pleuro-pneumonia, the lung is inflamed and at the same time compressed by an effusion in the sac of the pleura: if it remain long in this state, the smaller air-tubes and cells become obliterated by the adhesion of their sides, so that when the liquid is removed from the pleura, they will not expand again with the enlargement of the chest; but the large and middle-sized bronchi are not obliterated,—they bear the whole force of the inspired air, and become consequently dilated by it. These cases, although not uncommon, were not noticed by any writer, until described in the author's lectures published in the *Medical Gazette*. Dr. Corrigan has since described cases of dilated bronchi, which seem to be of the same character, although he refers them to the production in the lung of a new contractile tissue, like the cirrhosis of Laennec. We doubt the propriety of giving such a name to a lesion which seems to be the result rather of inflammation modified by the circumstances of compression or of slow progress, than of a peculiar production like the cirrhosis of the liver. Other lesions which cause the obliteration or obstruction of a considerable number of tubes and cells, tend to produce dilatation of the adjoining tubes, on which the motions of the chest act with augmented force. Thus it was observed by M. Reynaud, that when bronchial tubes become obliterated in consequence of the effusion and organization of lymph within them, (a result connected with pneumonia rather than bronchitis,) they are sometimes dilated up to the obstruction, and the neighbouring tubes and cells commonly so. The same result is not unfrequently observed in connection with tubercles which press on some tubes or obliterate the cells to which they lead. Larger tumours, such as aneurisms and cancer of the bronchial glands, pressing on one of the great bronchi, in a similar way, cause unusual distension of those parts of the lung to which the other bronchus leads.

SYMPTOMS.—The symptoms produced by dilatations of the bronchi vary according to the extent of the lesions. Slight degrees of them are met with in the bodies of persons who had not during life manifested any prominent disorder of the respiration; and their

simpler forms may exist to a greater extent without producing other effect than a liability to attacks of bronchitis. But where many tubes are affected, their structure modified, and much of the vesicular parenchyma obliterated in consequence, there are then produced habitual dyspnœa, with more or less cough and muco-purulent expectoration, which is often remarkable for its fœtor. The ordinary symptoms of severe chronic bronchitis, from which some of the affected tubes are scarcely ever free, are generally present; and the permanency of these symptoms, together with a degree of lividity, dropsical effusion in different parts, and cachectic condition of the whole frame induced by the crippled state of the lungs, constitutes the usual general character of the aggravated forms of dilated bronchi.

[In the cases which come under the notice of the physician, the disease will be found to have existed for some time. The patients will state that they have suffered from a violent cough for a year or more, with exacerbations more or less violent, at variable intervals. In the case of M. Lejendre, mentioned by Valleix, the little patient suffered a few days after birth, with all the symptoms of a violent catarrh, which constantly recurred till the age of four, when the first manifest signs of dilatation of the bronchi occurred. The cough is generally obstinate, frequent, easy, and but little painful. The expectoration is abundant; the sputa opaque, little or not at all aërated, yellow, greenish in colour, and sometimes even brownish; they are sometimes thick, adherent to the vessel, and mingled with a slight quantity of frothy saliva. In some cases the expectoration resembles pus, and in these great fœtidity is observed both in the breath and matter expectorated. The expectoration is more abundant in the morning and evening than at any other time; it sometimes will cease entirely for some days, and then a large quantity, of purulent aspect, will be voided. The dyspnœa is very slight, except when an accumulation occurs or acute bronchitis supervenes.]

The general health of patients suffering with dilated bronchi is often perfectly good; there is no fever, or loss of flesh. When the disease is very far advanced, there may be emaciation and hectic. When these symptoms are present, the disorder is generally complicated with tubercular phthisis. The supervention of acute bronchitis occasions an augmentation in the intensity of the local symptoms, accompanied with a febrile movement.]

The physical signs of dilated bronchi are very intelligible. [Percussion frequently furnishes no sign of value, but when the dilatation is considerable, and when the pulmonary tissue around is more or less condensed, there is decided dulness. When the dilatation occupies the bronchi of a whole lobe, or a whole lung, there is also dulness.] The air passing through them in respi-

ration causes a louder, hollower, more blowing sound than in those of the natural dimensions; hence a kind of tracheal or cavernous respiration is heard over them in regions where naturally the respiration is vesicular; and if, as it frequently happens, there be liquid in the tubes, the bubbling into which it is thrown will be coarse and gurgling, instead of the finer mucous rhonchus of common bronchitis. So, also, the voice may be powerfully transmitted through these enlarged tubes, not as usual in a diffused fremitus, but loud and startling, as if issuing from the spot; in some cases cracked and jarring as in bronchophony; in others more articulate, and with a snuffling or hollow sound, as in pectoriloquy. These, however, are also the signs of tubercles and excavations in consumption, with which the lesion under consideration is commonly confounded; we must therefore seek for other distinctions.

DIAGNOSIS.—Besides, in the history of the case, and in the character of the constitution, these are sometimes to be found,—in the situation of the sounds, which in phthisis is usually in the upper parts, but in dilated bronchi in the middle regions of the chest; in their character in relation to time, those in phthisis tending to increase and spread as the excavations proceed, whilst those of dilated tubes will remain nearly stationary for weeks and months; in there being less change in the shape of the chest with dilated bronchi than with phthisis, unless they have succeeded to pleuro-pneumonia, in which case the change is different; and, finally, in the nature of the sound on percussion, which in phthisis is more dull chiefly under the clavicles, whereas in dilated tubes, if any dulness exist, it is generally in the mammary, lateral, or scapular regions of the chest, and is often accompanied by a peculiar hollow sound, which, from its resemblance to that produced by mediate percussion on the trachea, or by tapping with the finger on the mouth of a phial, we have called *tracheal* or *amphoric*. We shall have occasion to mention this sign in treating of pleurisy and pneumonia.

The differential diagnosis between dilated bronchi and phthisical cavities will be better understood when the signs and symptoms of the latter have been fully described. We shall only add here, that when a case presents itself in which there have been cough, long continued with expectoration, dyspnœa, loss of flesh and strength, hectic fever, and even some of the physical signs of cavities in the lungs, the practitioner should be cautious in pronouncing it to be tubercular, if it be qualified by all or most of the following conditions:—If no proofs of a scrofulous habit can be traced; if the complaint have originated in a long-continued and violent cough, or in an attack of pleuro-pneumonia, and, considering its duration, emaciation have not proceeded far:

if the purulent expectoration have been fœtid and sanious, rather than flocculent or caseous; if the bronchial or cavernous respiration, or voice, be heard rather in the middle than in the upper portions of the chest, and be there spread over a considerable extent of surface: if these middle portions chiefly sound differently on percussion, being dull when the rest of that side sounds pretty well, or amphoric when the side is generally dull and contracted; and if, although the cough and expectoration continue undiminished, these signs remain stationary for many weeks together. In such a case the strong probability is in favour of its being one of dilated bronchi and not phthisis.

[Dilatation of the bronchi may also be mistaken for acute and chronic pneumonia. The former mistake could only arise where an acute bronchitis supervened to complicate the original disorder. With violent fever, obstinate cough, we have the local and physical signs just mentioned. If, however, we inquire into the circumstances of the case, we shall find that an habitual cough had existed for some time before this attack; that at the debut there were neither chill, pain in the side, nor deranged stomach; that the sputa was not characteristic; and that the general symptoms are not in relation to the extent of disorder indicated by the physical signs. Chronic pneumonia is much more rare than dilatation of the bronchi—succeeds to acute pneumonia—and is always accompanied with emaciation and fever.

Can we diagnosticate whether the dilatation is continuous or globular? In uniform dilatation of any extent there is dulness, with bronchial respiration and bronchophony, mingled with mucous rhonchus. In globular dilatation there is cavernous respiration with limited mucous rhonchus and pectoriloquy.

PROGNOSIS.—Dilatation of the bronchi is not in itself a dangerous disease; patients dying with it have generally succumbed to other affections. But the condition of the lungs, and the facility with which bronchitis is contracted, expose patients to acute chest affections, and principally to pneumonia, which may occasion death.]

TREATMENT.—It is obvious that dilatations of the bronchi, when once formed, can be little under the influence of medicine. The profuseness of the secretion may sometimes be restrained by acid mixtures; and we have known the nitro-muriatic acid in a few instances for a time remove its fœtor. Probably inhalations of chlorine or iodine would be useful in such cases. Where the cough is violent and troublesome, it should be allayed as much as possible by sedatives, such as hyoscyamus, belladonna, conium, and particularly opium or some of the preparations of morphia; due attention being at the same time paid to the state of the excreting functions

and the general condition of the system, which may need various kinds of treatment in different cases. The co-existence of chronic bronchitis often renders external counter-irritation of service, and other antiphlogistic measures are occasionally required for supervening acute inflammation. It is, however, from preventive measures that we may expect more success; and our knowledge of the causes and tendencies of this lesion suggests the inexpediency of abandoning the treatment of cases of bronchitis, pertussis, and pleuro-pneumonia, until the cough and physical signs have been satisfactorily removed. Most of the severe cases of dilated bronchi that have fallen under our observation, we have traced to imperfect treatment in former inflammatory attacks, especially those affecting the parenchyma of the lungs, which have yet been disguised under the name of a severe cold or influenza.

C. CONTRACTION OF THE AIR-TUBES.

[This lesion of the air-tubes is even more rare than the one just described. Its practical importance is not great. A few cases have been collected by Andral and others, where the air-tubes were considerably contracted in a greater or less extent; a large bronchus, in one instance, was so contracted as not to admit the end of a small probe. When this contraction is acute, it is due simply to considerable thickening of the bronchial mucous membrane, and is in such cases never excessive. In cases of chronic contraction, all the tissues of the air-tubes have been found hypertrophied,—and in one case Andral found in one of the smaller air-tubes a cartilaginous mass developed in its walls, which obstructed the cavity in a great measure.

The symptoms of narrowing of the bronchi are few. According to Andral, the chief rational one is habitual dyspnœa, which is less violent when the contraction is chronic than when acute. In his cases, however, other disorders, in which dyspnœa is a symptom, existed, as pleurisy and tubercles.

Percussion furnishes no sign of value. Auscultation detects sibilant and sonorous rhonchi, and sometimes, as in a case of Andral's, a considerable diminution in the respiratory murmur in that portion of the lung to which the contracted bronchus is distributed.

The disease is so little known that it is not worth while to treat of it at greater length. Its treatment is the same as that of chronic bronchitis.]

D. ULCERATIONS, TUMOURS, ETC., OF THE AIR-TUBES.

Ulcers seldom originate in the bronchi, but in connection with some cause which concentrates inflammation in a peculiar manner on the bronchial membrane, and carries it to the submucous tis-

sues, such as the habitual inhalation of irritating particles of dust, in the occupations of needle pointers, stone masons, and leather-dressers, the continued passage of tuberculous matter in phthisis, and occasionally the specific influence of measles, scarlatina, small-pox, and syphilis. We can describe no signs by which the presence of ulcers in the bronchi can be distinguished: but they rarely, if ever, exist without similar lesions in the larynx, in which case the voice is often impaired or lost. Ulcerations of the trachea and larynx are very common in phthisis, and from the observation of Louis, seem to be in some degree caused by the contact of the matter expectorated, for he found them particularly on that side of the windpipe on which the lung was most excavated. Ulcers of the larynx are commonly the effect of chronic laryngitis, which has already been described.

Tumours of various kinds are occasionally developed in the windpipe, and others external to the tube may press upon it and interfere with its function. The most common seat of the former is in the larynx: if small, they may continue long accompanied with violent cough and fits of stridulous breathing from spasm like chronic laryngitis: if large or of rapid growth, they may speedily occasion suffocation, preceded by the symptoms common to irritation and obstruction of the larynx.

External tumours pressing on the air-tubes are not of a very uncommon occurrence. Of those situated in the neck, bronchocele sometimes has this effect; but, as Dr. Stokes has observed, it is chiefly by tumours originating within the chest, where the windpipe is surrounded by an unyielding frame of bone, that compression of this tube is produced. Such are aneurisms of the aorta and innominate, various tumours of the deep-seated cervical and bronchial glands, and enlargement of the thymous gland. We have met with instances of all these lesions, except the last, inducing pressure on the windpipe or one of its branches, and inducing dyspnoea, which in some cases was the obvious cause of death. In two cases the tumour was encephaloid, originating apparently in the bronchial glands, and surrounding the trachea at its bifurcation, both of the branches in one instance, and one in the other, being considerably compressed by it. In one of these cases the blood-vessels, although passing through the tumour, appeared to be quite free; in the other, the vena innominate was partially compressed. In a case of aneurism of the ascending aorta the right bronchus was compressed. In another of aneurism of the innominate, the trachea was compressed at its bifurcation.

The signs of *aneurisms* compressing the air-tubes have been particularly described by Dr. Stokes. The general symptoms are dyspnoea, generally accompanied by acute bronchial irritation and

a sense of constriction under the sternum, occasionally dysphagia, distension of the jugular vein chiefly on one side, œdema of the face, and other signs of venous compressions. The chief physical signs are hissing or sonorous respiration heard best at the top or on one side of the sternum, with weak vesicular sound on that side, various signs of displacement of the windpipe, the lung, and the clavicle, dulness on percussion, and occasionally projection of some of the upper portions of the chest, generally most on one side, in which, in cases of aneurism, and sometimes of other tumours, there is a double or single pulsation. This is not the place for entering into details with regard to the signs of substernal aneurism; but we may remark that in more than one case we have observed slight oppression of the breathing at a very early stage, before there were signs of bronchial compression; and we are disposed to attribute this, as well as the paroxysmal attacks of dyspnœa occasionally occurring in the further progress of aneurismal and other tumours in this region, to an irritation of the vagus and its recurrent branch, which these tumours generally affect; and we agree with Dr. Stokes that the alterations of the voice are referable to varying irritation of the recurrent nerve. But the laryngeal constriction is sometimes also complicated with inflammation, to which the air-tubes are particularly subject under the influence of aneurismal irritation. We lately witnessed a case in which a patient with a substernal aneurism was at the point of death from spasm of the glottis, with stridulous breathing, which afterwards assumed the form of acute laryngitis, and was relieved by free expectoration after venesection and the prompt administration of mercury. In two instances we have observed dyspnœa, or rather oppressed breathing, for a time in connection with scrofulous enlargement of the lymphatic glands, manifest in those of the neck and axilla, and supposed to reach to the chest, yet without the hissing breathing in the trachea or the deficiency of vesicular sound in the lung, indicative of bronchial compression: the symptom here was probably from irritation of the pneumogastric nerve.

The treatment of tumours affecting the air-tubes is to be conducted on the general principles of counteracting, as far as possible, the irritation which they produce in the vessels, nerves and muscles of the respiratory organs. Hence, according to symptoms, antiphlogistics, sedatives and antispasmodics may be useful. Except in the case of enlarged lymphatic glands, it is of little use to attempt the cure of the disease itself. In that case a judicious course of alkalies and hydriodate of potash, with some mild tonic and sea air, will sometimes succeed in reducing the swellings, and removing the symptoms which they occasion.

SECTION VIII.

[HÆMOPTYSIS, OR HÆMORRHAGE FROM THE LUNGS.]

HÆMOPTYSIS (from *αἷμα*, blood, and *πτύσις*, spitting,) signifies the spitting of blood, without reference to its source. Pathologists, however, agree in limiting the term to the voiding of blood from the organs of respiration, and more especially the lungs and their mucous membrane. To indicate with greater precision the origin of this hæmorrhage, the term *pneumorrhagia* has been proposed as a substitute, but it is scarcely more definite, and has not been generally admitted by authors. After epistaxis, hæmoptysis is the most frequent of all the hæmorrhages; and from its seat and nature, it has, from the earliest times, occupied a large share of the attention of medical writers. Like most of the hæmorrhages, hæmoptysis is usually symptomatic, though sometimes it occurs as a primitive or essential affection. Two species must, therefore, be admitted, 1. essential; and 2. symptomatic. The former, though rare, still does occasionally occur, and includes those cases of pulmonary hæmorrhage which, independent of any appreciable organic lesion, replace some constitutional sanguine flux, as the catamenia in females, and hæmorrhoids in males. Those instances of bronchial hæmorrhage, occurring to travellers in ascending very high mountains, are also to be classed with this species. The second species, which is the most common, is most frequently dependent on the presence of tubercles in the lungs, though occasionally it results from cardiac disease. The hæmorrhage, from the rupture of an aneurism of the aorta into the trachea or bronchi, is also included in this species.

CAUSES.—These are of two kinds—predisposing, and occasional or exciting. Hæmoptysis occurs most frequently between the ages of fifteen and thirty-five, the period of life at which phthisis is thought to be most common. It is met with, however, occasionally at a much more advanced age. Children under seven years of age are probably never attacked. Between that age and puberty, it sometimes happens, both as a primitive and symptomatic affection. Rilliet and Barthez mention two cases of essential active hæmoptysis, occurring in plethoric young girls between the ages of twelve and fourteen. Both had been subject to attacks of violent epistaxis. The previous tendency to mucous hæmorrhage, the strength of constitution, the approaching period of puberty, with the absence of all signs of phthisis, led to the belief of its essential nature. In both instances intense bronchitis followed, and, perhaps, bronchial congestion. A recent writer on phthisis in children (Dr. P. Hennis Green) declares

that it is by no means uncommon in the course of that disease. Sex has a marked influence on the occurrence of hæmoptysis. Females are much more subject to it than males, not only from their greater predisposition to phthisis, and their liability to suppression of the catamenia, but it also occurs more frequently in tuberculous females than tuberculous males—in the proportion of three to two, according to the observations of Dr. Louis. A peculiar habit of body was once thought to indicate a predisposition to hæmoptysis, but the supposed constitutional characters are those of phthisis, and the symptom has been mistaken for the disease. The same may be said of hereditary influence. The suppression of an habitual sanguine evacuation, or the omission of an accustomed venesection is also to be enumerated amongst the causes of this affection. The suppression of the catamenia is the most frequent cause of essential hæmoptysis. Dr. Hoffman relates a remarkable instance of the effect of the neglect of an habitual bleeding. On the first omission a violent hæmorrhoidal flux occurred; and on the second a copious hæmoptysis. Whatever impedes the circulation of blood in the lungs, has a tendency to produce hæmoptysis. Organic affections of the heart, more especially of its right cavities, are very apt to be accompanied by hæmoptysis. Chomel mentions the case of an individual suffering under hypertrophy of the heart, who, whenever he ran any distance, was attacked with hæmoptysis, which ceased on his remaining quiet. The great rarity of the atmosphere on the tops of mountains, or in very high latitudes, is also an occasional cause of hæmoptysis. Blows on the chest, or penetrating wounds of that cavity, may also be ranked among the causes. Prolonged exertion of the voice, and playing on wind instruments, are by some considered both as predisposing and exciting causes. De Haen mentions the case of a child who was attacked with spitting of blood after having sung very loudly for some time. It recurred three times, but the patient ultimately recovered. But the most frequent cause of this affection is phthisis. Hæmoptysis, to a greater or less extent, occurred in two-thirds of the cases of phthisis which fell under the observation of Dr. Louis. It is very frequently, as we shall hereafter see, the earliest rational symptom of this malady, preceding cough and expectoration. Louis is of opinion that hæmoptysis, if at all severe, and when not traumatic or evidently supplementary, no matter what may have been the period of its occurrence, is, with infinite probability, due to the presence of tubercles in the lungs. When it occurs as symptomatic in children, Rilliet and Barthez think that it is always connected with bronchial phthisis: under these circumstances, it is generally abundant and terminal. Laennec regarded pulmonary apoplexy as a cause of hæmoptysis, and Broussais supported this opinion. Louis denies this, and asserts

that pulmonary apoplexy is frequently discovered, on examination after death, in individuals, who, during life, never had had hæmoptysis; and that the converse is no less common. Pulmonary apoplexy, he states, was very common in the autopsies of those who died of yellow fever in 1828, at Gibraltar, and in no instance did hæmoptysis occur. Besides, he says, that he has frequently seen patients suffering under severe hæmoptysis, either during the attack, or immediately afterwards, and in no case did he ever discover the symptoms pointed out by Laennec as those of pulmonary apoplexy.

SYMPTOMS.—An attack of hæmoptysis is sometimes preceded by premonitory symptoms, though when the hæmorrhage is slight or moderate, they are frequently absent. In the cases which fell under the notice of Dr. Louis they were generally wanting. The initiatory general phenomena consist in a chill, or alternations of heat and cold, flushing and pallor of the face, with general lassitude. A sensation of heat and weight in the chest, sometimes amounting to a dull or sharp pain, with dyspnœa, tickling behind the upper part of the sternum, or in the trachea, with a short dry cough, and a saltish or sweetish taste in the mouth, are the local precursory symptoms. When the hæmorrhage is active or supplementary, all the symptoms of hyperæmia—as a flushed face, a full and frequent pulse, and cephalalgia—may both precede and accompany the hæmoptysis. The acceleration of pulse noticed by some writers is most probably due to the concomitant affection, phthisis. After the variable duration of these symptoms, or without their intervention, the hæmorrhage occurs. When the blood is exhaled into the bronchi, it is not always immediately voided, but remains awhile in the air-tubes, giving rise to a train of phenomena, which are sometimes improperly included amongst the precursory symptoms. These symptoms are a distressing sense of ebullition within the chest and in the trachea, a rustling sound, produced by the air mingling with the exhaled blood in the successive movements of inspiration and expiration, together with severe dyspnœa. These symptoms usually persist throughout an attack. The exhaled blood is expelled in various ways. In a large majority of cases, its presence in the bronchi provokes a fit of coughing, and the blood is expectorated like ordinary sputa. When the hæmorrhage is abundant and rapid, the bronchi are quickly filled, the respiration becomes greatly embarrassed, and the patient appears threatened with suffocation. In such cases the expiratory muscles contract violently, and the blood is expelled with violence into the pharynx, where its sudden afflux excites the effort of vomiting, and the blood is rejected with force through the mouth and nose, sometimes in such quantity as to amount to a full stream. When slight, the blood sometimes gradually reaches

the mouth without provoking even cough, and is simply expectorated. In such cases its presence in the mouth is often the first indication of an attack. All these modes of expulsion may be successively observed in the same attack. When the hæmoptysis is moderate, the blood is fluid, vermilion, and spumous, the two last conditions being due to the admixture of atmospheric air; when excessive, it is pure and free from air; and when slight, it is generally dark and coagulated, owing to its prolonged sojourn in the air-tubes; this appearance occurs also towards the decline of an attack. The degree of coagulability is only worthy of attention when the blood is voided in a fluid state. In such cases, when the subject is plethoric, and chiefly in cases of essential supplementary hæmoptysis, it promptly forms a voluminous and firm clot. If, on the contrary, the individual be anæmic or scorbutic, it remains more or less fluid. When the hæmorrhage is of long duration and the subject feeble, the blood being very serous, remains in greater part fluid, even though at first it had been very coagulable. The violence and abundance of the hæmorrhage are very variable, ranging from a few bloody sputa to several quarts. When so excessive as to destroy life immediately, it is generally due to the rupture of an aneurism into the trachea or bronchi, although sometimes this happens in hæmoptysis from simple exhalation. Valleix mentions the case of a woman at the hospital of St. Antoine in whom the hæmorrhage was so violent, that although immediate assistance was given, she died almost instantly, nearly exsanguineous. On examination no other lesion was detected beyond a few crude tubercles in the lungs. Dr. Chapman once saw at least two quarts come away in twenty or thirty minutes.* Laennec says that he has known thirty pounds lost in about fifteen days, and in a very extraordinary case ten pounds in forty-eight minutes. J. Frank has collected a number of cases of abundant hæmoptysis, in one of which twenty-five pounds of blood were voided in three hours. The largest quantity that he himself saw was twelve pounds in twenty-four hours. A slight hæmoptysis is where a few mouthfuls of spumous blood, either pure or mixed with mucus, are voided. It is considered copious when two or three ounces of blood and upwards are evacuated within an hour.

Of the general symptoms which accompany hæmoptysis some are due to the hæmorrhage, others to the shock and trepidation produced on the patient by the sight of the blood. The sudden pallor, tremors, and syncope are produced, when the hæmorrhage is slight, by fear; and when severe, by the hæmorrhage itself. On auscultating a patient labouring under hæmoptysis we detect a loose mucous rhonchus

* Lectures on the more important Eruptive Fevers, Hæmorrhages, &c., p. 173. Philadelphia, 1844.

over a greater or less portion of the chest, as the hæmorrhage is more or less intense. When the hæmoptysis is slight, the rational symptoms above enumerated are rarely of any duration; but if the hæmorrhage is abundant and continues for any time, they often become frightfully severe. The face becomes very pale, and the extremities icy cold, and the whole body is bathed in cold perspiration; the pulse is frequent, small and irregular; syncope, more or less prolonged, occurs, and sometimes even violent convulsions take place; finally, when the bronchi become engorged, the symptoms of actual asphyxia are superadded, and the patient dies suffocated. Death is sometimes, though rarely, caused by exhaustion from the excessive and repeated losses of blood.

After the cessation of hæmoptysis, if it has been at all copious, there are usually considerable languor and pallor, with a quick, irritable pulse, and great impressibility—all the phenomena, indeed, of anæmia; but the subsequent emaciation and debility must not be attributed to the hæmoptysis, but, in a majority of cases, to the accompanying lesion.

Most persons who have once suffered from an attack of hæmoptysis rarely escape subsequent ones. Many cases of supplementary essential hæmoptysis recur at regular intervals, at or about the period of the suppressed flux of which it is supplementary; but in most instances it recurs at very irregular intervals, and without any appreciable cause. Cases of regular intermittent hæmoptysis have been cited. Dr. Chapman mentions the case of a lady, the wife of a respectable clergyman of this city, who, for eleven successive days, had hæmoptysis at precisely nine o'clock in the morning, always preceded by a slight chill.* Recently, Dr. Mazade related an instance where it returned every two days at ten o'clock in the morning, and yielded finally to the sulphate of quinine. M. Fantonetti has cited two other similar cases. Thompson, Borsieri, Richter, and other writers, mention numerous cases of the same kind. The natural tendency to intermittence of this affection, though ordinarily without any periodical precision, should be considered, together with the fears and anticipations of the patient, before implicitly acknowledging the reality of these cases. A fatal termination in hæmoptysis is said to be very uncommon. It is usually, as we have seen in adults, an early symptom of phthisis, and rarely occurs at the close of the disorder. We have witnessed four fatal cases within the last eighteen months; Louis met with three in three hundred cases. In all these instances the patients were tuberculous, and they died in a short time after the commencement of the hæmorrhage, asphyxiated from the quantity of effused blood. According to Rilliet and Barthez, when it occurs in the phthisis of children, it is abundant and terminal.

* Chapman, loc. cit., p. 173.

PATHOLOGY.—The seat of hæmoptysis is almost always the mucous membrane of the lungs. The blood is exhaled from the mucous lining of the air-tubes. Even when caverns exist, Louis considers exhalation as still the most common cause, although sometimes the ulceration and destruction of the walls of a large vessel traversing a cavity, are the proximate cause. The anatomical lesions are of two kinds; the one peculiar to the affection, the other belonging to the disorder of which the hæmoptysis has been the symptom. The symptomatic lesions are tubercles in the lungs, and disease of the heart, especially of its right cavities. On examination after death the bronchi are found filled with extravasated blood, and the mucous membrane highly congested, or pale and softened.

DIAGNOSIS.—In the diagnosis of hæmoptysis, several points are to be considered. We are first called on to determine whether the hæmorrhage is really from the respiratory organs, or from the nasal fossæ, the stomach, or the mouth itself. When the blood is derived from the nasal fossæ, it usually escapes at the same time from the nose and the posterior nares, and thus no doubt of its origin is left. If, however, the hæmorrhage takes place entirely from the posterior nares, the blood falling into the pharynx, provokes a constant tickling or cough, and the blood mixed with air, is voided by the mouth, thus resembling severe bronchial hæmorrhage. The true origin of the hæmorrhage may be ascertained, from the anterior history of the patient, who will be found to be liable to epistaxis, by a careful examination of the nares and mouth, by the absence of all symptoms in the chest, and the immediate cessation of cough on the termination of the hæmorrhage.* In hæmatemesis the blood is black and in soft clots, and sometimes diffluent; it is not voided after an effort of coughing, but by the forcible contraction of the stomach, diaphragm and abdominal muscles, and is usually preceded by nausea, gastric distress, and heaviness and weight in the stomach; after the vomiting has ceased, one or more bloody dejections usually occur; finally, besides the absence of all pectoral symptoms, hæmatemesis commonly accompanies organic diseases of the stomach, which are easily recognized.

Having ascertained the source of the hæmorrhage, it is often of great importance to determine whether it is essential or symptomatic. Hæmoptysis is, as we have seen, most frequently symptomatic, being secondary, in a large majority of cases, to tubercles

* A curious case of pharyngeal hæmorrhage is related by M. Aulanier, (*Jour. de Med. et Chir. Prat.*, t. x. p. 506,) where a leech was swallowed when quite small, and having attached itself to the pharynx, and attained a considerable size, caused a copious spitting of blood, until it was finally detached by the effects of vomiting.

in the lungs. The absence or presence of symptoms of tubercles in the lungs, will, of course, enable us to determine this. When cardiac disease is present, also, no difficulty occurs. When the hæmorrhage succeeds to the suppression of some habitual discharge, as the catamenia or hæmorrhoids, or the omission of an accustomed venesection, if no emaciation or loss of strength precede it, if evident relief follow it, if the patient be plethoric, we shall then, after careful physical exploration, have good reason to believe it to be essential or supplementary. The subject is one, however, of great delicacy and difficulty, and we should be very careful before hastily deciding.

The rupture of an aneurism into the bronchi or trachea generally proves instantly fatal, but this does not invariably occur. In some instances the blood escapes slowly and in small quantity through the clots which line the sac, and a moderate hæmoptysis is the consequence, which might be regarded as idiopathic if a careful investigation of the case is not made.

PROGNOSIS.—Hæmoptysis is rarely fatal in itself, but it is dependent, in a very large proportion of instances, on an incurable malady, and is to be regarded as a very serious affection. In three hundred cases, Louis saw it prove fatal three times. We have met with four fatal cases within the last eighteen months. In all these the patients were tuberculous, and died asphyxiated from the excess of the hæmorrhage. When it occurs in the latter stage of phthisis, and is at all copious, it is more likely to be fatal than when it happens at an earlier period, when the patient is less exhausted. When supplementary, it is usually without danger.

TREATMENT.—When called to a case of hæmoptysis, the first duty of the physician is to calm and assure his patient, who is generally in a highly nervous and frightened condition. He should be placed in a sitting posture, the clothes loosened, the windows open, so that the apartment be freely ventilated, and the most perfect repose and silence enjoined. If you have reason to believe the hæmorrhage is active and essential, blood should be drawn freely from the arm, revellents applied to the extremities, and an active purgative exhibited. But, in a vast majority of cases, the condition of the patient will not admit of depletion to any amount, and in many instances, it is entirely inadmissible. When there are evident signs of congestion present, we should bleed; but if the hæmoptysis be tubercular, and the patient feeble, we should be extremely careful how we resort to venesection, for it will probably not influence the duration of the hæmorrhage, and will compromise the strength of the patient. In addition, therefore, to the means just enumerated, a large sinapism may be applied between the shoulders, or over the front of the chest, the

feet placed in a hot bath, rendered stimulant by the addition of salt or mustard, and mustard poultices may be applied to the arms and thighs. A laxative enema may be given, and a saline purgative should be administered.

16. R.—Magnes. Sulph., ℥vj.
Acid. Sulph. dil., gtt. xv.
Inf. Rosar., f℥vj.

M.

Sig. One half immediately; the remainder in three hours.

Small pieces of ice, or iced water or lemonade may be allowed, but the quantity of fluid permitted should be limited. Dr. Chapman states, however, that he has seen a glass of iced water administered every fifteen minutes of decided benefit in arresting the hæmorrhage.* The chloride of sodium is a popular remedy of great repute in hæmoptysis, and is commonly immediately resorted to by the patient or his friends on the occurrence of the bleeding. Teaspoonful doses of it are swallowed every ten or twenty minutes. Dr. Law, of Dublin, (*Cyc. Prat. Med.*, art. Hæmoptysis,) says that he has seen it of essential service. From our own experience, we are unable to form any estimate of its value. The nitrate of potash also enjoys great popularity as a remedy in this affection. It is thought to be directly hæmastatic, and to act by increasing the coagulability of the blood. It has been administered to the amount of an ounce in the twenty-four hours. From its sedative properties it is no doubt, conjoined with other means, a valuable remedy. In obstinate cases it has been recommended to apply cold water and even ice to the chest; and Louis states that he has had recourse to it with advantage. It is at best a measure of doubtful propriety, and when resorted to should be continued for a very short time. The whole class of mineral and vegetable astringents has in this, as well as the other hæmorrhages, been constantly employed, and with variable success. Of these the acetate of lead in small doses, in combination with opium, is often of decided advantage where the hæmoptysis is passive, moderate, and of frequent recurrence.

17. R.—Plumb. Acetat., gr. xii.
Opii, gr. iv.
Con. Rosar, gr. i.

M.—Div. in pil. xii.

Sig. One three times a day.

Rhatany has been loudly praised by M. Mailly; and M. A. Latour has recently strongly recommended tannin.

18. R.—Acid. Tannic., gr. iv.
Pulv. Acac., gr. xvj.
Syr. q. s.

M.—Ft. pil. viij.

Sig. One every three hours for two days.

* Chapman, loc. cit., p. 184.

Monesia has also been lauded.

19. R.—Monesiæ.

Con. Rosar. āā gr. xv.

M. Div. in pil. x.

Sig. Two every two hours during the day.

Alum is thought by some to be peculiarly efficacious. Dr. Copeland has a high opinion of the effects of the oil of turpentine, which he has himself used extensively, and Dr. Wiltshire declares that it acts more promptly than any other astringent, and that he has seen hæmoptysis, which had resisted all other means, yield immediately. It may be given in doses of ten drops every quarter of an hour, in cold water, during the spitting of blood. The mineral acids, too, have also been tried, but no evidence of their efficacy has been adduced. Emetics are highly esteemed by many practitioners in hæmoptysis, both from their revulsive and sedative effects, and of late years this mode of treatment has been strongly recommended by Chapman, Nonat and Rufz, of Martinique. In cases of hæmoptysis with inflammatory symptoms, when the action of the heart is increased and when there is reason to apprehend pulmonic inflammation, tartarized antimony, combined with nitre, is recommended by Dr. Cheyne as superior to all other remedies.

20. R.—Ant. et Potass. Tart., gr. i.—ij.

Potass. Nitrat., ℥ij.—iv.

M.—Div. in pulv. iv.—viiij.

Sig. One every hour.

Dr. Graves places great confidence in ipecacuanha. He gives two grains every quarter of an hour until some improvement occurs, and then every half hour or hour until the bleeding stops. Local bleeding, by cups or leeches to the chest, is variously estimated, many practitioners being of opinion that it is likely to produce or increase the evil it is intended to remove. Dr. Graves, however, considers the application of leeches in the hollow of the throat, just above the sternum, as an excellent adjuvant in arresting the progress of hæmoptysis. When the cough is very teasing, and the quantity of blood expectorated very large, six leeches should be applied every sixth hour, until decided relief is obtained; in less severe cases, a smaller number applied daily will be sufficient.—(A Syst. of Clin. Med., p. 276.) Sir James Clark regards purgatives as highly useful in hæmoptysis, which, he thinks, in consumption is frequently connected with hepatic engorgement. The returns of hæmorrhage, he has often found, did not cease until the biliary secretion assumed a natural appearance. In all cases of hæmoptysis he recommends a strict attention to the condition of the liver. In essential active hæmoptysis, of frequent recurrence, small bleedings, frequently repeated, are of great service, and often succeed in arresting the attacks. After an attack of

active hæmoptysis, if much excitement continues, the diet should be sparing and unirritating.

After the paroxysm is over, the patient must continue in a state of perfect tranquillity of mind and body; silence must be enjoined; and a mild, nutritious and dry diet prescribed. The state of the pulmonic circulation should be carefully watched, for appropriate timely measures in that quarter will often prevent a relapse. A strictly regulated regimen and attention to the chylopoietic viscera are also very important. When the loss of blood has been considerable, and the patient's strength much reduced, mild tonics may be employed with benefit, such as the cold infusion of bark, with dilute sulphuric acid. An agreeable and suitable preparation under these circumstances is that made by the process of displacement.

21. R.—Pulv. Cinchon. Flav., ℥j.

Aquæ, q. s.

Displace f ℥vj.

Sig. A tablespoonful four, five or six times a day.

In chronic hæmoptysis unattended with excitement, and where the system is relaxed and debilitated, the chalybeates are very useful. Mead speaks highly of the chalybeate mineral waters under these circumstances. The iodide of iron, in doses of two or three grains, in aqueous solution, has been much recommended, and Dr. Dunglison states that he has derived decided benefit from its employment.

Where hæmoptysis is evidently supplementary, immediate and appropriate measures must be taken to restore the suppressed discharge. If it be vicarious of hæmorrhoids, leeches should be applied around the anus and aloetic purges administered; if of the catamenia, leeches to the inner portion of the thighs, the warm hip-bath, and other suitable measures, should be employed.]

SECTION IX.

PULMONARY EMPHYSEMA, OR DILATATION OF THE AIR-CELLS.

[Pulmonary emphysema was not practically known until investigated by Laennec, although it had been described anatomically by Ruysch, Valsalva, Morgagni, Baillie, and others. Laennec studied the symptoms of those affected with ordinary asthma, and referring them to the pathological condition of the lungs, found them to be due to a greater or less dilatation of the pulmonary vesicles. Since then the disease has been the subject of the especial study of Dr. Louis,* our own highly gifted countryman,

* Mémoires de la Société Médicale d'Observation, t. i. Paris, 1837.

the late Dr. J. Jackson, jr., of Boston, and Dr. Beau,* who has written an excellent paper on the mechanism of its production. Latterly, Rilliet and Barthez have investigated the same affection in children, where, however, it is comparatively rare, and have differed somewhat from Laennec and Louis. Many important questions connected with this disorder are still undecided, and a difference of opinion prevails regarding it amongst many distinguished observers.

Pulmonary emphysema is an affection characterized by increased capacity, to a more or less extent, of the thoracic parietes, accompanied with increased sonorousness of the chest on percussion, and diminished respiration in the dilated portions, with more or less frequent paroxysms of dyspnœa, and with marked dilatation of the pulmonary vesicles on examination after death.

Pulmonary emphysema is a very frequent disease. Louis was enabled to observe ninety cases in less than two years. Out of fifty patients dead of cholera, twenty-three had suffered from more or less emphysema. Most cases of asthma are instances of emphysema; idiopathic spasmodic asthma being an exceedingly rare affection, as we shall see hereafter.]

This lesion, like others essentially affecting the structure, will be best understood through its anatomical characters.

ANATOMICAL CHARACTERS.—These present some variety, but they have this in common, that when examined either through the pleura in the recent state, or after this membrane is inflated, dried, and sliced, the air-cells are seen much larger than those of healthy lungs. When the dilatation is general, the pleural surface of the lungs may be as smooth as usual, only more convex; but when it is partial, there are seen either several enlarged vesicles or lobules forming irregular prominences. Individual vesicles are sometimes seen under the pleura, and especially at the margin of the lobes, dilated to the size of a pea, a hazlenut, and in some cases to a much larger size. Dilatation may be partial or general: general dilatation may affect one lung, or the whole, or a considerable part of both lungs; partial dilatation may affect all the vesicles of a lobule or be confined to distinct vesicles. These different lesions may be accompanied by very opposite conditions of the texture of the lung: sometimes this has acquired an increased rigidity; it does not collapse where the chest is opened, and resists the impression of the fingers more than a healthy lung. There are notwithstanding the dilatation of the air-cells and its general lightness, hypertrophy and toughness of some of its textures, and portions near the root are sometimes found considerably indurated. With this condition there are commonly associated

[* Archives Générales de Médecine, Etudes théoriques et pratiques, etc., Dec., 1840.]

an altered state of the air-tubes, redness and thickening of the mucous membrane, hypertrophy of the longitudinal fibres, dilatation or partial contraction. In other cases, there is the opposite condition of the lung. The texture is more flaccid and yielding than usual; and when the margin of a lobe is pressed between the fingers, it feels thin, almost like a single membrane. It often does not collapse on opening the chest, and this appears to arise from a loss of elasticity, for it pits on pressure like an œdematous lung, and is commonly much paler than usual. This is the condition which M. Lombard describes as *lobar emphysema*; and he remarks that the inter-vesicular texture seems to have been absorbed, and the blood-vessels obliterated, changes which he considers to be the cause, rather than, as we view them, the effects of the dilatation. Andral has noticed this condition of the lung, under the name *atrophy*, and remarks that it occurs most frequently in old people. We have seen it both general and partial; the partial kind of flaccid dilatation being common in the anterior lobules and margins of the lungs in tuberculous phthisis. The fringe of dilated cells, like a row of beads, sometimes seen at the margin of the anterior lobes, is also simple dilatation, without the least rigidity.

CAUSES AND NATURE.—Laennec explained the origin of this lesion in this manner:—in cases of chronic catarrh, particularly of the dry kind, the small bronchial ramifications become so obstructed by the swelling of their membranes or by the secretion of a viscid mucus, that the air can be forced through them into the vesicles only by an effort. Now, as in ordinary respiration, the inspiration, a muscular effort, is more forcible than expiration, the former may prove sufficient to overcome the obstacle to the introduction of air into the vesicles, while the expiration is inadequate to expel it. Successive portions of the air expanding by the increased temperature are thus introduced and incarcerated in the cells, which are thereby kept in a state of continued dilatation. This may be one mode in which the air-cells become dilated, but there are probably other causes more efficient and common in operation. When there is partial or complete obstruction in any of the bronchial tubes or cells, the inspired air cannot press with the usual force beyond the obstructions; but it presses with more than the usual force into the adjoining tubes and cells to which its access is quite free, and these latter may thus become distended, and in time permanently dilated. The obstructions may be caused by viscid secretion in the tubes, thickening of the textures, tuberculous deposits, and the like; and it is with diseases in which these occur, that dilatation of the air-cells is most commonly associated. Another cause of dilatation of the air-cells is rigidity or want of extensibility of the longitudinal fibres of the

bronchi. This change has been already noticed as an effect of chronic bronchitis; and it is easy to perceive, that if the tubes do not lengthen with the expansion of the chest, the air will press unduly on their terminating cells, and occasion their dilatation. Thus we find the margins of the lower lobes most dilated, for these are most exposed to the influence of the forces expanding the chest. It is not common to find the marginal vesicles dilated in the lungs of old people with ossified cartilages; which may also be ascribed to the comparatively immobile state of the ribs and central portions of the lungs, and the increased action of the diaphragm, and consequent undue pressure of the air into the texture immediately contiguous to this part of the respiratory apparatus. Such are the chief mechanical causes by which the vesicular texture of the lung becomes distended: but there are others of a more vital nature, which may also be concerned in the production and perpetuation of this lesion.

[Louis has denied the explanation offered by Laennec. In nearly all his observations, the dyspnœa was not preceded by bronchitis; in several instances it occurred several years subsequently—Laennec has admitted the possibility of this—and the dyspnœa did not appear to be augmented by the occurrence of an intense acute catarrh. Again, we have seen that the maximum intensity of emphysema is at the free border of the lung and its neighbourhood, whereas that of bronchitis is posteriorly and inferiorly. Neither does pneumonia favour the development of emphysema. (Grisolle.) Moreover, whatever may be the size of dilated vesicles, they are always found empty, containing neither mucus nor false membrane. According to Louis, we must admit, both in vesicular dilatation as well as in bronchial, a force analogous to that which presides over the development of hollow organs, in virtue of which, these latter enlarge without our being able to account for it by means of any obstacle or mechanical obstruction. Beau advocates Laennec's theory, and contends that pituitous catarrh, also, is a cause, acting in the same manner. If it be true that emphysema is produced by secretion in the manner indicated, it is also certain that this cause is not constant, and that every thing is not mechanical in its production—some peculiar predisposition, that is yet not understood, is also connected with it. The distinguished Vienna pathologist, Rokitansky, believes that emphysema usually results from the forced inspirations in croup, whooping-cough, &c. &c. A simple moral emotion has produced the disease; Laennec has recorded two instances, and Louis the same number. Its hereditary character has been studied by Jackson—out of twenty emphysematous patients, the parents of eighteen were emphysematous; out of fifty non-emphysematous individuals, three only had asthmatic parents. The influence of certain disorders on its production has not yet been sufficiently studied.]

M. Andral conceives that the air-cells sometimes become enlarged by a wasting away and breaking down of some of their walls, so that several are reduced to few of larger size. This has been shown by M. Lombard to be the case whenever the enlargement of some cells is considerable: but we are induced to consider, with Dr. Carswell, that this is a consequence rather than a cause of the dilatation. The latter author has well observed that the long-continued pressure of the confined air on the vessels is a sufficient cause of their diminution, and of the atrophy of the tissues.

Dr. W. Stokes supposes that paralysis of the circular fibres of the bronchi is a chief cause of dilatation of the air-cells. Following the view which Dr. Abercrombie holds with regard to the intestinal muscles, he considers inflammation of the tunics investing the tubes, such as that of bronchitis, to be the chief cause of this paralysis. It is, however, doubtful, that this is more than an aiding cause in the production of pulmonary emphysema. The contractile property of the vesicular tissue is not fully proved; but its elasticity is undoubted, and it is very probable that a defect of this may assist in producing the lesion in question. But the chief agents are probably the mechanical causes of irregular distension of the lungs, which have been already noticed.

Reverting to the anatomical differences of the tense and the flaccid vesicular emphysema, we may well trace in one the effect of an over-active and irregular nutrition of the textures, the common result of repeated or prolonged inflammation, and in the other the absence of any such process, if not the presence of one of an opposite character, causing a wasting of the same parts. It is obvious that these opposite conditions will lead to very different effects in the signs and course of the lesion. In the one case the lungs become comparatively fixed in a distended state; and as they resist the power of the expiratory forces to expel the air from them, unusual exertion is required in inspiration to introduce sufficient air to serve the purpose of respiration. They are therefore perpetually exposed to a distending force: and as the dilatation proceeds, and the increasing rigidity or obstruction with it, the lungs acquire a permanent volume beyond what is usual even in full inspiration, and they distend the walls of the chest, and press on and even displace the adjoining organs and vessels. Hence may be expected to arise continual oppression of the functions of both respiration and circulation, and, as the sequel, cachectic and dropsical disease of the system. In flaccid vesicular dilatation, on the other hand, there are little or no increase of volume of the whole lung, and no pressure on the other contents of the chest.

[According to MM. Rilliet and Barthez, chronic pulmonary emphysema never takes place in children except in case of rickets,

where the lung is compressed by a deformed chest ; and they suspect that all cases referred to extreme youth, are originally connected with rickets, the deformity of the chest having disappeared or diminished, whilst the pulmonary disorder has remained.]

SYMPTOMS.—We are now prepared to understand the symptoms and signs of extensive vesicular dilatation. Inasmuch as it is permanent, it will cause a constant shortness of breath, or even dyspnœa ; and the least additional obstruction, such as that of a cold, bodily exertion, or flatulent distension of the stomach, may increase this symptom to an oppressive degree, so as to resemble an attack of asthma. [In connection with dyspnœa is a feeling of oppression behind the sternum. Patients should avoid carefully and fear any thing which will accelerate their respiration ; as running or rapid walking, breathing cold air, exposure to dust, and irritating particles of any kind. Reading aloud brings on shortness of breath, and when they talk quickly, there are long and noisy inspirations interrupting their speech. Cough is a constant symptom. When the disease has existed for some time, and there are palpitations of the heart, œdema often supervenes. These symptoms are due to more or less hypertrophy of the heart. Some have supposed that the cardiac affection was a cause, but an attentive study of the history and progress of the case will show it to be simply an effect. There is no fever except in the case of an intercurrent catarrh.] The permanency of the oppression to the function of respiration in severe cases induces a cachectic state of the body, which is manifested by pallidity and some emaciation, and a depraved condition of all the excretions. In the tense form of emphysema, with increased volume of the lungs, there may be superadded the symptoms of obstructed circulation as well as imperfect oxygenation of the blood, occasional lividity and even blueness of the face and lips, dropsical effusions, palpitation and other signs of hypertrophy of the heart. Dr. Stokes has remarked, that these symptoms are always worse in cases where the lower lobes of the lungs are chiefly affected, which he explains by the enlarged lungs of these parts preventing the free play of the diaphragm. The expectoration is various ; most commonly it is mixed, a thin dirty, mucous fluid, with portions of tough, pearly clots, or of the opaque sputa of chronic bronchitis. In the attacks of acute bronchitis which frequently occur, it becomes glairy, and often very copious towards their termination, as in bronchorrhœa.

Of the *physical signs* of pulmonary emphysema, one of the most remarkable is the loud, hollow sound on percussion, which is even greater than that of a healthy chest. This is common to both the tense and flaccid kinds of emphysema ; but in the former, when extensive, there is a distinctly *raised pitch* in the sound,

such as in a less degree that which can be produced by striking the chest of a person holding in a very full breath. In fact, as in this case, the walls of the chest are rendered more tense by the increased volume of the lung, and the vibrations which they make are, therefore, quicker, although from the elasticity of the contained material, they are still quite free. In advanced cases, the increased volume of the lung is manifest in the shape of the chest, which is unusually convex or rounded. The sides, the front, the back, and even the supra-clavicular spaces, some or all present this rounded projection; and as Dr. Stokes has observed, when the lower lobes are affected, the heart, the liver, and the spleen may be displaced by the emphysematous lung, which then yields its clear resonance on percussion over an extended region. [The alteration in the form of the chest has been studied with great care by Louis, Beau and Jackson. In a large number of cases the deformity of the chest consists in a bulging, confined usually to one side of the chest, more frequently the left, commencing under one of the clavicles, and continuing to the mammary region. This protrusion is due not only to the elevation of the ribs, but also to the manifest tension of the intercostal muscles, so that the intercostal depressions are no longer felt. Occasionally this prominence exists on both sides. Sometimes the bulging is seen on the posterior portion of the chest. It occasionally involves the whole chest, and is globular. Another bulging discovered by Louis occurs frequently; its seat is behind the clavicles; the post-clavicular region is effaced, and the plane of the anterior part of the chest is continued uninterruptedly to the lateral parts.]

In this tense kind of vesicular dilatation, the sound of respiration is very imperfect and wheezing, and forms a remarkable contrast to the efforts used to introduce and expel the air. On inspecting the chest it can be seen that, with all the expiratory efforts, it is very little diminished, and retains its large convex shape; whilst every intercostal and every supplementary muscle can be seen at work, endeavouring in vain to depress the ribs. We can scarcely wonder that this force, continually exerted on the thoracic vessels through the stuffed lungs, should obstruct the circulation, and cause lividity, cyanosis, dropsical effusions, and diseases of the heart. Inspiration is more easy, but even this requires exertion, for breath is taken, as it were, on the top of breath, and needs the supplementary aid of the cervical and superior dorsal muscles. Sometimes there are heard in the chest some odd sounds, besides the various rhonchi of the tubes, such as a sudden, loud clicking or cracking, as if from the sudden passage of air into or out of a set of tubes and cells which were before closed. Sometimes there is a sound of friction like that of a finger rubbed on a table, perhaps produced by the rubbing of projecting lobules or cells against the costal pleura.

The signs of the flaccid kind of dilated air-cells may be much modified by the other disease, such as tuberculous deposit, that commonly produces it; but they are essentially distinct from those of tense emphysema, and this difference has not been noticed by authors. There is the clear sound on percussion, but no raising of the pitch of the sound. In old people, where this form of emphysema is uncomplicated with solid deposit, the sound on percussion is clearer and deeper than in any other case. Neither the shape nor the motion of the chest is materially affected; and the sounds of respiration, instead of being obscure and wheezing, are remarkably loud and even puerile, sometimes with a little whiffing or bronchial character, probably from accompanying dilatation of the tubes. The reason of all this will be apparent when we reflect that, in these cases, air passes freely into and out of the dilated cells; and that their enlarged size, together with the increased energy which the feeling of dyspnœa gives to the acts of respiration, explains why the sound of respiration should be louder than usual.

[The subjoined tabular view exhibits the physical signs of pulmonary emphysema.

Inspection.—General expansion, giving a globular form to the chest if it exist on both sides, bulging of the infra-clavicle, post-clavicular, mammary and central sternal sub-regions, or of the anterior surface generally; diminished motion of expansion and elevation; and consequently of retraction and depression; duration of expiratory movement considerably exceeding that of the inspiratory; movement of expansion diminished as compared with that of elevation; costal motions diminished.

Application of the Hand.—Vocal and tussive vibration diminished.

Mensuration.—Semicircular measurement of one side, or of the whole chest, increased increase of bulk, under expansion of thorax in inspiration less than natural.

Percussion.—Increase of clearness and of duration of sound; resistance of walls decreased; character of sound more or less tympanitic; comparatively deficient diminution of clearness of sound at the close of a full expiration; limits of pulmonary sound scarcely reduced at the close of a full expiration.

Auscultation.—Respiration weak, in very rare cases suppressed in the affected part, exaggerated in those adjoining rhythm of the respiratory act divided; murmurs harsh, with expiration more or less, sometimes enormously prolonged, and in some cases absent altogether, although inspiratory murmur apparently audible, sibilant, sonorous, mucous, or subcrepitant rhonchi, from accompanying bronchitis; vocal resonance unaltered or weaker than natural; intensity of transmission of heart's sounds through the affected part diminished.

Situation of surrounding parts.—Heart detrued towards the opposite side, if one lung only affected; if downwards towards the epigastrium, if both are implicated; mediastinum detrued to the opposite side; either division of the diaphragm pushed downwards with the subjacent abdominal viscera,—this in some cases only.

DIAGNOSIS.—It is difficult to mistake this affection for any

other. In dilatation of the bronchi the paroxysms of dyspnoea are not so well marked as in pulmonary emphysema; and over the diseased portion of the lung there is bronchial or cavernous respiration with bronchophony. In the commencement of phthisis pulmonalis, along with feeble respiration, there is dulness on percussion; in pulmonary emphysema, on the contrary, with diminished intensity in the respiratory murmur, there is increased resonance on percussion. In aneurism of the aorta, there is bulging of a portion of the chest, with dyspnoea, and, if a bronchial tube is compressed, diminution or even absence of respiration in a portion of the chest; but the flatness on percussion over the vaulted part, the increased energy in the action of the heart, and often the blowing or rasping sound, will remove all doubts.]

PROGNOSIS.—When dilatation of the air-cells is so extensive as to alter the shape of the chest and to cause constant shortness of breath, there is little probability of its ever being entirely removed, and its general tendency is to increase, especially during the occurrence of any fresh attacks of bronchial inflammation. In some cases, the disease, if not congenital, takes its origin in very early life, and the individual is always very short-breathed, and on the occurrence even of a common cold, becomes completely asthmatic. But these are not the most severe cases; such are those which supervene to repeated and obstinate bronchial attacks, which, in the course of a few months, may induce a formidable degree of the disease. Even these cases do not prove speedily fatal, but only after the system has suffered much, and long, and disease of the heart and dropsy have supervened.

TREATMENT.—The prevention of the disease is more attainable than its cure; and with this view we should endeavour to remove those inflammations which lead to an obstructed state of respiration, and to disperse the obstructions which they produce. The use of counter-irritants and alkaline attenuants and expectorants, and other remedies recommended for chronic bronchitis and dry catarrh, is the most successful mode of affecting these objects. We have seen, in several cases, considerable relief with marked improvement of the physical signs, from the use of small doses of hydriodate of potash, and liquor potassæ, with squills and other expectorant remedies. Where there is already evidence of considerable dilatation, blisters to the chest, or frictions with a strong stimulating liniment, and the inhalation of steam impregnated with a little tar, turpentine, creosote, or even iodine, may prove of some benefit. Dr. Stokes mentions strychnia as likely to restore, in some measure, the lost contractility of the circular fibres.

The symptoms which arise in inveterate cases of pulmonary emphysema must be treated on general principles, remembering

that although we may be unable to remove the cause, we may, in some degree, prevent its increase and diminish its aggravations from temporary circumstances. With this view care should be taken to avoid the renewal of bronchial inflammation and congestion, by guarding against cold, keeping the secretions free, and carefully regulating the diet. If the expectoration be not sufficiently free, and a fit of dyspnœa occur during the night in consequence, benefit may often be derived from smoking stramonium in the evening: this excites secretion from the bronchial surface, and prevents the congestion which would otherwise ensue during the first sleep.

The flaccid form of emphysema is scarcely an object for treatment: we cannot increase the number of the pulmonary cells; but we may, in some degree, so regulate the body as to diminish the want of breath, and make the small number suffice. With this view, a tranquillizing plan of medicine and regimen, avoiding all excitements of the circulation and respiration, at the same time promoting the due activity of the secretions and tone of the system by gentle exercise and alterative tonics, may serve to keep a balance of imperfect health, and prolong existence on a lower scale.

SECTION X.

INTERLOBULAR EMPHYSEMA.

Interlobular emphysema is an effusion of air into the cellular membrane between the lobules and under the pleura; and though essentially distinct from the preceding affection, it may be combined with it. It is distinguished anatomically by the air being in the lines of the interlobular septa, and contained in angular cells of various shapes and sizes, and not round ones like those of the lung. Sometimes air is effused under the pulmonary pleura, detaching it from the lung in large bubbles. This affection is commonly produced by violent efforts, or by wounds of the lung, but sometimes from rupture of the air-cells by excessive or sudden dilatation. It may, if extreme, produce sudden and even fatal oppression to the breathing; but in slighter cases, it is of no consequence, and is removed spontaneously.

SYMPTOMS.—The only sign, supposed by Laennec to mark this affection, is a sound of rubbing with the motions of respiration, which the projecting emphysematous septa or bubbles make against the walls of the chest. This is heard and felt sometimes in successive jerks, so as to resemble the steps of a person mounting and descending a ladder.

[A dry crepitant rhonchus with large bubbles was also pointed out by Laennec as pathognomonic of interlobular emphysema. The friction sound is most probably owing, when it exists, to some cœxistent pleural inflammation, as it is now generally admitted that emphysema of any form is incapable of producing it. Dr. Walshe, however, thinks that he has observed, in persons dying of extensive infiltration of air under the pleura, friction sounds, whilst there were no false membranes in the pleura on examination. Although the serous surfaces, when healthy and in their natural relation, could not produce them, yet when one lamina presents a series of elevations, their occurrence is not improbable, and Laennec's opinion, after all, may not be erroneous.]

Sometimes concomitant sub-cutaneous emphysema exists, and this serves to clear the diagnosis.

TREATMENT.—From our imperfect knowledge of this affection, little can be said on the subject of treatment. In the cases of Laennec, the termination was happy, although little or no treatment was employed. From analogy, we should be led to trust, in well-marked cases, to narcotics, pretty freely administered. When the emphysema has extended to the sub-cutaneous cellular tissue, the air may be evacuated by small incisions or punctures into the skin.]

SECTION XI.

[EMPHYSEMA IN CHILDREN.]

IN children emphysema of the lungs is always an acute affection, except when caused by the pressure of the ribs in rachitic children, but in this case the anatomical characters do not essentially differ from those we are about to describe in the acute affection.

ANATOMICAL CHARACTERS.—On opening the chest the lungs are voluminous, and occupy the entire cavity of the thorax, and do not collapse. The vesicular distension is generally at the anterior border and at the summit. Although one of the lungs may incline towards the median line, it rarely overlaps the other. When the distended parts are examined very near, the vesicles are visible to the naked eye, and are of the size of a small pin's head; the anterior border of the lung is soft and somewhat rounded; when the emphysematous portions are pressed between the fingers, they do not appear to be thicker than usual; on cutting into them, there is no appreciable thickening of the sides of the vesicles. The distended portions are generally discoloured.

Sometimes the emphysema occupies an entire lung, which has the appearance of having been blown up ; at other times it is limited to a single lobe or parts of a lobe ; occasionally it is confined to several lobules, which, from their prominence and rosy white tint, are marked off from the other depressed and violet-coloured portions. Interlobular emphysema sometimes occurs ; it ordinarily occupies the anterior part of the lungs ; you perceive transparent, sinuous, prominent, and knotted lines, which wander over the surface of the organ, are lost in its depth, and collapse on being pricked. These lines often beaded, resemble the bodies of certain insects. Sometimes the lobes are completely dissected from each other for some distance ; sometimes the two laminae of the pleura are separated by the extravasation of air into the cellular tissue. Vesicular is infinitely more common than interlobular emphysema. The disease is more often limited to the anterior border and summit than extended over other parts. General emphysema is rare ; but the extent of the lesion is subservient to the cause which occasions it, and it is accordingly general or partial.

When interlobular emphysema exists, it is either alone, or united with vesicular emphysema. Different lesions of the lungs are met with in emphysema ; but almost always inflammation of the bronchi, or of the parenchyma ; generally the seat of those affections is at some distance from that of the emphysema ; the usual seat of pneumonia and bronchitis is the inferior lobe, that of emphysema the superior. Nor does there appear to be any ratio between the dilatation of the bronchi and of the vesicles, or capillary vesicular bronchitis and vesicular emphysema.

SYMPTOMS.—The symptoms of acute emphysema in children are very different from those of the chronic variety in adults. In adults we have feeble respiration and augmented sonorousness and dilatation of the thoracic walls ; in children we have, on the contrary, great exaggeration of the respiration ; the sound on percussion is the same, and no change takes place in the appearance of the chest. The chest is naturally extremely resonant in children ; the increased rapidity of the respiration produces exaggerated respiration. Hence emphysema is difficult to recognize in children ; but Rilliet and Barthez think that it exists in all children with rachitic ribs, and in all acute affections of the respiratory organs, which have lasted for some days, and required great respiratory efforts.

CAUSES.—Emphysema is produced by the forced distension of the pulmonary cells, on account of the difficulty the air experiences in entering other portions of the organ ; or from some obstacle to inspiration either in the bronchi, or some other part of the respiratory apparatus—as when the lungs are filled with thick

mucus, with false membranes, or blood, and the respiratory movements are considerably quickened. The intensity of the oppression is in direct ratio with the intensity of the emphysema. In cases of severe pulmonary apoplexy, when suffocation has speedily ensued, general emphysema occurs. Tumours compressing the bronchi are also a cause, as well as rachitic ribs. The rapidity with which emphysema is produced under the influence of a considerable acceleration of the respiration, joined to a mechanical obstacle to the penetration of air into certain portions of the lung, is incredible.

Can emphysema persist after the disease which causes it has subsided; and is it not the point of departure of chronic emphysema which occurs later in life? There is every reason to believe not.

No peculiar treatment is required; it being merely the mechanical effect of another affection, and subsiding with the concomitant disorder.]

CHAPTER V.

DISEASES OF THE LUNGS.

SECTION I.

PNEUMONIA.

PNEUMONIA, Gr. πνευμονία, *peripneumonia*, περιπνευμονία, *pneumonitis*, *pulmonitis* (from πνευμων, *pulmo*, a lung, or the lungs), are names given to inflammation of the parenchyma of the lung. These terms were applied by Hippocrates and other ancient writers to most of the acute diseases of the chest unattended with severe pain, those connected with this symptom being by them termed *pleurisy*. Although this ground of distinction by no means holds good with our improved knowledge of the subject, yet we shall find, in opposition to the opinion of Cullen and some modern writers, that between pneumonia, pleurisy, and bronchitis, there is a distinction founded in pathology, and most important in practice.

The characteristic symptoms of pneumonia may be given as follows:—fever, with more or less pain in some part of the chest; accelerated and sometimes oppressed breathing; cough with viscid and rusty-coloured expectoration; at first the crepitant rhonchus, afterwards bronchial respiration and voice, with dulness on percussion in some part of the chest. We shall find, however, that many of these symptoms are not essentially connected with pneumonia, which, with more precision, may be defined pathologically, as inflammation and its product in the parenchyma of the lung.

SYMPTOMS.—[The mode of invasion of pneumonia is variable; it is sometimes quite sudden; at other times it is preceded by precursory phenomena, as fever, &c. In one-fourth of the cases of Grisolle there were prodromic symptoms; the proportion was the same through each of the three years, 1836, 1837, and 1840. In twenty-eight cases out of fifty, there was general malaise, with or without loss of appetite, pain in the loins, languor and very great sensibility to cold; in two there were irregular febrile movements without any apparent organic affection; eighteen exhibited

the symptoms of slight bronchitis. One-sixth of the pneumonic cases admitted into the wards of Dr. Chomel, during a period of four years, commenced with symptoms of slight pulmonary catarrh. The duration of the prodromes varied from a few hours to one or two weeks; in four-fifths of Grisolle's cases they did not extend beyond the fifth day. In the invasion of pneumonia we observe the existence of a peculiar general state of the economy, which gives rise to the development of a series of different affections, according to the individual predispositions and the susceptibility of the different organs. In such cases Andral was enabled to predict the prospective occurrence of some acute inflammation from the richness of the fibrin, on an examination of the blood.] Acute inflammation of the lungs is, like other phlegmasiæ, accompanied by fever, which often commences with rigors prior to any other symptoms, but sometimes preceded by the local symptoms. [The chill is one of the most important initial symptoms in pneumonia. It is almost constant. Except intermittent fever and puerperal peritonitis, pneumonia is of all acute affections that most frequently accompanied by a chill at the commencement. In old persons especially, a sudden chill should lead us to suspect pneumonia. Chomel regards this an invaluable initial symptom of acute pulmonary inflammation. It has served him as a faithful guide in a large number of cases. Its occurrence should lead us to look always to the lungs. In one hundred and eighty-two of Grisolle's cases, it occurred in one hundred and forty-five within the first twelve hours, and in one hundred and ten indicated the debut—about four-fifths. This statement agrees with that of Louis, who found it to happen in sixty-one out of seventy-nine cases, (*Fiev. Typh.* 2d ed. t. ii. Paris, 1841.) It varies in intensity from a severe chill to a mere horripilation. In one-half of those cases, where the initial chill was wanting, the patients went to bed more or less well, and were attacked in the midst of the night, whilst the body was warm, and protected from the external air. According to Grisolle, Hourmann and Dechambre, the initial chill was more frequently absent in the pneumonias of autumn and summer than in those of winter and spring.] The fever is generally very intense, and in plethoric individuals, accompanied by flushing of the face,* injection of the eyes, headache, and other signs of local determination of blood. [In the immense majority of cases, from sixteen to seventy years of age, pneumonia commences by local symptoms that ought to attract attention to the chest; such as pain in the chest, dyspnœa, oppression, with generally a dry, prolonged cough. This last symptom occurred in nearly eight-ninths of

[* The injection of the cheek is more marked in pneumonia of the summit than in that of the inferior lobes. There is no constant relation between the seat of the coloration of the cheek and seat of the disorder. The coloration of the face remains only during the first, or a portion of the second stage.]

Grisolle's cases. Sometimes with intense fever the local symptoms point anywhere but to the lungs. In two of Grisolle's cases there was obstinate vomiting; in one, intense lumbago, leading to the suspicion of small-pox; in three, violent frontal cephalgia, such as generally precedes typhoid fever; and one, an old man, who went to bed the preceding evening quite well, awoke in the middle of the night with agitation, fever and delirium. These symptoms lasted from one to five days, without the development of any pectoral symptoms, although the chest was daily carefully explored.] The pain in the chest, which, when present, usually appears early, varies much in degree, being sometimes intense, and sometimes diffused and dull; frequently it is a deep-seated feeling of heat and weight rather than of pain. It generally seems to be deep-seated in the chest, under the sternum, the breast, or the scapula; when more at the side, it is often more acute, and this is frequently, but not always caused by the extension of the inflammation to the pleura. [In three hundred and one pneumonic cases, pain in the side was absent in only twenty-nine, and in one hundred and sixty-one out of one hundred and eighty-two patients, it appeared within the first twelve hours; in seventeen of the remaining twenty-one, before the end of the first day, and in the four others from the second to the fourth days. The seat of pain in one hundred and seventy-five cases was as follows:

	Cases.
At the nipple, in	89
At the base of the chest, about the sixth or seventh rib,	39
Laterally, at the extremity of a line perpendicular to the nipple, but five or six lines distant from this,	13
Over the entire antero-lateral surface,	10
Within the nipple, more or less close to the sternum,	6
Posteriorly, and especially in the infra-spinata fossa,	5
In the axilla,	2
In the supra-mammary region,	2
In one of the hypochondria,	4
In the flank,	1
In the loins,	1
In the supra-spinata fossa,	1

Thus in four-sevenths, the seat of pain was at or near the nipple; in one-fifth, it corresponded exactly with that of the pulmonary inflammation; in one-seventh, it was quite near; and in the remaining ones, they were widely distant from each other. In no case did the pain and inflammation occupy different sides of the chest. The intensity of the pain varied with the epoch of the disease. At the commencement it was sharp, lancinating and pungent, in more than one-half. Whatever was its character, it was constantly exasperated by cough or a deep inspiration. In a great number of cases slight pressure, especially in the intercostal

spaces, increased the pain, and caused great suffering in the patient. (Grisolle).]

There is commonly more or less cough, which aggravates the pain: it is short and dry at first, or accompanied with scanty mucous expectoration, and is by no means proportioned to the intensity of the inflammation, being in some cases so slight as to escape notice. [Most patients begin to cough from the commencement. In ninety persons in whom the pneumonia appeared whilst in a state of perfect health, in eighty the cough was heard within the first twelve hours, in six at the end of the first, and in four at the end of the second day. The cough is rarely as painful or frequent as in acute bronchitis, nor does it augment in the evening, or during the night, nor is it, when uncomplicated with acute bronchitis, accompanied with a sharp, burning, and tearing pain behind the sternum, and in the direction of the bronchi. It is more frequent if the disease is extensive.] The shortness or quickness of breathing is also an early symptom, and a better index of the extent of the disease: but it is to be judged by the number and forced character of the respirations, rather than by the feelings of the patient, which are often deceptive. The number of respirations in a minute (which in the healthy adult is about twenty) may rise to thirty and upwards. In some cases, particularly where the attack has been sudden, or has supervened on previous disease of the lungs or heart, the dyspnœa is more urgent, obliging the patient to assume a particular attitude, which is commonly on the back with the shoulders elevated. Muscular efforts, and particularly speaking, bring on or increase the oppression. [Frequency in the respiration is one of the earliest and most common symptoms. Of ninety-one patients who entered the hospital from the second to the sixth day, in whom there had been no active treatment, in thirty-eight the number of respirations varied from thirty to forty in the minute; in thirty-six it varied from forty to fifty; and in nine it rose to fifty-four and sixty, (Grisolle). It is rare in the pneumonia of adults for the number of respirations to exceed sixty or sixty-six in the minute; yet in two patients, one of whom recovered, it amounted to seventy-five and eighty. Extreme dyspnœa, amounting to almost suffocation, rarely occurs at the commencement of simple pneumonia; it does not generally supervene before the end of the first week, and is then connected with either double pneumonia, or with very extensive single pneumonia. Although the intensity of the dyspnœa is usually proportionate to the acceleration of the respiratory movements, still no constant ratio exists between the two phenomena. Although the dyspnœa and the number of respirations are generally in ratio with the extent of the inflammation, still there are numerous exceptions; patients dying from double pneumonia, or

complete hepatization of a lung, may not have had more than twenty-four or thirty respirations in the minute; whilst others, in whom the dyspnœa was intense, and the number of respirations exceeded fifty or sixty, may have had very circumscribed pneumonia. There is no direct relation between the amount of local pain and the dyspnœa, as is generally supposed. It has been stated by Bouillaud, Andral, Hourmann, Dechambre, &c., that pneumonia of the upper lobes was productive of more intense dyspnœa than that of the lower. This statement, it would appear from the tables of Grisolle, is not rigorously correct, and that there is really no difference. Advanced pregnancy and deformity of the thoracic parietes render the dyspnœa more violent, independently of the extent of the inflammation.] The pulse is quick, and in most instances sharp; sometimes, but less commonly, it is hard, and it generally loses this character as the disease advances. [The pulse is very much accelerated in pneumonia. In more than one-half of Grisolle's cases which recovered, the pulse was one hundred to one hundred and six; and in about one-fifth, it varied from one hundred and sixteen to one hundred and forty. With some rare exceptions, the rapidity of the pulse was in ratio with the extent and severity of the disease, and nearly always the duration of the disease was in direct ratio with the number of arterial pulsations. In more than one-half the pulse was large and resisting. In two-thirds the pulse attained its maximum of frequency about the third or fourth day, although the disorder continues to increase for some days. More or less sweating from the commencement of the disease generally occurs.] There are, moreover, the other symptoms of fever, such as thirst, furred tongue, loss of appetite, scanty and high-coloured urine, pain in the head and limbs, and weakness. If blood be drawn, it exhibits the buffy coat. The febrile irritation varies greatly in character, sometimes affecting particular organs, as the brain, causing delirium; the stomach, inducing sickness; the liver, giving rise to jaundice, and other bilious symptoms; and in many cases the fever, instead of being inflammatory, is typhoid, producing a variety of the disease which will be afterwards noticed. [One of the most common of the sympathetic phenomena of pneumonia is cephalalgia. According to Grisolle and Louis, it is absent in only about one-eighth of the cases; the pain invariably occurs from the first day, and is nearly always frontal; it is usually severe, and lancinating, or else is a violent constriction; it attains its maximum of intensity from the first to the fourth day, and generally ceases by the end of the seventh day. Louis never saw it exceed the eighth day.

Pneumonia is one of those acute affections which weakens the forces less than any other, and even after an active antiphlogistic treatment, patients still exhibit a great deal of strength, and lift themselves up in bed.

The decubitus in this disorder varies. The seat of the pneumonia has less influence upon it than the degree of pain. When severe patients generally lie on the back, or on the affected side; when the pain diminishes, though the disease is not moderated, both decubitus and motion become freer. When the inflammation is very extensive, and when hepatization is more complete, and the dyspnœa and the oppression are in ratio with the extent and intensity of the phlegmasia, dorsal decubitus, with the head and shoulders very much elevated, is the only one tolerated.]

In the course of a day or two, the cough becomes, accompanied by the expectoration of a rusty-coloured sputum of various shades, semi-transparent, tenacious, and coherent; at first it does not differ from that of acute bronchitis except in colour, which is light-reddish or rusty, sometimes passing into an orange-yellow or even a greenish tint: as the disease proceeds, the tint becomes more pronounced, and the viscosity greater. When the characteristic sputa appear, the dyspnœa is often increased; and if the pulmonary inflammation be extensive, the oppression is urgent. The pain, on the other hand, is often diminished, though sometimes it continues and prevents the patient from lying on the affected side. [The sputa in pneumonia offer different degrees of colour and consistence. In some cases, during the first days of the disease, they are reddish or bloody; if you examine them attentively, you find that they are formed by a tenacious and viscous mucus, more or less adherent to the sides of the vessel, containing small bubbles of air, and a certain quantity of blood, producing the colour in question. The blood is, in a great measure, intimately mixed with the mucus. Still, on the surface of the sputa, you observe several points where this fusion is not perfect, which gives to them a resemblance to powdered brick. In proportion as the disease progresses, either the combination of the blood and mucus becomes more and more intimate, or less blood is exhaled, and the red colour diminishes; from bright red it becomes dull, and takes a tint which has been compared to the rust of iron; then another transformation occurs, they cease to be reddish, and acquire a yellow colour, the shade of which varies. In the first degree, the tint resembles the yellow of the fresh rind of a perfectly ripe orange; in the second degree, it is like the marmelade of apricot, or sugar candy; or it is clearer, like a weak infusion of saffron. In some instances the yellow colour, instead of being uniform, is slightly tinted green, as if bile were mixed with the mucus; the tint finally becomes deeper, and the sputa decidedly greenish. Subsequently the expectoration becomes white, opaque, and resembles that of acute bronchitis. The consistence and viscosity of the sputa are remarkably great; they resemble gelatine, and adhere to the sides of the vessel so closely that it may be upset

without even displacing them. In other cases they resemble albumen; their consistence is not great, and they form a nearly homogeneous mass, which, when you incline the vessel, rolls together, and leaves clean and nearly dry the portion of the vessel it has quitted. The rusty, apricot, and sugar candy sputa, are those which usually are most viscous and consistent. These different kinds of sputa are semi-transparent, and occasionally transparent; when carefully looked at, you will find them aërated, some with small bubbles of air, whose tenuity and number are in exact ratio, generally, with their viscosity. Sometimes the expectoration in pneumonia is serous, of a dull reddish colour, sometimes brownish, or even black, resembling liquorice or prune juice, occasionally covered by a white froth, which is easily dissipated by blowing in it. In other cases the expectoration, having lost all its tenacity, resembles in consistence and its slightly yellow colour a strong solution of gum arabic. The quantity varies—it may be estimated in simple pneumonia, at about five ounces in twenty-four hours. The various hues of the sputa are due to the intimate mixture of the blood with a peculiar morbid secretion; at first sanguinolent, they become in turn orange-red, yellow, yellowish, then green, in proportion as the blood exhaled in more or less quantity is more intimately combined with the mucus. In the brick dust sputa the blood seems pure, and liquorice juice sputa is evidently formed by blood nearly pure and profoundly altered. Laennec was mistaken when he supposed these sputa to come from the gums in cachectic cases. In a very large proportion of cases the characteristic expectoration takes place during the two first days; it has less tendency to appear as the disease is advanced, and after the seventh day it is rare to see it appear for the first time, unless there be a relapse.

In sixty-six cases the sputa were red from the commencement, in thirty-five, apricot colour in twenty-five, and barley sugar in six. The rust colour is most frequently primitive. After a duration of from one to nine days, they are transformed usually and sometimes suddenly into yellow; whilst it is very rare to see sputa originally yellow, become red. The green sputa are always consecutive, as are, also, the prune juice. Rusty sputa last from one to twelve days—mean five; sanguinolent, two to three days; yellow primitive, two to nine—mean four, when consecutive less; mean, less than three days. In those who recover, mucous or seromucous expectoration always succeeds; although white and opaque, it is still more or less viscous. The viscosity is the property that lasts the longest. The sputa are very much aërated. This expectoration lasts for a long time. According to Grisolle, pneumonia is always preceded by acute bronchitis, in those cases in which the cough and expectoration come on at an early period.

Sometimes, throughout the whole course of the disease, whether fatal or not, the expectoration continues white, opaque and catarrhal. Certain medical constitutions seem to influence this. Thus, during the epidemic influenza of 1837, and during the months that followed it, Grisolle saw fourteen persons at the Hôtel Dieu, in whom the expectoration was throughout perfectly white and opaque, without any red, yellow, green or black sputa.

Sometimes the expectoration is entirely wanting. According to Bouillaud and Grisolle, this occurs more frequently in pneumonia of the summit of the lungs. Chomel mentions a case where it was alternately white and rosy, resembling closely white of egg, well beaten, and covered a reddish, transparent, consistent liquid; on chemical examination, a large proportion of albumen was found.]

In favourable cases, the disease may decline on the third or fourth day, with a general alleviation of the symptoms. This is generally first evinced by the skin becoming more cool and moist, and the expectoration less tinged and viscid, and more abundant and opaque, like that of declining bronchitis. Sometimes the improvement is rapid, the patient being restored to convalescence in six or eight days; but it is often more protracted, slight exacerbations recurring every evening, and prolonging the disease for a fortnight or more. The quickness of pulse, cough, and slight dyspnoea are the symptoms which are most apt to linger, with the temporary recurrence of the sanguinolent tinge in the sputa: these are to be regarded as signs of a lurking disease, which a slight cause may aggravate and bring to a relapse. In more formidable cases, the increase of the disease is apparent on the third or fourth day, by the quickened respirations (sometimes amounting to forty or sixty in a minute), occasionally obliging the patient to sit up; sometimes by more frequent cough, though this is by no means constant; by the greater viscosity and deeper tinge of the sputa; the more weak and rapid pulse; more depressed state of the bodily powers; the loaded or dry tongue; the hot skin, or its feeling cold and partially perspiring. Sometimes there is delirium or coma, which are dangerous symptoms, especially in old persons, and often disguise the nature of the disease. Laennec justly describes comatose symptoms as of more unfavourable import than fierce delirium.

The progress of fatal cases is marked by increasing failure of the strength and more hurried breathing, but the feeling of dyspnoea is not always increased in proportion, sometimes it is even diminished. The cough is less effectual in discharging the sputa, which sometimes retain their viscosity and sanguinolent hue. In most instances, there is a total suppression of the expectoration for some hours before death; in others, it is still voided, but in an

altered state, being a thin transparent or dirty mucus, or an opaque dirty brown or greenish fluid, consisting of a mixture of mucus and pus, with a little blood. In some cases it has a very fetid odour; in others the thinner reddish-brown fluid, noticed by Andral, like prune juice or liquorice-water, is that last expectorated. With these changes in the expectoration, the pulse becomes thready, very frequent, and often irregular; the countenance pallid and cadaverous; the lips livid; the skin cold, and bedewed with cold sweats; the breathing gasping, with an increasing rattle in the throat; the sensorial functions give way, and the patient dies asphyxiated.

When the disease terminates favourably, the amendment is often accompanied by some critical evacuation, such as perspiration, a lateritious deposit in the urine, expectoration, diarrhœa, epistaxis, hæmaturia or some other hæmorrhage, or the menstrual discharge: of these the four first are by far the most common, and the two first are often conjoined; but the critical evacuation varies with the cause of the disease and the nature of the prevailing epidemic. The observations of Andral have in some degree confirmed the opinions of Hippocrates and other authors, ancient and modern, that on certain days the symptoms show a tendency to abate. These are especially the seventh, eleventh, fourteenth, and twentieth days. In ninety-three cases, observed by Andral, the recoveries on critical days averaged fourteen, on non-critical little more than three. [Grisolle collected all the cases of pneumonia in which the day of commencement could be accurately ascertained; he noted the precise moment when the symptoms commenced to decrease, and marked carefully the beginning of convalescence, and he became convinced that the disease had no natural tendency to terminate on certain days. He has seen convalescence commence on the non-critical as often as on the critical days.] In these favourable cases, after continuing with greater or less intensity for the various periods just mentioned, the symptoms become evidently ameliorated; the dyspnœa subsides; the cough becomes less constant and more easy; the expectoration less viscid and tinged, and more opaque and free; and the pulse less frequent, often with an increased fulness. The fever also abates; the skin becomes cool, soft and moist; the tongue cleaner, and the thirst abates. Some quickness of breathing and of pulse generally lingers after the other symptoms, and often cough with bronchitic expectoration, which may remain for some time, and pass through the changes observed in acute bronchitis.

[The convalescence in pneumonia is generally remarkably rapid; and the digestive functions are speedily re-established; as soon as the fever diminishes, there is an appetite, and on entering on convalescence, it is generally imperious. In healthy adults who have suffered from simple pneumonia, the strength returns very

rapidly, and the excellent condition of the patient, his flesh, &c., is often surprising. Still there is some persistence of the local symptoms; the cough remains, and auscultation will detect that the lung is not altogether permeable. The pain in the side, also, sometimes persists for a long while, sometimes for two or three months. It often returns with considerable violence after the patient has recovered, and resumed his labours. It is accompanied with no fever, or other functional derangement. We encounter the same phenomenon after acute pleurisy, and it is probably due to some displacements or change in the false membranes.]

In recovery from pneumonia, relapses are by no means uncommon: they are marked by a recurrence of the chief symptoms, pain, shortness of breath, cough, and viscid sanguinolent expectoration. The fever is less acute than at the first attack; hence a relapse, if serious, may be less tractable. [This statement is opposed to the experience of Grisolle, who found relapses to be rare—occurring about once in 28 times. They generally, too, are of shorter duration than the original disorder.]

We shall have occasion to revert to the character and variety of the general symptoms, when treating of the pathology of the disease and the physical signs.

ANATOMICAL CHARACTERS.—The first condition produced in the lung by inflammation is *sanguineous congestion* or *engorgement*, in which the vessels are then so much distended, that the whole tissue appears red, of different shades, and is much heavier than usual, but still crepitates. In some cases a frothy serum exudes when a section of the lung is made; this is probably the effect of the coagulation of the blood after death, for it is not observed in those cases in which the blood remains fluid. It is a common notion that the blood in an inflamed lung is effused into the air-cells, but for several reasons we are inclined to believe that it is contained chiefly in the distended vessels and in the tissue, although it may be occasionally extravasated. Andral examined an inflamed lung after drying and slicing it, and the only difference which he could perceive in its structure was, that the membranes between the cells were somewhat thicker and redder than natural; but there was not that obliteration of the cells that might have been expected if they had been filled with blood. In typhoid pneumonia, and that from asphyxiating gases of the sedative kind, (such as those generated in sewers,) the inflammation often does not go beyond this stage, and when it does, it passes at once into a half gangrenous, half purulent destruction of the lung, there being apparently in these cases some change in the vital properties of the tissues, or in the condition of the blood, which incapacitates it from supplying coagulable lymph, the deposition of which constitutes the next stage. [A healthy lung

weighs about seven and a half ounces. Grisolle has seen it weigh, when hepatized, five and a half pounds.]

The second stage of pneumonia, *red hepatization*, as it is called, brings the lung to a state of solidity more or less approaching that of the liver. But the transition from the first stage is not sudden but gradual, being the result of the same overflow of the nutritive function, which causes the effusion of lymph in the inflamed pleura. The tissue of the lung, thus consolidated, is so heavy, that it generally sinks in water; but it is also more fragile than usual, so that, on being pressed, it breaks down under the finger. This softening seems to be chiefly the consequence of the interstitial deposit of soft fresh lymph, which diminishes the molecular cohesion of the tissues; and the more acute and recent the inflammation is, the greater generally is the softening. The colour of a hepatized lung varies much according to the quantity of blood left in it: if this be much, it is red; if little, pinkish-brown; or reddish-gray, if mixed with the black pulmonary matter. The deposition of lymph seems to supersede the red particles, or possibly it may be formed at their expense. When a hepatized lung is cut into or torn, numerous little granulated points, of the size of pin-heads, and of a lighter colour than the rest, are often observed. These granules Andral first represented to be the single air-cells or terminations of the bronchi, and he conceived that they were distended with the same viscid mucus secreted by their mucous linings, which is seen in the sputa. Laennec considers these little bodies, the air-cells, converted into solid grains, by the thickening of their parietes and the obliteration of their cavities by a concrete fluid. From many minute examinations which we have made, we have been long convinced that the granulations of hepatized lungs contain no appreciable quantity of viscid mucus, but that they are probably portions of vesicles and minute tubes, with their tissues distended with an interstitial deposit of lymph, and occasionally having the same matter in their interior. In his work on *Pathological Anatomy*, Andral has expressed a similar opinion. But hepatized lungs do not always present this granulated appearance; sometimes there is a uniform condensation of a deeper red than usual. This condition Andral refers to a more complete obliteration of the cells, a further degree of solid effusion; but this would not agree with its redder colour. We are disposed to view this non-granular kind of hepatization as the result of inflammation confined more to the plexus of vessels and intervesicular tissues, and less affecting the membranes forming the cells: hence the consolidation partakes more of the character of the vessels and the blood which they convey, and less of the lighter-coloured deposit which the membranes of the cells secrete. The recent

researches of MM. Hourmann and Dechambre, on the pneumonia of the aged, confirm this view: they have been led to distinguish the granular hepatization from that of a more uniform aspect; and they designate the first as the result of a *vesicular* pneumonia, the other of *interlobular*. Having been the first to describe the latter as a separate form of pneumonia, we prefer the term *interventricular*. When the blood remains fluid, the consolidation is imperfect, and the portion of lung thus affected, although it may sink in water, is quite soft and resembles the substance of the spleen rather than that of the liver; hence it has been called *splenization*.

The third stage to which inflammation brings the lung, is that of *suppuration* or *yellow hepatization*. This consists in the conversion of the semi-solid particles of lymph or blood, which constitute the solid or red hepatization, into an opaque, light-yellowish, soft, friable matter, and finally into a liquid pus. This suppuration is commonly diffused in the form of purulent infiltration; and it is rare to find it assume the character of a distinct abscess. We see a sufficient reason for this in the very porous structure of the lung, which renders the circumscription of the matter by the effusion of lymph, such as that which takes place in abscesses in general, a very unlikely result; and the life of the patient, or the vitality of such a delicate and porous structure as that of the lung, is generally destroyed before the process of suppuration can be completed. Hence, even where the suppuration has advanced furthest, there is generally much of the tissue of the lung remaining, and a gangrenous condition is often added to the suppuration, giving the matter a very offensive odour. Nevertheless, circumscribed abscesses in the lung are now and then met with, and this is generally when the inflammation is limited, or more intense in one part, so as to tend to the early formation of pus, whilst the adjoining parts are still capable of throwing out a circumscribing lymph. In this way we have seen abscesses arising from pneumonia, affecting separate lobules: thus, too, abscesses are formed around foreign bodies within the lung, such as a musket-ball, and around calcareous and scrofulous tubercles, which may act as foreign bodies. In all these cases the inflammation of the most irritated parts reaches the stage of suppuration long before that of those around them; and the latter thus forms a separating wall of effused lymph, which may afterwards constitute a kind of cyst. The purulent deposits that are sometimes met with in the lungs of individuals who have died after surgical operations, wounds, or other injuries, generally present this circumscribed character.

[Primitive abscesses in the lung following pneumonia are exceedingly rare. Out of several hundred examinations, Laennec

encountered them but five or six times; Louis, once; Andral, once; Chomel in more than twenty-five years, three times; and Grisolle in ten years *not once*.

Grisolle has collected, however, twenty-two cases, and gives the following description of them: they are sometimes single, sometimes multiple and disseminated; they vary in dimensions from an egg, when single, to a filbert, when multiple. They are situated beneath the thinned and softened pleura or are more deeply seated and occupy the centre of the lobe. Their cavity is ordinarily anfractuons, sometimes traversed by bridges, contains a white, inodorous pus, or gray, reddish, flocculent and fetid, sometimes with shreds of cellular tissue, or fragments of lung infiltrated with pus. Their walls are sometimes formed by the hepatized tissue, on which you may see the orifices of the bronchi; sometimes their internal surface is lined by a gray, thin, sometimes firm, sometimes soft, pultaceous false membrane, about a half a line in thickness. The surrounding tissue is generally in a state of gray or red hepatization of variable extent. They increase by extending from the centre to the periphery, and sometimes by the union of several together, and open either into the bronchi, pleural sac, or into another neighbouring cavity.]

Gangrene unconnected with suppuration is a very rare sequel of pneumonia. It may, however, be caused by the inhalation of noxious gases, which seem to directly destroy the vitality of the lung. The lungs of those who have died some days after being nearly asphyxiated in sewers, have been found reduced in parts to a dark brown, greenish, or livid softening, having a very fetid odour, and being probably the result of the poisonous influence of the gas on a congested lung.

[Laennec thought that primitive pneumonia rarely or never terminated in gangrene, and nearly all subsequent pathologists agree with him. Grisolle never saw a case of gangrene of the lung at an autopsy of primitive pneumonia. Of 305 cases of pneumonia analyzed in his work, not one ended in gangrene. It is not rare to see a part of a lung gangrenous, and other portions in one of the stages of pneumonia, and it is difficult to say whether the pneumonia is consecutive or not. A peculiar lesion of the lung once met with by Grisolle, is thus described by that author. In an individual who died on the ninth or tenth day of an attack of pneumonia on the right side, the greater part of the lung was in a state of red and gray hepatization. In the centre of the lower lobe appeared a spot of four or five centimeters in extent, which was rendered very remarkable among the surrounding grayish-coloured tissue by its mahogany and blackish hues. The lung was here converted into a sort of pulp, without the admixture of clots; it exhaled no smell, fell away under the slight impetus given by

water falling on it, and left in its place an irregular excavation, two centimeters deep, the walls of which, stained of a blackish colour, presented a great number of cellulo-vascular filaments. This morbid state had not the aspect of pulmonary apoplexy, and differed from gangrene in the absence of the characteristic odour. However, Dr. Grisolle is inclined to believe that this softening must be considered a species of gangrene of the pulmonary tissue, analogous to certain softened states of the brain and medulla.]

The state of the tissues adjoining the vascular plexus, which is the proper seat of pneumonia, is worthy of notice. The interlobular cellular texture sometimes partakes of the general redness, and sometimes it is singularly free from it, or has it so much less, that a section of the lung is quite marbled by its lines, which are of a lighter colour. So also in the hepatized stage the interlobular septa retain their cohesion, and in more chronic cases sometimes become more thick and hard than usual. The mucous membrane of the large and middle-sized bronchi is almost always more or less inflamed, and presents the striated aspect that is also seen in the more acute forms of bronchitis. That of the smaller bronchi is often of a deeper red than in bronchitis; but from its bluish tint this would appear to arise rather from the blood under it than in it. The bronchi in the inflamed part, generally but not always, partake of the softening of the parenchyma. We have, in a few instances, found some of them plugged with coagulated lymph, as described by M. Reynaud and Dr. Stokes: but this by no means occurs so frequently as to strengthen the opinion of these writers, that pneumonia is generally a plastic inflammation of the minute air-tubes and cells. When this albuminous exudation does take place, M. Reynaud has shown that it may cause the obliteration of some tubes, which would lead to the dilatation of others. More commonly the air-tubes, as far as they can be traced, contain more or less of the slimy rusty mucus, like that which has been expectorated. The pleura is generally, but by no means constantly inflamed: we have seen it free from redness, lymph, and liquid effusion, even where covering a hepatized portion of lung.

The cases of pleuro-pneumonia, in which the inflammation of the pleura is so considerable as to modify the course of the parenchymatous inflammation, will be considered hereafter.

SITE OF PNEUMONIA.—Dr. Grisolle collected an immense body of facts to elucidate this question. Pneumonia of the right lung is about twice as frequent as pneumonia of the left. This predominance exists at all ages. Double primary pneumonia is very rare. It occurred in one-sixteenth of Dr. Grisolle's cases. Dr. Louis has found it to be equally rare. Of 125 pneumonias,

occurring in Dr. Chomel's wards, in 1838 and '39, eight only were double. The alleged frequency of double pneumonia is owing to the sub-crepitant rhonchus of capillary bronchitis, heard at the base or internal border of the lung, being mistaken for pneumonia of the opposite side, even by able and experienced physicians. The inferior lobe is more frequently attacked in the commencement in the proportion of four to three to the superior. Of two hundred and sixty-four cases, the upper lobe was the first to suffer in one hundred and one, the inferior in one hundred and thirty-three, the middle third of the organ in thirty. This proportion varies with different years; it is sometimes almost epidemic. Pneumonia of the apex is two and a half times as frequent in the right as the left lung; it is more frequent in persons of weak and feeble constitutions.]

PHYSICAL SIGNS.—On applying the ear or a stethoscope to the chest of a person with incipient inflammation of the lungs, a fine crackling sound accompanying the respiratory murmur is heard generally in the inferior and posterior region of one side. In its slighter degrees, it is scarcely more than an unusual loudness and roughness in the vesicular murmur, as if the air met with slight short resistances in its passage, which destroy the smoothness of the sound; but in its more pronounced degree, there is a distinct crepitation, like that heard when common salt is thrown on a hot iron, or like that caused by rubbing between the finger and thumb a lock of hair near one's ear. This, which is the *crepitant rhonchus*, is first heard at the commencement of inspiration and at the end of expiration; but it soon accompanies the whole respiratory act, and in advanced degrees of the first stage, it is heard only at the end of inspiration and the beginning of expiration.

[The crepitant rhonchus in pneumonia does not always present these characters; but sometimes closely resembles the sub-crepitant of capillary bronchitis. This occurred in thirty-four of Dr. Grisolle's cases. Its limited seat, characteristic sputa, and other pathognomonic, general and local signs, served to distinguish the affection. It occurs in all seasons and ages, but was more commonly above fifty, and especially above seventy.

However perfect crepitation may be, it is almost always limited to inspiration; sometimes it is heard during the whole of inspiration, at other times the first half is pure, and crepitation is heard only at the end. Sometimes it can only be heard by making the patient cough, when it is heard during the cough, or during the deep inspirations which follow it. In cases of pneumonia, where before the respiration appeared natural, you will often be astonished to hear a crepitant rhonchus. During certain epidemics, the crepitant rhonchus may be wanting. During the influenza of

1837, out of eighteen cases observed by Dr. Grisolle, not one offered crepitation.]

The physical cause of the crepitation of pneumonia has been the subject of some difference of opinion. M. Andral considers it to be produced by the passage of air in minute bubbles through serum effused in the smallest air-tubes and vesicles, and that the fine and even character of the crepitation depends on the fineness of the bubbles in these tubes. Thus he supposes that this crepitation differed from the mucous rhonchus only in the size of the tubes in which it is produced, and the consequent size of the bubbles in them. This opinion has been adopted by several writers, who reduce the liquid rhonchi of catarrh and the crepitant rhonchus of pneumonia to two heads, large and small crepitation. From a consideration of the pathology of pneumonia, and of the course exhibited by its physical signs, we have long been led to consider the crepitation which attends the first stage as distinct in nature from the other rhonchi. We have before had occasion to notice, that the structure and motions of the lungs tend to bring all liquids secreted in the minute tubes into those of larger size, whence they are ultimately collected in the trachea, and expelled by expectoration. Were the crepitation of pneumonia dependent on serum in the smallest tubes and cells, we ought to have proof of the presence of this serum in the other tubes by a bubbling rhonchus, if not in the expectoration also. But in most cases of the first stage of pneumonia, the chest is remarkably free from bubbling sounds in the large tubes, the rhonchi, if any, are dry, sonorous or sibilant, and the expectoration is not serous but viscid. In fact, there is good reason to suppose that the serum which exudes from an engorged lung after death, and which Andral assumed to be the cause of the crepitation, is chiefly the result of a cadaveric change, the coagulation of the blood in the distended vessels, which does not take place during life. But what is the condition of the extreme air-tubes and cells in the first stage of peripneumony? They are narrowed and partially obstructed by the enlarged vessels which are distributed between and around them; and as the smallest tubes are narrower than the cells in which they terminate, it is easy to conceive that they are so far obstructed that the air can pass through the viscid mucus lining them only in successive minute bubbles, the bursting of which constitutes the crepitation in question. This appears to be the true view of the crepitant rhonchus; and we can thus understand that at first the crepitation must be slight and confined to the period of the respiratory movements in which the tissue is most collapsed; that as the narrowing increases, it extends to the whole movements; that subsequently the obstruction is such that it permits the crepitating passage of the air only when the lungs are most expanded, as at the end of inspiration and at the begin-

ning of expiration ; and finally, that the obstruction becomes complete, and the crepitation ceases, except, perhaps, still on a forced respiration.

Dr. Stokes has made the important observation, that a puerile or unusually loud sound of respiration precedes the occurrence of crepitation in pneumonia, and he considers this to denote the first stage of the inflammation. We question the propriety of calling this another stage, which probably is only a degree of the same condition which causes crepitation, the partial narrowing of the tubes, which renders the sound rougher and louder before the crepitation begins. The sound of respiration becomes weaker as the crepitation comes on, and extends to more of the minute tubes : and it ceases when the abnormal sound occupies them all. If the disease be extensive, and the function of the lung much infringed on, the energy and frequency of the respiratory movements will be increased, and consequently the respiratory murmur on the sound side will be louder than usual, having the character of puerile respiration.

The increased matter of the congested lung will have further effects on its properties with regard to sound. It will deaden the sound on percussion, so that the affected side will give a sound rather duller than the opposite side, and different degrees of force in percussion will not materially affect this variation. But the first stage of inflammation, without liquid effusion, is insufficient to make the sound on percussion quite dull ; for even in its most advanced degree, there is still enough air in the lung to give some elastic resistance to the walls of the chest, and to leave their vibrations pretty free. [Attentive comparative percussion of the thorax will sometimes indicate, during the first stage of pneumonia, a difference of sound of the two sides. But it is particularly necessary to study the sensation of resistance felt by the percussing finger. It sometimes happens, that in pneumonia of the first degree, and sometimes even in that of the second or third, percussion in muscular persons gives no shade of difference in the sound ; but on the healthy side a certain degree of elasticity is felt by the percussing finger, whilst over the seat of disease, the chest is hard and resisting.] The motion of the affected side will be diminished in proportion as the air fails to get admission to the inflamed lung ; and instead of being fixed in a state of permanent distension as in pleurisy, or in a state of contraction, as in spasmodic asthma, the side holds an intermediate size, measuring on full inspiration less, and on the completion of expiration more, than on the sound side. The increased density of the congested lung also makes it conduct sound better than the light spongy condition of the healthy organ ; so that in extensive inflammation, even during the first stage, and whilst the crepitation still continues, there may be heard some degree of the bronchial respi-

ration and vocal resonance that are fully developed only in the stage of hepatization.

The deposition of lymph which constitutes hepatization of the lung, completes the obstruction of the minute tubes and cells: hence all crepitation and vesicular respiration cease, and the only sounds which reach the ear are those of the air and voice in the larger tubes, and these are transmitted by the consolidated lung with unusual loudness. The respiration is no longer heard with its prolonged murmur; but in the neighbourhood of the bronchial tubes there is a *short whiffing*, confined to parts only of the respiratory act, and often ending abruptly with a click. This bronchial whiffing is not to be heard in every case, but only when the hepatization involves bronchial tubes of some size, and is most commonly found in the middle regions of the chest. Here, too, both may be heard and felt various degrees of morbid bronchophony, or vocal resonance. [In a large majority of cases the transition from crepitation to bronchial respiration is sudden; but Dr. Grisolle has occasionally heard a transition sound, peculiar and perfectly characteristic, which he calls the *sarsenet sound*, resembling the tearing of a piece of new sarsenet, or the crumpling of a silk gown; it is heard only during inspiration. Dr. Grisolle thinks that puerile respiration in the healthy portions occurs much more rarely than is generally supposed; in thirty-six cases puerile respiration occurred but three times on the sound side; on the diseased side and around the seat of pneumonia six times, and in *two* of these latter, the puerile respiration became bronchial. A feeble, yet perfectly soft, respiration, is much more common in the vicinity of the inflamed portions of lung.] When the consolidation of the lung is very complete, and involves especially the central parts of the lung, the voice may be heard to sound over a space of considerable extent in the mammary, scapular, or axillary region, and so loudly, that it resembles pectoriloquy, for which it is sometimes mistaken. The bronchophony of a consolidated lung may generally be distinguished by its being extended over a considerable space, and by its being much diminished by using the stethoscope with the stopper, which is not the case with the pectoriloquy of a cavity. [In some persons who have naturally acute and shrill voices, true œgophony may be heard, without any effusion existing. This is particularly the case in aged persons.] The vocal resonance of the tubes is also transmitted to the walls of the chest, as a vibration or fremitus, which may be distinctly felt by the hand placed on the affected side, and which is much stronger than that on the healthy side. This sign, the discovery of which is due to M. Reynaud, affords an easy mode of distinction between a hepatized lung and a pleuritic effusion, for the latter generally abolishes pretty completely the vocal vibration. [Drs. Grisolle and Walshe consider this a very fallacious sign. In ten of the cases

reported by Grisolle, it was either entirely absent on both sides, or it was equally well marked on the healthy as on the diseased sides.] The dulness on percussion is now pretty complete, but it is seldom so uniform and general in the lower and middle portions of the chest as the dulness from liquid effusion. We see a reason for this on examining a hepatized lung: there are generally some lobules or portions retaining enough of air to prevent them from sinking in water: this is also sufficient to prevent the stroke sound from being uniformly and perfectly dull; and when the consolidation is perfect, it transmits the stroke of percussion to deeper-seated parts, which then yield their resonance. Thus on the left side a hepatized lung sometimes gives the tympanitic resonance of the stomach; and near the sternum, or in the mammary, axillary, or scapular regions, we may occasionally have the tubular resonance, or bottle-note of the large air-tubes. It is not difficult to distinguish these sounds from that of healthy percussion; and when once we understand the cause, their presence and properties will serve rather to instruct than to confuse us. In the stage of hepatization, the lung being merely inextensible, the corresponding walls of the chest are nearly motionless; and they are so in a state neither of distension nor of contraction, without fulness of the intercostal spaces, or displacement of the viscera; and thus we have further distinctions between this case and that of pleuritic effusion. When the left lung is solidified, it transmits the sounds and impulse of the heart to an unusually wide extent of surface, instead of diminishing or displacing them as a pericardial or a pleuritic effusion does.

[Pneumonia may terminate in resolution, suppuration, abscess, gangrene, chronic pneumonia, or some other affection.]

In the third or suppurative stage, there is no change in the condition of the lung, which can modify the physical signs until the effused matter begins to liquify; and then there is a mucous or bubbling rhonchus from the secretion into the air-tubes. There may be a change in the expectoration, either to pus or to the liquorice-water-like liquid, described by Andral, and which seems to be a sero-mucous fluid, coloured by hæmatine in an altered state: this kind of sputum, however, we have found to succeed to pulmonary hæmorrhage more commonly than to pneumonia. More generally there is no expectoration, or such only as proceeds from the upper tubes, and therefore gives no evidence of the state of the lung. In fact, we are to infer the supervention of the third stage from the duration of the disease and the general symptoms, rather than from the physical signs. The inflammatory symptoms and fever give way to great prostration, rigors, cold sweats, a quick, weak, thready pulse, whilst the breathing is as short as ever, and the countenance exhibits the pallid, waxy, anxious, drawn, tremulous features of ebbing vitality. [We have

no trustworthy signs to mark the passage of pneumonia from the second to the third stage. The rational signs of suppuration in other acute, deep-seated inflammations, are always absent in pneumonia. The physical signs afford us no aid. Dr. Stokes and others have imagined that it might be detected by the super-vention of mucous rhonchus. Dr. Grisolle has studied this question attentively, and does not think that our knowledge is yet sufficient to warrant a positive decision being made. When the disease has reached the third stage, the general condition is always alarming; the features are altered; the countenance is pale, leaden, or yellow; the strength diminishes; the pulse falls; the teeth and tongue are covered with fuliginous matters; coma, or sub-delirium occurs, and finally prostration. The occurrence of creamy, opaque, puriform sputa, has been considered as indicating suppuration. This expectoration occurs, however, frequently, especially in old persons, or where bronchitis has preceded or supervened on pneumonia. The prune or liquorice-juice expectoration would seem to be a better, though not a certain sign, for of nine cases of Andral where it occurred, in six there was suppuration, two were in the second stage, and one recovered from a pneumonia, which, probably, never had passed beyond the second stage. The four cases of Grisolle, in which this expectoration was seen, all died, and suppuration was found. It is only by studying and comparing the morbid phenomena, with the different epochs of the disease, that we obtain some presumptive evidence of its existence. Situation and age influence notably the occurrence of the third stage. Pneumonia of the upper lobe, and that of old, feeble persons are most liable to end in suppuration. It is probable that the third stage nearly always terminates fatally.]

The formation of abscess is less unfavourable, because it implies less extent of suppuration, and a power in the structure to circumscribe it. There are several cases recorded of recovery from pneumonia after the signs of abscess had manifested themselves. Dr. Stokes describes a case in which the cavity became obliterated by a cartilaginous septum, during a complete recovery and enjoyment of health in the pursuit of a laborious occupation for twelve months, at the end of which time the individual was again attacked with pneumonia, which proved fatal, and its effects were found to have been curiously limited by the cicatrix of the former abscess. The signs of abscess are those of a cavity communicating with the bronchial tubes, first containing liquid and air, and producing a coarse bubbling or gurgling sound on coughing or deep breathing, and, after the expectoration of pus, a cavernous or hollow respiration with pectoriloquy, or loud resonance of the voice, in some part of the chest corresponding with the affected spot. [For the production of these signs a communication sufficiently large should exist. This does not always happen; it is either wanting entirely, or is very narrow—in such cases aus-

cultation can give but negative signs. Chomel, without denying the possibility of a cure by the evacuation of pus, and subsequent cicatrization, considers it as very rare, and that most ordinarily the patient succumbs, either before or after the elimination of the purulent matter.] These abscesses are not uncommonly of a gangrenous character; and then there is added to the signs a putrid fetor in the matter expectorated as well as in the breath of the patient.

As our limits do not permit us to enter into minute details, it may suffice to point out how the physical signs of pneumonia indicate the situation and extent of the inflammation; and, as far as relates to the diseased organ, they may guide us in the prognosis and treatment. Thus a crepitant rhonchus heard throughout a whole lung, or a considerable part of both lungs, implies extensive disease: if heard at the root of the lung, or at its apex, that is, at the scapulæ or under the clavicles, it indicates a more severe form of the disease than if heard only at the lower parts of the lung in the back. The extension of this crepitation, or its presence in new parts, is a proof of the increase of the inflammation. Its cessation, and the substitution of bronchial respiration and perfect dulness on percussion, are proofs of its advancement to the second stage. On the other hand, the return of the crepitation and resonance, where they had been replaced by bronchial respiration and dulness, announces a progress towards cure by the absorption of the obstructing lymph, and by the air again getting a straightened admission into the cells. As this process proceeds, the act of respiration, accompanied by crepitation, becomes longer in duration, until it equals in length that on the healthy side; but the sound is still for a time somewhat whiffing where it has been bronchial; and a crepitation of a looser, less even character, also remains after apparent cure; this is the subcrepitant rhonchus, and probably depends on the presence in the smallest bronchi of a little thin serous mucus, such as that which is seen in the expectoration, and the secretion of which seems, as in bronchitis, to assist in removing the depositions left by the inflammation. [When the pulmonary engorgement diminishes, the blowing respiration becomes less marked, and finally ceases to be heard during inspiration, and is confined to expiration; crepitation now reappears, but it is larger and moister; at first but little abundant, and heard only during a profound inspiration or cough, it is heard, as resolution advances, during ordinary inspiration. Redux crepitation—whose duration may vary from a few hours to even one or two months—generally soon diminishes in abundance, its bubbles become fewer and less distinct, and it is heard only during cough, or a deep inspiration, and is replaced by the natural respiratory murmur, which is feeble; the prolonged expiration diminishes progressively, and, finally, after some time, becomes feeble; and the respiratory

murmur becomes natural as to duration and softness; for it is a rule, that of all the stethoscopic signs in pneumonia, feebleness of the respiratory murmur is the last to disappear. Laennec stated that, with few exceptions, where a large extent of lung had been successively affected, resolution occurred in those last affected first. In ninety pneumonias which had reached the second stage, and which had gradually extended over large and successive portions of lung, Grisolle found that in one hundred and sixty, those parts last affected were the first to be resolved; in eighteen, the reverse was true; and in twelve, where the pneumonia was not very extensive, the signs of resolution were simultaneously shown over the whole affected part.] If the inflammation have proceeded to the stage of hepatization, and particularly if it have verged on that of suppuration, in which the albuminous deposit, becoming opaque and lower in vitality, is less susceptible of absorption, the restoration of the texture of the lung to its natural light condition requires a considerable period of time, even after the apparent cure of the disease; and during this period, there remain more or less of the physical signs just noticed, as well as some dulness on percussion, and perhaps, also, not a full power to expand that portion of the chest. We suppose, here, the cure to become perfect eventually, but to require a long time; though there are other cases in which inflammation of long duration produces permanent changes in the lung, as the obliteration of some portions of the tissue and the dilatation of others; these changes happen most frequently when the inflammation is modified by a cotemporaneous effusion in the pleura, which will be noticed hereafter.

VARIETIES AND COMPLICATIONS.

BILIOUS PNEUMONIA.—[Bilious pneumonia prevails endemically in certain regions, and also epidemically, both in Europe and this country. With us it is known as bilious pleurisy. It would seem to be more common in temperate climates. Its causes are permanent or temporary. It prevails for a while in a certain district and then abandons it. At Paris, since 1804, a case has been rarely met with. Adults are usually its subjects. The invasion is sudden, and in general, the disorder of the digestive organs occurs simultaneously with that of the pulmonic. The pulse is usually soft, feeble, depressible, and has no relation with the intensity of the disorder, nor the apparent strength of the patient; the skin is hot and dry; the frontal cephalalgia is severe and persistent; sometimes a good deal of prostration accompanies the disease, which cannot be accounted for by the extent or intensity of the inflammation; the digestive organs exhibit evident signs of derangement; there is a bitter taste in the mouth; the tongue is covered with a thick, yellowish fur; there are nausea and vomiting; the thirst varies with the intensity of the febrile movement; some-

times there is tenderness on pressure in the epigastrium ; there is generally constipation ; the tint is yellow. When the treatment fails, it is very apt to assume the typhoid type, especially when it prevails epidemically.]

TYPHOID PNEUMONIA.—The form termed typhoid pneumonia, whether it be secondary to continued fever or primary, and originally attended by low adynamic fever in consequence of the constitution having been lowered by excesses or extreme privation, or by the depressing influence of foul air, or of an unhealthy season, differs remarkably from common pneumonia in many of its phenomena. The local symptoms are by no means prominent ; and although there may be pain, cough, and very disordered breathing, the obtuse state of the mental faculties prevents attention from being drawn to these symptoms. The general functions are, however, greatly disordered ; the pulse is very quick, small, and weak ; the skin harsh, dry, and partially hot, or covered with a clammy sweat, and sometimes covered with petechiæ, or suffused with a dusky rash ; the tongue is furred, brown and dry ; the alvine excretion dark and unusually offensive ; and the urine is scanty, turbid, and ammoniacal. The lungs, in such cases, are sometimes found after death so engorged, particularly but not exclusively their posterior portions, that they sink in water : the texture is very soft and fragile, and when broken, exudes a dark grumous blood : there is only an imperfect approach to hepatization ; but the texture in some parts occasionally shows a softening of a lighter colour, which seems to be an imperfect suppuration. Sometimes partial hepatizations are found, and slight films of lymph on the pleura ; and in such cases, it is not uncommon to find similar marks of slight recent inflammation also in the pericardium and peritoneum. We have observed this particularly in cases of external erysipelas.

[Primary typhoid pneumonia may be either sporadic or epidemic. In 1348 it devastated the whole of Europe, and is still very common in some parts of it. In Dublin it is frequently to be met with. It occurs, also, in this country, both endemically and epidemically ; it is, however, usually connected with more or less gastric symptoms, and hence partakes much of the character of bilious pneumonia. In the year 1836, it prevailed epidemically in the village of Noyes, in France. Whether primary or sporadic, it is apparently developed under the influence of causes which act slowly and for some time on the economy. The primary symptoms last generally for five or six days. Cephalalgia, general malaise, and great prostration are constant phenomena. It may assume the adynamic form from the commencement ; or this may succeed to symptoms decidedly inflammatory ; but in the majority of cases, early symptoms, indicative of the implication of the nervous system, are present. The pulse seldom falls below

ninety-six, and often rises to one hundred and twenty; it is small, feeble, depressible, and sometimes intermittent. When the prostration is considerable, the ordinary stethoscopic phenomena are often modified, the rhonchus is sub-crepitant or mucous, and there is often an entire absence of sound, natural or morbid, over the seat of disease. Sometimes a deep inspiration or cough will make a little crepitation, or blowing heard. The typhoid symptoms, as a general rule, are better marked when the disease is epidemic than when it is sporadic.

The gravity of the typhoid symptoms has no ratio with the extent of the inflammation. In Grisolle's cases their intensity was in inverse proportion to the space occupied. This looks as if the pneumonia were an epiphenomenon, and was a consequence of some general alteration of the liquids and solids of the economy. No critical phenomena terminate the disease when resolution takes place. According to Grisolle, this form of pneumonia more frequently occurs between eighteen and thirty, and fifty-five to seventy years of age. It is more frequent in males than females; and the superior lobe of the right lung is more constantly its seat.]

The physical signs in such cases are, in the posterior parts of the chest, dulness on percussion and absence of the respiratory murmur, with an occasional short whiffing and sibilant rhonchus; but, as Dr. Stokes has remarked, there is often no crepitation, or, if it be present, it soon ceases, the obstruction becoming complete. In the anterior parts of the chest, the breathing sometimes remains quite distinct, although accompanied by sonorous and sibilant rhonchi. The signs of obstruction remain for a very long time, and the sound of respiration and percussion is much slower to return than in acute peripneumonia. Dr. Stokes has observed, that recovery in these cases is very slow, and sometimes attended by contraction of the affected side.

We are disposed to consider this affection as partaking of a congestive more than of an inflammatory character; and Dr. Hudson, in an able paper on typhoid pneumonia, published in the *Dublin Medical Journal*, has taken a similar view. By some unknown cause, whether in the condition of the blood in the affected capillaries, or in both, the blood stagnates in particular viscera, generally to some degree under the influence of gravitation; and the functions of the organs are proportionately impeded or disturbed. There is at the same time more or less irritation, which may give to the congestion the semblance of an inflammation; but its products are imperfect and irregular; and neither by the free effusion of plastic lymph, nor by the formation of pus, is a true inflammatory orgasm manifested. We can see why this condition in the lung may be unaccompanied by the usual signs of the gradual formation of a crepitating obstruction, because the engorgement is at once produced, and renders a great part of the

tissue impervious to air. But this degree of congestion, if it occupy the middle parts of the lung, may give bronchophony and bronchial respiration.

BRONCHO-PNEUMONIA.—The complication of pneumonia with bronchitis is very common: in fact, in almost every case of pneumonia, the bronchi are also inflamed; but sometimes the bronchial affection is primary and extensive, and inflammation of the parenchyma is superadded. In such cases, if the bronchial secretion be considerable, the noisy rhonchi which it occasions mask the physical signs of peripneumony; and in consequence of the depressing influence of the same cause on the respiratory function, the general symptoms also are more than usually obscure. But on listening particularly at the end of inspiration on the posterior and inferior regions of the chest, which correspond with the lower margins of the lobes, the fine crepitation may generally be heard if pneumonia is present. The rusty tinge of parts of the sputa, and as the disease proceeds, the greater dulness on percussion, will also become apparent when the inflammation has extended to the pulmonary plexus of vessels. Of the forms of bronchitis that occasionally pass into pneumonia, those of epidemic influenza, whooping-cough, and those accompanying fevers and diseases of the heart, may be mentioned as presenting this combination.

[This affection may be sporadic, or epidemic. It is particularly apt to occur as a complication of influenza, and to be developed under the influence of certain medical constitutions. It occurred during the epidemic influenza of Paris, in 1837. Not only are the general symptoms modified, but the local phenomena of inflammation of the lungs are more or less masked or replaced by those of bronchitis. It is produced without any appreciable cause, either occurring in the course of influenza, or at its convalescence, or consecutively to a mild bronchitis, in which there were malaise, prostration, and loss of appetite. Its commencement is generally insidious, the initial chill being frequently wanting. Pain in the side is always present, but is commonly not severe. Crepitant rhonchus is never heard, but is replaced by the sub-crepitant with large, humid, unequal bubbles, mixed with sibilant and sonorous rhonchi. It generally exists at the base and on one side, but when it is heard on both sides, it is better marked on the side of pain. It is soon replaced by blowing. The sputa are rarely those of simple pneumonia, but are white or opaque, little aërated, not viscous, resembling those of acute bronchitis. Although the respiration is not more accelerated, the dyspnoea is considerable and is not in relation with the extent of the inflammation. The pulse is generally soft, not full, or resisting, and often does not exceed eighty-eight. The nervous system is powerfully engaged; whatever is the degree of pneumonia, you find feebleness, and even prostration; sometimes there is violent delirium, followed by con-

traction and rigidity of the limbs; and at other times all the symptoms of adynamia seen in continued fevers. These symptoms have no relation to the local affection. Its progress is irregular; sometimes the inflammation will remain stationary for several days, auscultation giving the signs of the first degree, or of circumscribed lobular pneumonia, and then suddenly it will pass to the second stage, and the adynamic symptoms be developed. It always passes to the second stage, and never remains in the first. The *redox crepitant* is very frequently wanting; bronchial is replaced by feeble respiration, mingled with a little sibilant rhonchus. The lung recovers its permeability very slowly, the respiration remaining for some time rude.]

PLEURO-PNEUMONIA.—The effects of a concomitant pleurisy on the pathology and signs of pneumonia are highly deserving of notice. Whenever the inflammation extends from the lung to the pleura, it may be supposed to increase the serous secretion, and perhaps lead to the effusion of lymph; but when the pulmonary inflammation has existed first, and become extensive, these pleuritic products are commonly of small amount. When the inflammation has attacked the parenchyma and the investing membrane nearly to an equal degree, constituting the disease called by Laennec *pleuro-pneumonia*, the effusion in the pleura by its pressure modifies the effects of the inflammation in the lung. The lung is found after death consolidated, but more tough and red than in the state of ordinary hepatization, and totally destitute of the granular aspect. It much resembles the substance of some muscles; hence Laennec termed this condition *carnification*. It seems to exhibit the more essential part of inflammation of the lung; the sequel or effect, effusion into the coats of the air-cells, which constitutes granulation, having been prevented by the pressure of the external liquid effusion. This combination is, therefore, also slower in progress than simple pneumonia: the degree of the inflammation as well as the quantity of its product is restrained by the external pressure, and it scarcely, if ever, proceeds beyond the second stage. But this slower rate of progress tends to make its effects also more permanent. If false membranes are formed on the pleura, they have time to become firmly organized, and to bind down the lung in its compressed state; and the lymph effused in the tissue itself, scanty though it be in comparison with that of a hepatized lung, may become the means of adhesion and permanent contraction of the compressed cells and finer tubes, and of consequent obliteration of more or less of the proper tissue of the lung. There is an ulterior result which has hitherto escaped the attention of pathological writers. When the liquid effusion is removed by absorption, and the chest becomes again capable of expansion, what will supply the place of the obliterated cells? The chest remains to a certain degree contracted as after

pleurisy; but the atmospheric pressure will also at each inspiration be brought to act on the larger air-tubes that are yet unobstructed; the air can no longer reach the smaller branches or cells of these tubes, so it must dilate the tubes, and make their increased size, in some degree, compensate for their defective terminations. Pleuro-pneumonia is then, as we have before had occasion to remark, a cause of dilatation of the bronchi. We have met with several examples of this kind; and on referring to the records of other cases of extensive dilatation of the bronchi, we have found several in which the symptoms are described to have originated in an inflammatory attack like pleuro-pneumonia; and probably all those cases in which the dilatation affects one side only, and in which there is much consolidation of the lung with some contraction of the chest, originate in this way.

The general symptoms of pleuro-pneumonia are not materially different from those of the more simple inflammations, but they are often less severe, and sometimes very obscure. The physical signs are a combination of those of pneumonia, and of liquid effusion in the pleura. At first there is crepitation; but this becomes indistinct, as the lung is pushed aside by the liquid; whilst the dulness on percussion is much more marked than in pneumonia, at least in the lower parts of the affected side. In the central regions of the chest, bronchial respiration and bronchophony are soon produced by the condensed lung being pushed against the walls; and if a thin layer of liquid intervene, the bronchophony acquires a loud buzzing accompaniment, like the voice in the performance of *Punch*: in fact, the sound seems to consist of two voices, which probably arises from some of the vibrations being modified into a buzzing or bleating, by passing through the thin layer of liquid, whilst other vibrations pass unchanged. The vocal resonance is generally louder in pleuro-pneumonia than in either pleurisy or simple pneumonia; which probably arises from the chief tubes being pressed more closely against the walls of the chest, with complete condensation of the vesicular structure. The same circumstance sometimes gives the amphoric or tracheal sound on percussion in the mammary region, which forms a singular contrast to the dulness of other parts. We have also found the respiration quite tracheal in this spot, and the resonance of the voice quite as loud as that of caverns. These phenomena become more remarkable in cases which, from inefficient early treatment, become chronic, the consolidation of the lung remaining permanent; for, as the liquid is absorbed, the bronchi become dilated, and exhibit the phenomena of pectoriloquy, cavernous breathing, &c., as described under *Dilatation of the Bronchi*.

[PNEUMONIA OF OLD PERSONS.—In some vigorous old persons, when the inflammation is limited to a small portion of the lung,

pneumonia resembles that of adults; but in a large majority of cases, it is very different in many respects. Its commencement is obscure; there is neither chill nor pain in the side; general malaise, feebleness, some dyspnoea, or irregularity of breathing, a short, dry cough, heat of skin, are the only phenomena announcing its invasion. Sometimes there are only general debility and discomfort; occasionally those attacked die suddenly, without complaint of any kind.

The local symptoms are often wanting, or are scarcely marked; the pain and dyspnoea are slight, especially when the disease is situated in the lower lobe; the cough is insignificant; and the pathognomonic sputa are absent, or exist for a short time only. Sometimes the local symptoms are veiled by a collection of general phenomena which give a special physiognomy to the disease; the face is earthy; the expression peculiar; the pulse, small and irregular; the skin harsh and dry; and the tongue red. In a great number of cases there is considerable derangement of the intellectual faculties, with adynamia. Crepitant rhonchus, when present, is obscured by intense sub-mucous rhonchus, and bronchophony is not so marked, or so constantly connected with blowing respiration, as in the pneumonia of adults.]

COMPLICATION WITH OTHER DISEASES.—Pneumonia frequently attacks patients in both the early and advanced stages of *tuberculous disease*. Sometimes it is partial and readily yields to treatment: but not a few fall victims to it when it is more general, and this sometimes in the absence of symptoms sufficient to distinguish it from the pre-existing disease. Again, it is not unusual to find miliary tubercles in the lungs of those in whom the ordinary treatment for pneumonia had proved unavailing.

The pneumonia, which sometimes supervenes in continued fevers, small-pox, erysipelas, scarlatina, and in various chronic diseases, during the prevalence of epidemic peripneumonia, is generally of a congestive or typhoid kind, and often appears to be the immediate cause of death. In many such cases the symptoms of the pulmonary affection are often very obscure.

The bronchial affection of *measles* sometimes passes into pneumonia, especially when the eruption disappears suddenly with continuance of fever; here the symptoms are generally pretty evident. A congestive and latent inflammation of the lungs is sometimes a complication of *endemic and periodic fevers*; and the reaction after the collapsed stage of *malignant cholera* and *asphyxia* is peculiarly apt to fall on the lungs.

Several surgical writers have noticed the occurrence of pneumonia after severe *injuries* and *surgical operations*. It is often latent, and may declare itself only a short time before death, by the oppressed breathing and rattle in the tubes. In some instances

of this sort, the lungs are found only in the first stage of inflammation; in others there are circumscribed hepatizations; and not a few present the singular lesion of purulent deposits in the pulmonary tissue. These deposits are always well-circumscribed, the tissue around being sometimes inflamed, sometimes healthy; they are at first of a red colour with a brighter margin, and interspersed with pink, drab, or yellow spots; the latter appear to be sections of the vessels, and on being pressed, exude pus. In a more advanced state, more of this lighter colour is seen, and gives the appearance of purulent infiltration, whilst on the margin of the deposit a distinct coat of lymph can be traced, circumscribing the diseased part. In a few cases, the process of suppuration has been found completed in the formation of an abscess. These fatal sequels of injuries are to be considered as the result of a diseased state of the blood rather than of true pneumonia. Pus is probably formed in the blood or elsewhere, and deposited in the lungs on account of their great vascularity, where it is circumscribed by secondary inflammation; sometimes it is deposited in other organs.

[*Pericarditis* may complicate pneumonia, and, according to some observers, coincides more frequently with pneumonia of the left lung. It occurs oftener than is generally supposed. The heart should be carefully and frequently examined during the course of the disease. Fibrinous concretions in the heart and large vessels are constantly found after death from pneumonia. Dull, obscure, and veiled sounds of the heart, with intermitting pulse, are supposed to mark their occurrence. These phenomena, at best, lead us to suspect their formation.

Icterus is a complication of pneumonia, which sometimes occurs. It occurred seven times in 1838, in Chomel's clinic; and Grisolle saw it in twenty-seven out of seventy cases. In these twenty-seven cases, it was twenty times on the right side, six times on the left, and once double. The yellow colour of the integuments and of the sclerotica is the most common phenomenon of this complication; sometimes there is bitterness in the mouth with bilious vomiting. These symptoms, generally, do not last long, and disappear with the pneumonia. Its occurrence has been explained by the propagation of the inflammation to the convex surface of the liver; this could only be applicable, however, to inflammation of the right lung; and on examination after death, no inflammation of its envelopes has been found.]

DIAGNOSIS.—Under this head we need only pass in review some of the more distinctive signs of pneumonia, and the chief points by which it may be distinguished from the diseases which most resemble it. The general symptoms, when all grouped together, often sufficiently characterize the disease, but their occurrence and their degree are very uncertain, and by no means

constantly announce its amount or even its presence. Of the single symptoms the expectoration is certainly the most characteristic. The rusty tinge is considered by Andral and others to be quite pathognomonic of pneumonia; but we have seen it in various degrees communicated to the bronchial mucus by congestions which are not inflammatory, as in bronchitis supervening on organic diseases of the heart, causing great pulmonary congestion, and also after pulmonary hæmorrhage. [The sanguinolent and brick-dust sputa, and those resembling a strong solution of gum arabic, should lead to the suspicion of pneumonia, but are not characteristic of it. They occur sometimes in acute bronchitis, capillary bronchitis with sanguine exhalation, and pulmonary apoplexy. The rusty, apricot, sugar-candy, saffron, prune juice and liquorice, are pathognomonic, and all observers, except Laennec, have not met with them in any other affection.] It sometimes happens, too, that there is no expectoration, especially at the onset of the disease, and in the case of young children, it is seldom brought to view. The crepitant rhonchus, in conjunction with the general symptoms, may be more safely depended on, for its presence is more constant, and its extent and progress well represent the amount and state of the disease. [Genuine crepitant rhonchus may be considered as pathognomonic of pneumonia. Where this has been denied, it is most probable that the sub-crepitant rhonchus has been mistaken for it. The existence of a crepitant rhonchus either anteriorly or posteriorly at the summit of the lung, may be considered as indicative of the pneumonia being tubercular, especially when it is limited, and continues for some time unchanged in degree.] Increasing dulness, with bronchial respiration and sound of the voice, equally mark the transition of pneumonia to the second stage. [Both fever and the sympathetic phenomena furnished by the expression of the face, and state of strength, are important elements in the diagnosis, especially in old persons. Often at this period of life the pneumonia being latent, the pain in the side, and sputa, are wanting; there is even sometimes no oppression; auscultation gives no assistance, owing to the seat of the disease being in the central and deep portions of the lung. In spite of the negative result which is obtained by the exploration of the thoracic organs, if it be found that the patient, after having had a chill, followed by an intense fever, which has lasted for some time, and is accompanied by a decided change in the physiognomy and strength, if no other local inflammation is discovered, the existence of a pneumonia should be suspected; and in the majority of cases, this presumption will be transformed into certitude. This presumption is founded on the great frequency of pneumonia in old persons; that of all acute affections, it is the one that is the most frequently latent; and because it is of all acute diseases, in attacking old persons, that which causes the most intense pain, prostrates most the forces, and

produces sympathetic affections, with functional derangement of the affected organs.]

From pleurisy, pneumonia may be distinguished in the first stage chiefly by the crepitation and expectoration; [and by the much less intensity of the febrile movement;] in the second, by the bronchophony and vocal vibration sensible to the hand, and by the absence of signs of displacement of the walls or organs bounding the lungs, and of any change by posture in the sound of percussion. [Blowing respiration occurs frequently in pleurisy; Grisolle observed it in one half of his cases; but it rarely attains the same intensity as in pneumonia.]

From bronchitis, pneumonia may commonly be distinguished by the crepitation, which is finer and more equal than that of bronchitis, by the rusty tinge of the sputa, and, as the disease advances, by the dulness on percussion, bronchophony, and bronchial respiration. The skin is hotter and less livid in severe bronchitis; neither is the cough nor the dyspnoea generally so urgent. [In some pneumonias, you hear only a sub-crepitant rhonchus, which occurs also in capillary bronchitis; and many cases of double pneumonia are annually published by good observers, which are in fact only cases of intense bronchitis, or of single pneumonia with bronchitis of the opposite side. By marking the differences between the sub-crepitant and genuine crepitation, and remembering that the latter only is pathognomonic, and that the sub-crepitant rhonchus of pneumonia is limited and confined to one side, or is more intense in the side affected with pneumonia than the other, a diagnosis may be made.]

From pulmonary apoplexy, or hæmorrhagic congestion, it may be known by its febrile commencement and course, by the absence of any real hæmoptysis, and by the crepitation and dulness on percussion being progressive, and rarely so circumscribed as in pulmonary apoplexy. Inflammation is, however, very commonly engrafted on pulmonary apoplexy.

Œdema of the lungs and tuberculous disease in their physical signs may resemble pneumonia, but their history and general symptoms will, in most instances, sufficiently distinguish them.

PROGNOSIS.—Pneumonia must, at all times, be viewed as a serious disease, and the prognosis, even in favourable cases, should be given with caution, as cases which are at first slight may take an unfavourable turn, and in progress towards recovery, as long as the disease lasts, there is a chance of relapse, which may throw the patient into new danger. The circumstances which chiefly affect the prognosis are the stage of the inflammation, its seat, its extent, its complication with other affections, and the state of the general health and strength. As this disease, in its progress, tends to the disorganization of the lung, so its continuance increases its danger; hence the prognosis is more unfavourable.

ble if hepatization has taken place; and still more so, if the signs seem to indicate the supervention of the third stage. The duration of the stages varies very much in different cases, according to the violence of the inflammation, the age of the subject, and the effects of the remedies. Laennec states the average duration of the first stage (engorgement), at from twelve hours to three days; the second (hepatization), from one to three days; the suppurative from two to six; remedies which retard the progress of the disease prolong the period of the two first stages. We think even these statements more precise than the subject will admit of, for the duration of the first two stages presents a remarkable variety in different cases. In children, and in some epidemics, also in adults, the first stage may last for more than a week, without the production of hepatization. On the other hand, in aged and debilitated subjects, the inflammation may speedily reach the stage of suppuration. Laennec describes this to have taken place in some instances within twenty-four hours. Recovery may take place from every degree of pneumonia; but the chances of this are very small, when it is probable that suppuration has taken place. Even simple hepatization requires time and favourable circumstances to effect the absorption of the effusion. Until there is evidence of the advancement of this process of absorption, as well as improvement in the general symptoms, the prognosis must remain doubtful; for inflammation may readily return in the lung around the hepatized portions. The supervention of a gangrenous odour in the expectoration is a formidable event; but not a hopeless one, for a few cases in our own experience, and several on record, have occurred in which recovery took place.

[The prognosis is doubtful in those cases where auscultation and percussion indicate a diminution in the pulmonary engorgement, and there is no amendment in the general symptoms. It is serious where at the same time that there is an amelioration of the local symptoms, there is an aggravation in the general phenomena. The presence of a pulmonary abscess increases the danger of the prognosis.]

The extent of the inflammation greatly affects the danger of the case. A double pneumonia affecting both lungs at the same time is frequently fatal even in the first stage; and whenever the whole of one lung is involved, there is great peril of an unfavourable issue. Inflammations attacking the upper lobes and root of the lungs are more fatal than those confined to the lower lobes: a result which may be the consequence of the former containing blood-vessels of larger size.

[Pneumonia of the upper lobe is generally more dangerous than that of the lower lobe. Of nineteen pneumonias of the summit treated in the wards of Chomel in 1838, 1839, five or nearly one-fourth died; whilst of eighty-four attacked with pneumonia of

the base, there were only eight, or one-tenth who died. Grisolle found that in subjects whose mean age was between thirty-six and thirty-eight, the mortality of the summit was one-fifth, and that of the base one-eighth. Pneumonia of the summit, moreover, should lead to a more grave prognosis, because it is frequently complicated with tubercles.

In a series of eight years, from 1832 to 1839, one-half of the cases of double pneumonia terminated fatally in the clinical wards of the Hotel Dieu, whilst of single pneumonia, the mortality was about one-seventh. Of five cases of pneumonia observed by Chomel in 1832 and '39, occupying the whole of one lung, four terminated fatally.

The phenomena furnished by auscultation and percussion should not enter as elements in the prognosis, except they be in proportion to the general symptoms, for they can lead us to know only the superficial extent of the pneumonia, and not the actual amount of space it occupies. Severe general symptoms often exist with limited stethoscopic phenomena, and after death a large portion of the centre of the lung will be found implicated. On the other hand, very extended stethoscopic phenomena may exist, occupying, perhaps, nearly the whole of the posterior portion of the lung, with but slight fever and dyspnœa, and the patient recover, showing that only the external surface of the lung was implicated.]

The complication of pneumonia with other diseases generally increases its danger. It is often fatal when supervening on the different forms of fevers, on gastro-enteritic, bronchial,* pericardial or peritoneal inflammations, and in these cases it is very apt to be latent. Pleurisy on the same side may diminish the intensity of the pulmonary inflammation, but if it attack the opposite side, it adds to the oppression and danger. Pneumonia is more than usually fatal during pregnancy and in the puerperal state, and at the extremes of age, especially in weakly infants, in cachectic old people, and in those exhausted by habitual excesses. The fatality is much greater among the lower classes than among those well and regularly fed and clothed. Besides the preceding circumstances, the general health and vigour of the subject, the severity of the chief symptoms which indicate the state of the vital functions, especially the dyspnœa, the pulse, the expectoration, and the mental faculties, and the influence of the remedial measures which have been employed, all must be taken into account in estimating the prognosis in particular cases.

[Of all the complications of pneumonia, continued delirium is that which should cause most fear. Idiosyncrasy should, however, be taken into account, for some persons, whenever sick, suffer from delirium.

[* Bronchitis, unless intense and very extensive, does not aggravate the prognosis in pneumonia.]

Pneumonia, consecutive to a general disease, attended with primitive or secondary alterations of the blood, as in typhus, the exanthemata, phlebitis, glanders, Bright's disease, &c., at all ages, is most generally mortal. In nine cases of pneumonia complicating measles, six died; and in four complicating small-pox, all died. In scarlet fever epidemics, and especially in the consecutive anasarca, intercurrent pneumonia is always mortal. Pneumonia occurring in persons suffering from cancer, is mortal. Pneumonia attacking phthisical patients who have still some strength and flesh, or who are not in the last stage of the disorder, generally ends happily, nor does it, in the majority of cases, cause softening of the tubercular matter.

The influence of early or tardy treatment on the prognosis of pneumonia is best shown by the following table of Dr. Grisolle :

The mortality among patients admitted the first 3 days	$\frac{1}{3}$
“ “ “ 4th “	$\frac{1}{8}$
“ “ “ 5th “	$\frac{1}{6}$
“ “ “ 6th “	$\frac{1}{4}$
“ “ “ 7th “	$\frac{1}{3}$
“ “ “ 8th “	$\frac{1}{2}$
“ “ “ 9th “	$\frac{1}{3}$
“ “ “ 10th “	$\frac{1}{3}$

Delay here is numerically demonstrated to be death. This results not so much from the mere absence of all active treatment, as from the baneful anti-hygienic conditions to which such patients are commonly exposed.

Pneumonia following wounds of the chest is probably less dangerous than any other. Vidal de Cassis says, that it nearly always terminates favourably, and the observations of Grisolle, though not numerous, confirm this opinion.

The prevailing medical constitution influences the prognosis in pneumonia, as in all other diseases. Some years it is very benignant, and yields readily, whilst at other periods, it resists the most energetic means. When it is epidemic, it is more severe; this is owing to the pulmonic inflammation under such circumstances being connected with a general condition, of which the pneumonia is a mere element.

From puberty to twenty, it presents characters of great benignity. Of fifty-nine cases from fifteen to twenty, observed at the Hotel Dieu, from 1832 to 1842, death occurred only in two, and those were patients debilitated by previous diseases. After twenty it becomes dangerous in proportion to the age; whilst not more than one in thirty die who are under twenty, the mean mortality between twenty and forty, is one in eight; one in five between forty and sixty; and one in two, after sixty.

Sex is also an important element in the diagnosis; the mortality in females is from one-third to one-half as much as in men.

Pregnancy is one of the most unfavourable conditions for the

issue of a pneumonia. Of fifteen pregnant women, eleven died, although apparently in excellent previous health. Its gravity is greater if it occur before the seventh month. Of ten who were between the third and sixth months, nine died; of five over seven months, three died. It is also often fatal to the fœtus.

The existence of anterior attacks of pneumonia exercises also a very unfavourable influence.

CAUSES.—Pneumonia is one of the most frequent of all diseases; it attacks all ages, from the fœtus in utero to extreme old age. It is rarely primitive under five years of age; it would seem to acquire its maximum between twenty and thirty, it is frequent from puberty to fifty, then diminishes to sixty, and becomes the most common and mortal of all the diseases of old age. It attacks more males than females. Of ninety cases admitted into the clinical wards of the Hôtel Dieu from 1823 to 1827 there were seventy-three men, and twenty-four women, although the number of beds was the same for both sexes. Of one hundred and twenty-five admitted in 1838 and 1839, there were of one hundred and twenty-five patients, seventy-five men, and twenty-nine women, though there were more female beds. This predominance is probably due to the different hygienic conditions of the two sexes—women of the working classes, following sedentary occupations, whilst the men are more exposed to the vicissitudes of climate. The influence of sex is then not real but apparent. At Buhl, in the Grand Duchy of Baden, where the women share the labours of the men, pneumonia attacks both sexes equally; the same has been found true in other localities. In the prison at Rennes, the same fact was observed by Toulemouche. Children of both sexes are attacked in the same proportion.

It was supposed that humpbacks were very liable to pneumonia; this opinion seems to be not founded, primary pneumonia being, on the contrary, a rare disorder amongst them.

A previous pneumonia predisposes to subsequent attacks, and these, moreover show a preference for the lung previously attacked. Some persons seem peculiarly liable to relapses. Chomel attended an individual that had had it ten times; J. Frank, one who had eleven pneumonias; and Dr. Rush a German, who had had twenty-eight consecutive attacks.

Those professions which demand great muscular exertion in the open air, and require exposure to sudden changes of temperature, are those which chiefly predispose to pneumonia.]

It is well worthy of remark, that bronchitis and pleurisy affect vessels which freely communicate with those of the parenchyma: but although they do occasionally extend to the latter vessels, and thus excite peripneumonic inflammation, yet they are generally quite distinct from it both in their present course and in their

ulterior effects, and require a distinction in treatment which should be borne in mind. We find an explanation of this difference in the peculiar character and importance of the pulmonary blood-vessels; in their great number and capacity; in the large proportion which they bear to the other solids of the lung; and in their great liability to congestive distension. This extensive and important plexus of vessels, through which the whole blood of the body passes, is, as we have before seen, peculiarly liable to distension from any cause which may disorder the function of the heart or lungs. Thus all those causes which tend to induce asphyxia, produce also that congestion of the pulmonary vessels which, added to irritative reaction, may constitute inflammation. Thus we see that various causes which disturb greatly the balance of the circulation, particularly by deranging the passage of the blood through the lungs, may become causes of pneumonic inflammation. Of these the most remarkable are, long-continued exposure to cold, asphyxiating poisons, congestive fevers, violent exertion, diseases of the heart, bronchitis, asthma, wounds, tubercles, and foreign bodies in the lungs, and the moribund state. Pneumonia is so frequently complicated with hooping-cough, measles, and small-pox in children, that it forms one of the chief sources of the danger in these diseases. The same remark applies to many forms of continued fever in adults. In common with other inflammations, it may be occasioned by the suppression of habitual discharges. The inflammations of gout, rheumatism, and cutaneous diseases, are rarely transferred to the lungs. Cold is unquestionably the most common cause; this is especially shown by its prevailing almost exclusively in the cold season, and chiefly in March and April, during the continuance of cold winds. The epidemic occurrence of the disease has been repeatedly noticed. Laennec conjectures that the epidemic cause is often not merely change of temperature but deleterious miasms in the air, which exert a specific operation on the lung, as the poisons of the rattlesnake and of some fungi are said to do. Huxham observed that, during an epidemic, bronchitis prevailed in low, damp places, and pneumonia and pleurisy on more elevated situations. Although met with chiefly in cold countries, milder climates are not free; it occurs to a great extent in the south of France and Italy, where, however, the winds cause great and sudden changes of temperature. Its frequent occurrence in the neighbourhood of Vesuvius may, perhaps, be attributed to the noxious exhalations which prevail there.

[Contusions of the thorax,—especially where the ribs have been fractured at the same time, and a broken fragment projects into the thorax, and irritates the lung,—will produce pneumonia. Sometimes pneumonia occurs suddenly in persons who have attempted to lift a heavy weight beyond their strength. Penetrating wounds of the chest, particularly those by fire-arms, readily induce pneu-

monia. Foreign bodies in the bronchi are followed by pneumonia almost invariably, if they remain any length of time in the air-tubes.

The influence of sudden chill whilst the body is heated, in the production of pneumonia would appear, from the researches of Chomel, Grisolle, and Barth, to be much less general than was supposed, although its effect is undoubted. Dr. Grisolle found that of two hundred and five patients submitted to very close examinations, forty-nine only distinctly could refer their pneumonia to the sudden accession of chill. These results, coupled with those of the two other accurate observers just named, show the real influence of cold.

	Cases.	Seizure preceded by sudden chill.
Chomel,	79	14
Barth,	125	38
Grisolle,	205	49
Total,	409	101]

TREATMENT.—The indications of treatment in pneumonia vary according to its stages. In the first stage, the chief object is to remove the inflammatory irritation and congestion from the pulmonary vessels; in the second there is another indication, to promote the removal of the interstitial effusion, the product of the inflammation; even in this stage, when the strength fails, and more particularly in the third stage, it is necessary as far as possible to support the functions which are oppressed by the extent of the organic lesion induced. Particular symptoms may also give occasion to other indications in every stage. We shall shortly notice the principles which may guide us in the use of remedies to fulfil these several indications, and then advert to the application of the treatment in the different forms and complications of the disease.

TREATMENT OF THE FIRST STAGE.—Distension of the great pulmonary plexus of blood-vessels being the first condition of pneumonia, from whatever cause it may proceed, we may hope, in the early stage of the disease, to relieve it by blood-letting, as well as to prevent the process of reaction which renders it essentially inflammatory; and in some instances, where the local signs announce the presence of the disease in its first stage, and the general symptoms prove it to be of a sthenic character, the free loss of blood by one venesection will arrest the progress of the disease. But when the vessels have been so long distended, and become the seat of fixed irritation so much that the mere removal of pressure from the sanguiferous system at large will not enable them to recover their usual size, a single blood-letting may not be sufficient; it must be repeated as often as the strength will

bear it, and other remedies must be used, which also have the power to counteract the inflammatory irritation. Of these the most important are tartarized antimony and mercury. M. Louis has inferred from an application of numerical calculation to certain cases of pneumonia, that early blood-letting never arrests the disease, and that it only shortens its duration by four or five days. It is clear, however, that many of the cases, classed by Louis as pneumonia, were instances of the asthenic or typhoid disease; an affection certainly in treatment, if not in pathology, differing widely from sthenic or acute pneumonia. We suspect also that a great prevalence of similar cases, and the absence of the fully sthenic character among the pneumonic patients of the Meath Hospital, have led Dr. Stokes to conclude that one, or at most two bleedings will be sufficient, and that local blood-letting is the principal remedy. [In this country one or two large bleedings from the arm are usually sufficient; but in most cases they should be followed up by free cupping or the application of leeches.]

The utility of tartarized antimony in emetic and nauseating doses in pectoral inflammations had long been recognized, but its power of subduing acute inflammation, independent of its emetic, nauseating, or diaphoretic effects, was first pointed out by Dr. Marryatt of Bristol, and further developed by Rasori of Genoa. Its peculiar efficacy in pneumonia was especially shown by Laennec, who considered its value to be above that of blood-letting. Chiefly to the efficacy of this remedy he ascribes the uncommonly small mortality of only two in fifty-seven cases which he states to have been the result of his practice of late years. He gave the medicine in doses of from one to two and a half grains in three ounces of sweetened weak infusion of orange-leaf, withholding the medicine after the sixth dose, or preserving it according to the severity of the symptoms. This remedy has now been successfully employed by many practitioners at home and abroad, and its efficacy seems pretty well established, but not to the degree claimed by Laennec. In this country it is considered as subsidiary to blood-letting; and it has not been found useful to give the large doses which Laennec sometimes employed. From half a grain to two grains in an ounce and a half of some agreeably flavoured liquid, may be given every second, third, or fourth hour, according to the severity of the case. The first dose commonly causes vomiting, but this generally ceases after the second or third, and if it should not, two or three drops of the diluted hydrocyanic acid will generally stop it. If it causes purging, it may be useful to combine a small quantity of opium with the antimony. The mode in which tartar-*emetic* acts is not well understood. Its anti-phlogistic power does not essentially depend on its nauseating, emetic, purgative, or diaphoretic effects; for although these are

occasionally induced by it, yet it is as often quite as successful where none of these effects has been produced. It appears to be directly antiphlogistic by a specific action on the inflamed vessels; this, although not an explanation, is as intelligible as the specific action of remedies on the vessels of the intestinal canal, the liver, or the kidneys. Some pathologists, particularly the followers of Broussais, suppose tartar-emetic to act as a kind of internal blister, inflaming and causing pustules on the gastric mucous membrane; and Andral cites two or three cases in which such a condition was found after death. But these are rare instances; and among very many in which we have seen it used, we have never met with any in which, with due discretion in its administration, any symptoms of permanent gastric irritation have resulted from its use. In the wards of Laennec we have seen patients taking twenty grains daily, not only without experiencing sickness, pain, or diarrhœa, but even without losing either appetite for food or the power to digest it. Such a quantity is, however, by no means necessary; we have never found it useful to exceed ten or twelve grains in the day, and a smaller quantity often suffices. After

[22. R.—Ant. et Potass. Tart., gr. xij.
Syr. Acaciæ, f̄ $\frac{3}{4}$ j.
Aquæ Cinnam., f̄ $\frac{3}{4}$ vi.

M.

Sig.—A tablespoonful every two hours.]

blood-letting judiciously employed, this remedy has appeared to us the best for reducing the inflammation in its first stage, if properly administered: it will often prevent the necessity of further loss of blood; but as Drs. Graves and Stokes remark, its use must be continued for some time after the apparent amelioration of the general symptoms; and it must not supersede further bleeding should the symptoms indicate the propriety of this measure.

The exhibition of mercury and opium as a remedy in inflammations was first practised in this country by Dr. Hamilton of Lyme Regis: it is now very generally employed as an antiphlogistic, after and together with blood-letting. The efficacy of mercury depends in great measure on its being given to such an extent as to affect the gums; but its beneficial operation is often apparent before this effect is produced, and in some instances, as in children, without its occurring at all. But there is seldom that speedy improvement, which is often apparent after the first doses of tartar-emetic: the operation of mercury is more gradual, and as might be expected, when once the system is under its influence, the effect is more permanent. It is therefore more adapted to the less active forms of the disease and to the second stage. Calomel is the form of mercury generally preferred in acute inflammations; and as its purgative effect is not an object, it is necessary to combine it with opium, except the first dose, with which it may be

useful to clear the intestinal canal. With this view, from five to twenty grains of calomel may be given alone after the first bleeding: and subsequent doses of from five to twelve grains with a grain or a grain and a half of opium, and the same of ipecacuanha three or four times in the day until the gums be affected, will generally be found suitable for the more sthenic cases. Smaller

[23. R.—Hydrarg. chlor. mit., gr. xij.

Pulv. Ipecac.

Pulv. Opii, āā gr. iij.

M.—Div. in pil. vj.

Sig.—One every three hours.

Or,

24. R.—Hydrarg. chlor. mit., gr. xij.

Kermes Mineral, gr. ij.

Potass. Nitrat., ℥j.

M.—Div. in pulv. xij.

Sig.—One every two hours.]

doses more frequently repeated answer better in less acute cases, and those with more semblance of continued fever. Where there is a tendency to diarrhœa, the hydrarg. c. cretâ, in larger doses, may be substituted for calomel. In apportioning the doses of mercury and opium, we must be guided by the features of the individual case. The opium acts as an anodyne in allaying the pain and cough, and as a sedative in quieting that nervous irritation which often follows free blood-letting and the use of mercury, whilst the injurious stimulant and astringent effect of opium is counteracted by the mercury and previous blood-letting. But the chief action of the mercury appears to be of that specific kind which enables it to remove the product effused by inflammation, as we see visibly illustrated in the case of iritis.

It may be supposed that in an inflammation so deep-seated as pneumonia, local blood-letting is of but inferior efficacy, and is useful only as an aid to venesection, when from the local pain there seems to be an inflammation of the pleura: or, after general bleeding has been carried to a full extent, a decided impression on the symptoms may be kept up by local bleeding together with tartar-emetic or mercury. Counter-irritation in the early stage, during the prevalence of fever, causes too much excitement, but it becomes of use when the pulse has been reduced; and in typhoid cases, blisters may be used from the commencement.* They also much promote the dispersion of the congestion, which even the first stage of inflammation leaves in the lung. Little good is to be anticipated from purgatives, diuretics, diaphoretics, or sedatives until the violence of the inflammation has been reduced by blood-letting; then each of these kinds of remedies may be indicated by the symptoms. The same observation will also apply to expectorants in all but the slighter cases, in which there is obviously a

[* Dr. Grisolle has rendered it a matter of demonstration that blisters do not lessen the duration of the disease.]

natural tendency to relief by expectoration: in such instances, the decoction of senega with tincture of squills and solution of acetate of ammonia, or an alkali, may considerably promote this discharge.

TREATMENT OF THE SECOND STAGE.—When the physical signs announce that the lung has already become extensively consolidated, with little remains of crepitation, the treatment must be conducted on a different principle from that of the first stage. Solid matter is already effused, and no amount of blood-letting or other means of depressing the circulation can remove this. Their utility is, therefore, much more limited, and is chiefly confined to the removal of any increase of irritation or congestion, or to reduce the bulk of the blood to the capacity of the abridged state of the respiratory organs. The most powerful remedies are those which modify the action of the diseased vessels, and promote the absorption and elimination of the effused matter. Mercury is the most efficacious of these, and calomel the most convenient form. Its combination with opium assists its effect, and tends to allay the pain and cough which may be present, as well as the nervous irritation which is very apt to occur after depletion has been carried to a full extent.

As the consolidated state of the lung often remains for a long time, even after the inflammatory action has been subdued, a great variety of remedies, according to the state of the general symptoms, may become necessary in this stage. Thus, besides the antiphlogistic means before mentioned, some of which must be used as long as crepitation is heard in any part of the lung, more aid may now be derived from external counter-irritation by blisters or tartar-emeti, and from expectorant mixtures containing an alkali. According to the state of the pulse, heat of skin, cough, pain, &c., these mixtures may be saline, with digitalis, squill, and liquor potassæ, or in a less sthenic state, decoction of senega, camphor, squill, &c., with acetate, muriate, or even carbonate of ammonia. [In such cases, too, where the strength is to be supported and expectoration promoted, the following formula is often very effectual:

[25. R.—Rad. Sanguinar. Canad., ℥ij.
Rad. Polyg. Senegæ, ℥iv.
Aq. Bullient. Oj.
M.—Ft. Inf.

Sig.—To be taken in divided doses in the course of 24 or 48 hours, as the stomach will allow.]

We have found these alkaline salines exert considerable influence in promoting expectoration and in dispersing the solid recent product of inflammation in the lung. If such measures with external counter-irritation be neglected because the general symptoms are relieved, there is great risk that the hepatized portions of lung may become the seat of chronic disease, or that acute

inflammation may be re-excited around it, and there is more danger of these evil consequences in scrofulous constitutions and where the inflammation has been of less acute character. When the fever has entirely subsided, and the symptoms of local irritation are inconsiderable, although the physical signs show that a portion of the lung remains consolidated, a combination of liquor potassæ and hydriodate of potash with decoction of senega or sarsaparilla will sometimes assist to restore the healthy state of the lung.

TREATMENT OF THE THIRD STAGE.—When, from the supervention of rigors, cold sweats, feeble, very rapid, or irregular pulse, or other signs of prostration, it is probable that suppuration has commenced in the lung, the utility of antiphlogistics wholly ceases, and if any thing may be yet done by medicine, which can rarely be hoped, it is by remedies of a stimulant kind, especially those which may tend to assist the respiratory forces to expectorate the matter which accumulates in the tubes; such as carbonate of ammonia, tincture of lobelia, ether and camphor, in decoction of senega, or wine, or hot spirits and water. Nor are such remedies to be restricted to the third stage; they may be indicated whenever the vital powers fail, and when the sthenic character of inflammation has entirely ceded to its ulterior and opposite result—depression from incapacity of the disabled organ. Under all such circumstances, the general symptoms are better guides to practice than the physical signs, for the whole frame then suffers as well as the function of the lung, and requires more immediate attention.

When, from the fetid odour of the breath and expectoration, it is probable that a portion of the lung has lost its vitality, the treatment must still be guided by the general symptoms. If these betoken the persistence of active inflammation, the gangrene is probably circumscribed, and antiphlogistic remedies must still be used; but if they have given way to adynamic symptoms, the use of stimulants is indicated even more imperatively than in the suppurative stage. Dr. Stokes gave the chloride of lime, combined with opium, in a case of gangrene of the lung, with a temporary effect of removing the fœtor of the breath and sputa, and of greatly improving the constitutional symptoms. We have used the nitro-muriatic acid with the same view, to counteract the septic influence of the putrescent matter in the system, and apparently with good effect. In one instance the patient recovered, although the physical signs had showed the existence of a large cavity in the posterior lobe of the right lung with great fœtor of the breath and expectoration. Laennec recommends bark or sulphate of quinine in large doses in gangrene of the lung, even when accompanied by extensive hepatization.

We now proceed to point out the application of the treatment

to particular cases. Where the disease is at all severe, the treatment with tartar-emetic or with calomel and opium should be commenced immediately after the first bleeding, and continued uninterruptedly until an impression is produced on the disease. It is not safe, however, with either of these remedies to lay aside blood-letting: if obvious relief do not ensue in the course of five or six hours after the first full bleeding, this measure must be repeated either generally or locally, as the strength may bear it, and again on the next day, if necessary.

In the more acute cases, uncomplicated with gastric disease, we have found advantage from combining the mercurial with the antimonial treatment, by giving a pill containing from five to ten grains of calomel with from a half to one and a half grains of opium every four, six, or eight hours, and in the intervals the tartar-emetic draught, and where the tolerance is soon established, the effect of this combination is very powerful. If the bowels be too much acted on, the hydr. c. cretâ in double quantity may be substituted for the calomel. When an improvement takes place in the symptoms, the mercury may be given at night only, or omitted altogether, and the case left to tartar-emetic and whatever depletion or counter-irritation may be required.

If the attack of pneumonia be very recent, and accompanied by a pleuritic stitch in the side, or catch in the breathing, a full dose of opium, after a large bleeding, as recommended by the late Dr. Armstrong, will sometimes succeed in cutting short the disease. This plan can be adopted only where the bleeding has been so copious as to produce a great impression on the heart's action, almost if not quite amounting to syncope. The dose of opium should be large; two or three grains of the aqueous extract, or, if the pain and tendency to reaction be urgent, from thirty to sixty minims of the liquor opii sedativus, or of Squire's tincture of bi-meconate of morphia, will generally succeed best. Even in this case we think it advisable to give from six to twelve grains of calomel soon after the opium: it does not interfere with the sedative operation of the latter, and by preserving the balance of the secretions, it prevents those functional derangements which sometimes follow the use of opium even in this way.

If the disease have to any extent passed into the second stage, and even if the first have lasted twenty-four hours, there can be little hope of subduing it by opium; and we must then trust to the other remedies. Blisters can seldom be used with advantage until all fulness and hardness of the pulse and heat of skin have subsided; and either these symptoms or the continuance of a fixed pain would counter-indicate the use of senega and other mild tonics and expectorants, which are otherwise useful in the decline of the inflammation.

The great fatality of pneumonia among children renders it

necessary that its treatment should be directed with the greatest promptitude and care. This fatality does not arise so much from the course of the inflammation, as this is less rapid than in adults, but from the latency of the local symptoms, and the tendency of the disease in a disguised form to pass the period in which remedies are most effectual. Hence many infantile cases of pneumonia, particularly among the lower classes, are in an asthenic state before we are summoned to treat them; the depressing influence of the injured function of the lungs having already removed the sthenic character of the disease. This shows the importance of physical examination of the chest in all the febrile affections of children, in order that if any crepitant rhonchus be discovered, the fit remedies may be promptly used. In this early stage blood-letting is very efficacious; but when used after the disease has lasted for several days, it sometimes produces convulsions and sinking without relieving the breathing. The same observation applies to tartar-emetic, which, if used together with blood-letting soon after the commencement, will seldom fail to subdue infantile pneumonia uncomplicated with tubercle. Mercury acts in children more on the bowels than on the gums, causing green feculent evacuations: it is of great efficacy, and our chief remedy when blood-letting is no longer borne. In children there is little risk of arresting the expectoration by purgatives: it would seem that as it is a less natural process in early life, expectoration is of less consequence than in the adult. Counter-irritation, with mild tartar-emetic ointment or solution is of great benefit in the after stages of pulmonary inflammation in children, and should especially be persevered in when there is any sign of a phthisical tendency.

In aged persons, the disease being generally of an adynamic or typhoid type, is often intractable in consequence of the great debility which accompanies it. Advanced age alone, however, should not restrain us from blood-letting where the state of the breathing, heat of skin, and the pulse seem to require it. Frank bled an octogenarian with pneumonia nine times with a good result. Such cases are, however, exceptions; for the period in which blood-letting is useful in old people is short, and often restricted by a complication with humid bronchitis. Expectoration is here an important process, and may sometimes be aided by some of the remedies just mentioned, with the mercurial or tartar-emetic treatment and blisters at an earlier period than usual.

The typhoid form of pneumonia requires a treatment considerably modified. Blood-letting not only is very ill borne, but it appears to have very little influence on the disease. There seems to be in the pulmonary vessels a loss of tension or tonicity, and we might empty the great blood-vessels, and stop the heart's action

before the congestion of the lungs would be relieved and their vessels enabled to contract. Besides, the depressing influence of typhoid diseases renders any loss of blood hazardous, and local depletion is the utmost that can be attempted. Considerable advantage may, under these circumstances, be derived from dry cupping on the chest; which, for the time, tends more effectually than even blood-letting to draw the fluids from the congested organs whilst it does not drain the blood from the system. Blisters and sinapisms also may give relief in slight cases, but their effect is limited, where, as it commonly happens, the whole posterior part of both lungs is congested with blood, which is itself probably in a morbid state. The principal remedy in this form of pneumonia (if pneumonia it can properly be called) is mercury, which may be combined with opium and saline medicines, and, in case of great prevalence of the adynamic symptoms, with stimulants and tonics, such as wine, ammonia, and bark. Medicine has often very little power in these cases: but as far as our experience goes, stimulants judiciously given when the heart's action, as examined by the stethoscope, is feeble, and diminished or withdrawn as soon as it becomes increased, and the pulse sharp or hard, have appeared to relieve the pulmonary affection as well as to support the strength. Musk is highly recommended by M. Récamier in typhoid pneumonia: he gives it in doses of from twenty-four to thirty grains, with an effect which he almost considers specific.

It may be questioned whether the affection called intermittent peripneumony, and said to have been cured by bark, is really an inflammation; it is more probable that it consists of a simple congestion of the lung, just as similar congestions are more familiarly known to take place in the spleen and liver, and which, when recent, give way to bark or arsenic, not to blood-letting. We have stated that typhoid pneumonia, and that attending continued fevers, are more properly to be viewed as congestive than inflammatory; at the same time it must not be forgotten that congestion may, by a process of reaction, be converted into acute inflammation with all its products, and otherwise, unless soon removed, frequently tends to produce some chronic change of structure.

The complication, of pneumonia with bronchitis is generally best treated by moderate blood-letting followed by the antimonial treatment. Blisters and expectorant mixtures are of more avail than in simple pneumonia, the disease often terminating by free expectoration.

In pleuro-pneumonia local as well as general blood-letting should be practised freely; and after the more acute stage has subsided under the influence of these and of antimony, if the buzzing bronchophony and dulness on percussion still continue,

the side should be blistered repeatedly, and a mild course of mercury prescribed to promote the removal of the fluid and the interstitial lymph which might lead to partial obliteration of the tissue of the lung.

In pneumonia supervening on hooping-cough and influenza, it is sometimes a chief indication to give sedatives to allay the cough, which appears often to have a considerable share in producing the parenchymatous inflammation; with this view the sedatives recommended for hooping-cough should be combined with the usual treatment.

Where an inflammatory state of the mucous or serous membranes of the alimentary canal accompanies pneumonia, it is of great moment that in the treatment these complications should be considered, as they may render some of the ordinary remedies injurious. Leeches followed by poultices should be applied to the abdomen, and the milder forms of mercury with Dover's powder exhibited, assisted by laxative enemata or very gentle aperients.

DIET AND REGIMEN.—In ordinary cases of pneumonia, the diet should be strictly antiphlogistic, and during the early stages, confined to thin mucilaginous or farinaceous liquids. Even these should not be used in excess, for in large quantity any liquid may first distend the stomach and then increase the mass of the blood, and in both ways augment the dyspnœa. In those addicted to a very free use of fermented or spirituous liquors, as well as in typhoid pneumonia in general, it is sometimes necessary to continue a certain quantity of these stimuli. M. Chomel found a considerable diminution in the great mortality of such cases, on adopting this plan. In gangrene, or extensive suppuration indicated by fœtor and copious purulent expectoration, with great prostration of strength, it also becomes necessary to give beef tea, animal jellies, and wine; but great circumspection must be used to withdraw them in case of fresh excitement. It is equally necessary to be very cautious with regard to the improvement of the patient's diet during convalescence, by adopting gradual transitions, and by properly regulating the alvine function.

Pneumonic patients should be kept in an airy room, without draught, of moderate temperature (about 60°). It is of considerable importance, in the more severe cases, to raise the chest above the level of the body by a bed chair: this facilitates breathing and expectoration, and prevents the too free gravitation of the blood to the lungs. In prolonged cases, especially those of a typhoid kind, it is also proper to vary the posture from side to side, and to lying on the face when the patient cannot sit, several times in the day, to prevent the *hypostatic* congestion. This is recommended by M. Gerdy and Dr. Stokes.

SECTION II.

CHRONIC PNEUMONIA.

As we shall see, with regard to pleurisy, so also in pneumonia, the inflammatory action may not entirely cease with the effusion of lymph, although it do not lead to the third or suppurative stage. When acute inflammation is extensive, and the effusion of lymph is not removed by absorption, the disease generally proves fatal before there is time for further change; but in circumscribed peripneumonies, or in small parts of more extensive hepatization, a chronic inflammation sometimes goes on, and produces that kind of tough induration which is the general result of chronic inflammation in a parenchymatous structure. Thus in the lungs of those who have suffered from long and repeated attacks of inflammation of the chest, even where there are no tubercles, we not unfrequently meet with portions of the tissue that are dense, almost destitute of air and of liquid, tough, and sometimes almost cartilaginous. Their colour varies from a dark dingy red to different lighter shades of reddish brown and buff, sometimes rendered gray by a mixture of the black pulmonary matter. Their aspect also is varied, like that of acute hepatization, by the tissues that are chiefly affected, being sometimes granular or oolitic (as Laennec has stated) from the especial thickening of individual vesicles; in other cases streaked or veined, from the hypertrophy of the interlobular septa and cellular tissue around the large vessels; in others more uniform and of a darker colour, from the pulmonary plexus of vessels being the chief seat of the alteration, and the colouring matter of the blood entering largely into the deposition. In this last variety, the cellular tissue between the lobules is sometimes thickened to the amount of several lines, and is of a light drab or gray colour, like that of miliary granulations, and like them has almost the density of cartilage. These changes, which thus occur as the sequel of acute pneumonia, are also frequently met with complicated with those states of the lung which are called tuberculous; and a considerable portion of the consolidation that is met with in phthisical lungs often presents the same anatomical characters as these chronic hepatizations which supervene on acute pneumonia imperfectly subdued. These will be further noticed under PHTHISIS. We have also several times met with these chronic consolidations in the lungs of those who have long suffered from extensive organic disease of the heart, where the circulation of the lungs was perpetually impeded by the structural lesions of that organ; it is probable that the same mechanical congestion from this cause, which sometimes leads to effusion of blood in the tissue, constituting pulmonary apoplexy, may, if long

continued, terminate in effusion of lymph, and obliteration and consolidation of the pulmonary texture. This condition of the lung is sometimes coupled with an irregular dilatation of the air-cells; and, on examination after death, the organ presents a knobby surface, and feels nodulated, where the consolidation occupies lobules or parts. There seems to be reason for ascribing also to a minor extent of chronic inflammation of the parenchyma, that increased density and rigidity of the pulmonary tissue, without entire consolidation, which are often found in the lungs of those who have long suffered from dyspnœa, whether from bronchial or cardiac disease.

[Induration of the lung, with more or less complete impermeability of its tissue, is an essential character of chronic pneumonia. The colour of the exterior portion varies, but is generally of an ashen-gray, or reddish, or black. The tissue is very hard, dense and resisting; it sinks immediately on being placed in water; it resists on being cut more than hepatized tissue, but does not grate as scirrhus tissue. Sometimes the cut surface is granulated as in hepatization, and sometimes is perfectly smooth, whether cut or torn. Grisolles thinks that the more ancient the disease, the less marked are the granulations. However advanced the condition, the texture of the organ is always to be recognized in the diseased portion, showing the connection of the disorder with inflammation, and separating it from organic diseases which destroy the tissue. The development of the inter-lobular cellular tissue is also very marked, as noticed before. The tissue in chronic induration is drier than that of hepatization; a little reddish, non-aërated serosity is sometimes pressed out. Sometimes small purulent collections are found disseminated in a lung with chronic induration.

Chronic induration of the lung is very rarely met with. Dr. Grisolles, in eight years, saw it only three times; and Dr. Chomel, in sixteen years, during which time he opened three thousand bodies, twice only. Those authors, who speak of it as common, have mistaken other lesions for it, more especially chronic pleurisies, and tubercular degeneration.]

SYMPTOMS.—The signs of chronic pneumonia are those of circumscribed consolidation and obstruction of the pulmonary tissue, which continue long after the urgent symptoms of the acute disease have subsided. The dyspnœa has become less oppressive, but it is still felt on exertion; the fever has been reduced, but there is still some quickness of pulse and heat of skin towards night; there is still some cough; and although there may be improvement in the appearance and strength, it is not progressive, the patient remaining with his organs and functions abridged: there is still partial dulness on percussion, with some bronchial respiration and vocal

resonance in the seat of the late inflammation. If in this state the patient neglect the means which may most conduce to the restoration of his general health, as well as to the removal of these remains of local disease, the indurated portions of lung may either prove centres of fresh inflammation, or they may themselves spread, ulcerate and commence the career of phthisical disease, which will sooner or later destroy life. We have met with several cases of consumption that have appeared to originate in this way, independently of any distinct tuberculous disease or diathesis; the individuals having been in excellent health, and quite free from all chest complaints before the attack of acute inflammation, which afterwards degenerating into this chronic form, laid the foundation of a consumption, and ultimately proved fatal. It is, however, slower and less intractable in its progress than the true tuberculous consumption, for the disease is more local than constitutional; and if circumstances do not occasion its extension, and injure the constitution by a constant and increasing inroad on the functions of respiration and circulation, it may be in the power of nature, aided by art, to effect its removal.

[Simple chronic pneumonia may be regarded as probably always a consequence of acute pneumonia. When the disease passes from the acute to the chronic stage, we perceive an amendment in the acute symptoms; the fever diminishes or ceases altogether; the pain in the side disappears; the sputa lose their viscidness, and the reddish or yellow colour; the appetite returns; but in spite of this amelioration, the flesh and strength in place of returning, diminish more and more, and exploration of the chest shows a portion of the lung more or less impermeable to air; the sound is dull; and bronchial respiration, with bronchophony, with or without the sub-crepitant rhonchus, is heard. Some of the results of exploration are purely negative; the ear detects neither the respiratory murmur, nor any rhonchus; on speaking there is not vocal resonance; and we are led to believe that there was only a circumscribed pleuritic effusion of considerable date. The expectoration is white and more or less opaque than in bronchitis; there is dyspnoea, and sometimes a feeling of oppression in the chest. The fever at the commencement is not continuous, but is so subsequently, with material exacerbations and sweats. At this stage emaciation is rapid, and arrives to a degree that we see only in phthisis, and cancer of the stomach.

We know nothing, or next to nothing of chronic pneumonia. Its duration is from two to three months. Its termination is fatal, though Chomel asserts that it usually terminates favourably, on what grounds he does not say.

DIAGNOSIS.—It can be confounded only with chronic bronchitis and phthisis. The differential diagnosis is indicated in the following synopsis:

Chronic Pneumonia

Is generally, if not invariably, consecutive to acute pneumonia.

More or less dulness over a portion of the chest.

Bronchial respiration; bronchophony; or absence of all sound.

Fever; emaciation and loss of strength.

Chronic Pneumonia

Succeeds to acute pneumonia.

Antecedents; no hæmoptysis; slight emaciation; no night sweats.

Signs of auscultation and percussion in some point on the posterior part of the chest.

Chronic Bronchitis

Succeeds to acute bronchitis, or has the character of chronicity ab initio.

No dulness.

Sub-crepitant rhonchus.

No fever; no emaciation.

Phthisis

Rarely, if ever, consecutive to acute pneumonia.

Signs furnished by auscultation and percussion, under the clavicles.

The *prognosis* is very serious.]

TREATMENT.—The subject of the treatment of chronic pneumonia will be resumed in connection with that of phthisis. It may suffice for the present to add that for those cases which succeed to acute disease, the most effectual treatment consists in a mild course of mercury in the first instance, combined with external counter-irritation, followed by a course of hyriodate of potash and sarsaparilla or some similar alterative, with a mild sea-air, regular gentle exercise, and a well-regulated diet.

SECTION III.

[PNEUMONIA OF CHILDREN.]

PNEUMONIA is a very common disease in children, and is the cause of a larger number of deaths in childhood than any other disease, with the exception of the exanthemata.—(West.)

Under five years of age, lobular pneumonia is the most common in children, although lobar pneumonia sometimes occurs. Lobular pneumonia occurs frequently as a secondary affection in childhood as in adults, complicating the exanthemata, hooping-cough, &c.—but it also occurs as an idiopathic affection; by many writers, however, it is considered as always secondary, resulting from the extension of the bronchial inflammation to the substance of the lobules; and the condition of the bronchi, as we shall see, when we come to treat of the post-mortem appearances, would lend a good deal of countenance to such an opinion. Pneumonia in children, may, as in the adult, be developed in the midst of health, or in the course of another disease. But whilst in adult life primitive pneumonia is common, in children, especially in the first years of life, it is rare. By lobular pneumonia we understand

that form of pulmonary inflammation which occupies one or more isolated lobules.

ANATOMICAL CHARACTERS.—Exteriorly the lung is soft and flabby; its colour is a reddish-gray, more or less deep; and throughout there are disseminated in patches, spots of a violet red, generally well circumscribed, salient, solid under the finger, and not collapsing, on the chest's being open, like the surrounding pulmonary tissue. These spots, ordinarily circular, though sometimes elongated, especially from above downwards, are usually seated on the posterior border of the lung; but they are also found in other parts of the organ; sometimes they are absent, and the lung appears sound to the sight, but the finger detects the nodosities, situated more or less deeply. On cutting into the lung, the cut surface presents a marbled appearance of rosy gray and deep violet red; the red external patches correspond with the deep-coloured internal portions, and these spots, and others which are entirely central, form engorged masses, whose aspect resembles that of ordinary pneumonic engorgement—smooth to the cut, granulated on being torn, easily penetrated by the finger, and sinking in water. To ascertain these characters it is necessary to isolate perfectly the hepatized point, and to examine especially its central portion. On pressure this tissue crepitates very little, or not at all, and furnishes a sanious and aërated liquid; but if the central portion alone is pressed, the liquid which exudes is red, sanious, and non-aërated, as in lobar pneumonia.

Lobular pneumonia occurs in the first, second, and third degrees.

First degree.—The cut surface of the pulmonary tissue is marbled of a red and rosy gray; the red portions more or less regularly limited, are a little less firm than the neighbouring parts; they float in water, no matter with what care they have been isolated; and furnish, on pressure, a liquid aërated throughout; they yet crepitate under the finger.

Second degree.—Described above.

Third degree.—This is characterized by a yellowish, or grayish-yellow, or simply gray coloration, which is due to the infiltration of pus into the pulmonary parenchyma; the tissue is very friable; and pressure causes a purulent liquid to exude. When the tint is simply gray, it is easy, unless great attention is paid, to overlook the lesion, for gray hepatization has nearly the same aspect as the surrounding healthy parenchyma, and if care is necessary to ascertain the characters of lobular pneumonia in the second degree, it will require much more when the red colour, the most striking phenomenon, is absent. But if the inflamed points be attentively examined after a section, particular lobules are found salient, and the vesicles not effaced like those of the surrounding parts; on

pressing these salient lobules, a purulent and not serous fluid escapes, and the other characters are detected.

MM. Rilliet and Barthez have described two forms of lobular pneumonia; the one perfectly circumscribed, which they term *mamelonnated*; the other imperfectly circumscribed, which they call *partial*. They believe that these are two varieties, whose origin is the same, but whose progress is different, and which finish by offering some alteration in the symptoms; and that one, *partial lobular pneumonia*, is a transition between lobular and lobar pneumonia. In the first variety, the hepatized patch is perfectly isolated, is situated in the midst of healthy or nearly healthy tissue, and is neatly defined, even when the surrounding tissue is engorged. Sometimes the boundary is established by a resisting white circle or sphere, of a quarter of a line in thickness, and of a fibrous aspect. According to Grisolle, this aspect is due to a false membrane, whose organization is very rapid. Ordinarily, the demarcation is not only established by colour, but also by a slight projection, resulting from the incision having effaced the surrounding permeable tissue; the size of these spots of engorgement varies from a hemp seed to a pigeon's egg; their form is regular and generally spherical; their number ranges from one to twenty or thirty in a single lung. This form of pneumonia results from the inflammation of one or more lobules, without the implication of the surrounding lobules; its tendency is centripetal, *i. e.*, it tends to concentrate itself in the lobules primitively affected. Sometimes there is an engorged circle around *mamelonnated* pneumonia, in which case it becomes centrifugal, and resembles miliary tubercles, which often develop lobular inflammation around them.

The second form, that of *generalized partial lobular pneumonia*, is much less defined than the other; its circumference is insensibly lost in the surrounding tissues, without any distinct limit either in colour, or projection; its volume is generally greater; its form is not always regular; the inflammation extends in different directions, and is everywhere in the second degree, or the centre is in the second degree, and the circumference in the first. In the latter case, it sometimes happens that the engorged patches of the diseased portions unite with several other surrounding pneumonic patches, from whence it results that a considerable part of the lobe is involved, and presents the characters of the first and second degree intermingled. This form of pneumonia has generally been confounded by pathologists with lobar pneumonia. When generalized pneumonia has reached the third degree, it has become lobar, and on being incised, shows the tissue marbled red and yellowish red; the portions which were at the first, have passed to the second degree; and the parts which were at the second have passed to the third degree.

There is, however, an anatomical difference between generalized pneumonia and lobar pneumonia, for, though in both there may be a reunion of different degrees, they are differently disposed. In ordinary lobar pneumonia the inflammation extends from below upwards, in regular gradation; in generalized lobular pneumonia, on the contrary, several lobules, indiscriminately disseminated, inflame and unite. When, however, it remains at the second degree, it simulates lobar pneumonia perfectly; but in these cases you ordinarily find in the same lung, or in the opposite one, inflamed lobules in the second degree, and the remains of well-marked lobular pneumonia.

Lobular pneumonia is much rarer, in all its forms, than lobar; generalized lobular pneumonia is much more frequent than mame-lonnated. Lobular pneumonia, in the immense majority of cases, is double. Mamelonnated pneumonia is equally frequent in all parts of the lung; generalized infinitely more so in the inferior than superior lobes, but is often disseminated in the three lobes. Mamelonnated pneumonia is as equally common on the right as on the left side; generalized pneumonia is more common on the left side. Mamelonnated pneumonia is more rare above six years of age than partial; and generalized is more rare than mame-lonnated pneumonia, from six to fifteen years.

ABSCESS.—The pus primitively deposited in the interstices of the pulmonary tissue, unites in a small collection, which occupies the centre of the inflamed mass; this drop of pus is surrounded by two concentric zones of inflammation; the internal one yellow (first degree); the other peripheric, red, more consistent, (second degree); later the external red circle is invaded by the suppuration; the dimensions of the central cavity increase at the expense of the yellow circle, and finally, an incision of the inflamed points shows cavities varying from one to several lines; they are generally perfectly round; more rarely oval; they contain a yellowish or greenish yellow, thick, non-aërated liquid; it is rare to see this fluid reddish and thin; but sometimes clots of blood are mingled with the pus. The interior of these cavities before they have reached their full development, is formed by a layer of hepatized pulmonary tissue, in the second and third degree; they are lined sometimes with a layer of concrete pus, at other times with a yellowish false membrane, soft and easily detached. Later this false membrane is transformed into a thin, smooth, polished lamina, resembling serous membrane. Sometimes these cavities are completely isolated from the cavities which surround them; at other times they communicate with them; and at the point where the bronchus communicates with the cavity, the mucous membrane is perforated with a sharp perpendicular edge. If the inflammation has invaded several neighbouring lobes, the cavity is multilocular, and each of the purulent cavities is isolated from its neighbour, by a lamina of

hepatized tissue, or communicates with it when the walls are partially broken down.

An abscess may be situated in any part of the lungs, but more ordinarily it tends to the surface, and in some instances is formed by the adhesion of both layers of the pleura. A small, thin and soft false membrane, entirely analogous to that which covers sub-pleural tubercular granulations, unites the costal and pulmonary pleuræ, and when the lung is raised, the false membrane ruptures, and a little passage is perceived conducting into the interior of the excavation. If adhesion does not occur, the pulmonary pleura gradually thins, and perforation and pneumothorax occur. When the abscess communicates with the cavity of the pleura, the purulent pouch is entirely empty. In a case reported, adhesion occurred between the base of the left lung and diaphragm, and the abscess, by perforation of the diaphragm, opened into the cavity of the peritoneum. Sometimes abscesses, entirely empty and lined with false membrane, are found side by side with abscesses quite full. It is possible that their contents have been absorbed.

These pulmonary abscesses are often perfectly isolated, and except the thin layer of hepatized lung, which envelops them, they are surrounded by hepatized tissue. At other times an entire or large portion of a lobe is inflamed. The cut surface in this instance offers the same appearance as that just described for generalized pneumonia, with the addition of purulent collections, either in the centre or near the surface of the inflamed portions, their mamelonnated origin being evident from their regular form, the exact circumscription of their contour by a yellow hepatized circle, whilst the intermediate parts are unequally studded with patches in the first and second degree of hepatization. These abscesses vary in number; sometimes there is but one; sometimes though rarely, they are so numerous that they cannot be counted. Their size is in proportion to their number. They are usually limited to one lung, and are situated on the left more frequently than the right.

CARNIFICATION.—The lung is depressed, soft and flaccid, instead of being, as in pneumonia, salient, resisting and hard to the touch; its colour is violet, or pale red, and marbled with white radiated lines, disposed in lozenges or squares, which mark the lobules. It does not crepitate. When cut into, it is red, smooth, and firm under the finger, which penetrates with difficulty; a serous, bloody, non-aërated liquid is squeezed out,—its aspect is nearly that of a muscle, whose fibres have been compressed and are indistinct; it generally occupies the margin of the base of the lungs; it resembles a portion of fœtal lung, or that condition of lung described by Jörg, called *Atelectasis pulmonum*. The advanced age of many of the patients in whom it is met, forbids, however, its being

attributed to that cause. Rilliet and Barthez regard it as a termination of pneumonia. It is generally single; and attacks either lung indiscriminately.

COMPLICATIONS.—Bronchitis is a very common if not constant accompaniment of lobular pneumonia, and is met with in all its forms and degrees; it occupies almost exclusively the smaller bronchi. The bronchial glands are very constantly inflamed. Pleurisy is frequent, and to such a degree as to constitute pleuropneumonia. Acute emphysema of the lungs is frequent; its intensity is in ratio with, 1st, the extent of the pulmonary inflammation; 2d, with that of the bronchitis; 3d, with the severity of the disease; and 4th, with the accompanying dyspnoea; it occupies the summit of either lung, or the lower edge of the upper lobe; it is more generally vesicular than interlobular; it is ordinarily double, like the pneumonia; and is always more decided on the side where the inflammation is greatest.

CAUSES.—Lobular pneumonia most generally is secondary, supervening on other affections; but it is sometimes idiopathic, appearing in the midst of health. Of two hundred and forty-five cases, three only were in health at the moment of seizure. Lobar pneumonia occurs more frequently in the midst of health, and when secondary, generally occurs in acute diseases, and rarely in cachectic and debilitated children. *Age* is a predisposing cause. Of two hundred and forty-five cases, one hundred and seventy-two were below five years. Of two hundred and three cases of lobular pneumonia, one hundred and sixty were in children from one to five and a half years of age; and forty-three from six to fifteen.

Sex.—Pneumonia is more frequent in boys than girls at all ages.

Season.—This question is solved with difficulty, for pneumonia in children being usually secondary, we find that it is common in proportion to the diseases which give rise to it.—(West.)

Anterior Diseases.—Pneumonia supervenes as a secondary affection in typhoid fever, the eruptive fevers, bronchitis, gangrene of the mouth, croup, and bronchitis. Certain anti-hygienic causes, as prolonged dorsal decubitus, teething or bad air, bad diet, the crowded wards of hospitals and asylums, &c., produce pneumonia. The occasional causes are brisk changes of temperature, external violence, &c.

SYMPTOMS.—In describing the symptoms of pneumonia, we shall divide it into three forms—1. Idiopathic pneumonia, or pneumonia supervening in children of good constitution in a state of health. 2. Secondary or intercurrent pneumonia, or pneumonia occurring in the course of an acute disease. 3. Pneumonia occurring in the course of chronic disease, or in a cachectic condition.

1. *Idiopathic Pneumonia*,—Commences generally by intense fever; it is sometimes preceded in very young children by symptoms of slight bronchitis; the respiration is always accelerated; there is a small dry cough, and sometimes, though rarely, pain in the chest. There is occasionally vomiting, and, in young infants, diarrhœa; great thirst; anorexia; there are often agitation and anxiety; in young children there is drowsiness; convulsions are rare. During the first day auscultation detects, if the pneumonia is lobular, general subcrepitant rhonchus, and very rarely bronchial expiration; if lobar, crepitant or subcrepitant rhonchus; sometimes there is blowing respiration ordinarily limited to one side and the base of the chest. On the succeeding days, the intensity of the fever and of the blowing respiration increases, whilst the rhonchi diminish; the *alæ nasi* are largely dilated; the inspirations are rapid, often unequal and interrupted; the cough is frequent, short, dry, painful and paroxysmal; there is great anxiety of expression; at this period expectoration takes place—rarely, however, in young children—it is not abundant, often bloody, and rarely rusty. About the fourth or fifth day, the acceleration of the pulse and of the respiration has attained its maximum, with that of the hepatization; blowing respiration is well marked; it is heard in both times, is accompanied by bronchophony or resonance of the cry, and with dulness to some extent. This condition of things lasts for one or two days; at that period, (about the seventh or ninth day,) if the disease is to terminate favourably, there is diminution in the frequency of the pulse; the heat of skin is less; the respiration falls; the *alæ nasi* no longer dilate; the expression is natural; the injection of the face disappears; the cough is moist; abundant subcrepitant rhonchus is heard; blowing is limited to expiration; the resonance of the voice and dulness diminish; the fever disappears; the respiration becomes natural; the appetite returns; cough diminishes; and from the tenth to the fifteenth day, convalescence is established, though a little prolongation of expiration continues, with diffused resonance, and the respiration often remains feeble, and does not resume its vesicular character for some days. When the disease is to terminate fatally, the oppression from the first is excessive; the pulse is very small, the face pale, the cheeks violet; moist rhonchi are heard over the chest, mixed with dryer rhonchi, or with bronchial respiration and diffused resonance; the general symptoms go on increasing, and death occurs in seventy-two hours. In other cases, a pneumonia, which for the first five or six days has presented the symptoms above enumerated, and arrived at the period of resolution, remains stationary or the resolution is incomplete; although the fever has diminished, the pulse remains accelerated; the face is pale, the body emaciated; there are anorexia, thirst, diarrhœa; the cough, which had disappeared, returns, and is difficult and painful; auscultation

reveals extensive hepatization, and at the end of three or four weeks the child dies in a state of great emaciation and debility.

2. *Secondary Pneumonia*—offers a special character. If it is simply lobular, the symptoms resemble nearly those just described; subcrepitant rhonchus is heard on one side or generally on both, posteriorly. If it becomes rapidly generalized, or from the commencement is lobar, the fever increases, the respiration is accelerated, and suffocation, as in capillary bronchitis, sometimes takes place; the strength is depressed; the face is greatly altered; the cough is intense; there is rarely expectoration; the colour of the face varies. The physical signs vary; sometimes subcrepitant rhonchus is heard posteriorly on one or both sides; sometimes disseminated bronchial respiration; and sometimes feebleness of respiration only. The intensity of the symptoms increases, and coldness of the extremities, alteration in the countenance, smallness of pulse, and the violet-tint of the face, announce approaching death. Sometimes death happens in the course of a few days, sometimes not for two or three weeks. When the disease is to terminate favourably, the regular progressive march which is seen in primitive pneumonia does not occur; the rhonchi are much more abundant, more moist; it is not till the seventh or ninth day that resolution commences; bronchial respiration appears one day and is absent the next, and reappears at a later period; the general symptoms diminish. The duration of secondary pneumonia is variable, and is governed by the disease it complicates; it rarely, though, exceeds twenty-five days.

3. *Asthenic or Latent Pneumonia*.—This form is generally confined to young children, and usually appears in the course of chronic enteritis. Occurring in debilitated, emaciated subjects, the symptoms are not usually well-marked. Cough is infrequent, and sometimes does not exist; expectoration is absent; the skin is pale and cold; the pulse is very small; the face and extremities are œdematous; sometimes, however, there is a temporary reaction, which does not last long, and the disease would remain entirely latent, if auscultation did not reveal the state of the case; there is colliquative diarrhœa; no thirst; the appetite is good; sometimes boils and ecchymoses appear on the skin, with ulcers; there is great emaciation, and the infant dies in a state of marasmus. When simply lobular, it is difficult to ascertain its character with precision.

DIAGNOSIS.—When a case of pneumonia is seen from the first, the practitioner can generally readily distinguish one form from another—lobular pneumonia being known by its abundant moist rhonchi, sometimes on one side, sometimes on both, posteriorly, and cannot well be confounded with lobar. But if not called early the physician may easily be mistaken.

A generalized lobular pneumonia may be confounded with a lobar pneumonia. If the child has been sick for some days, if

there is bronchial respiration over a great extent of the chest, and on percussion considerable diminution in clearness, there may be some doubt as to its precise character, if it is primitive, and limited to one side. If there be none or but little moist rhonchus, it is probably lobar; if secondary, or double, with an abundance of moist rhonchi, it is most likely lobular. The course of the disease will, however, elucidate its nature, especially the manner in which resolution occurs; in lobular pneumonia, bronchial respiration appears and disappears several times—whenever, indeed, the rhonchi increase or diminish; in lobar pneumonia, it accompanies the redux crepitant, which is generally of short duration, and imperfect.

Lobar pneumonia and bronchitis cannot well be confounded; but the differential diagnosis of lobular pneumonia and bronchitis is more difficult, the two diseases having common elements, which frequently mask each other, and it is sometimes almost impossible to diagnosticate with certainty, the mamelonnated and partial varieties from simple bronchitis, and even when generalized, the distinction in some cases is very difficult, the quantity of the rhonchi masking the inflammation of the parenchyma. The resonance of the voice or of the cry, and percussion alone furnish some light, the general symptoms being identical. The age and circumstances under which the disease appears serve to elucidate the diagnosis. If humid rhonchi occur from the first, in a child above six years of age, it is probable that the disease is simple bronchitis; if the same symptoms occur in a very young infant, it is nearly certain that it is broncho-pneumonia.

PROGNOSIS.—This varies according to the age of the patient and the form of the disease. When primitive, and occurring from two to five years, it terminates by a cure in a large majority of cases, when uncomplicated with gangrene of the mouth, or cerebral or intestinal symptoms. When primitive pneumonia attacks children between six and fifteen, it usually terminates favourably, with certain exceptions, however—lobular being more dangerous than lobar, and double lobar than single pneumonia. The occurrence of an intercurrent scarlatina, meningitis, or pleurisy, influences materially the result.

Lobar pneumonia from six to fifteen years of age, in perfectly healthy children, when single, and uncomplicated by any intercurrent affection, is cured in a great majority of cases. The symptoms announcing a fatal termination are, convulsions from the beginning; smallness of pulse, either from the commencement or in the course of the disease; great acceleration of the respiration; persistence of bronchial respiration in very young subjects; the incomplete resolution of the pneumonia within the ordinary period; obstinate diarrhœa and cerebral symptoms. Considerable emaciation, great depression, and lividity of the face, excessive irritability, and a general yellow tint of the skin, are signs of bad augury. Inter-

current pneumonia, occurring in the course of the eruptive fevers, is very serious; especially if the patient is feeble, or has been debilitated by previous disease.

TREATMENT.—In the treatment of pneumonia in children, the circumstances under which the disease is usually developed must be borne in mind, and the general as well as the local condition of the patient must be looked to. Pneumonia in children, as we have seen, is very frequently a secondary affection, and we have other indications than merely to subdue the inflammation. Certain useful indications are furnished from its frequent complication with bronchitis, and in treating this disease, we should bear in mind that we have not only to treat the parenchymatous lesion, but at the same time to diminish the bronchial secretion and favour its expulsion.

When idiopathic pneumonia attacks a healthy child, we should first deplete as freely as the constitution of the patient will permit; our first depletion should be large, for children in general do not bear repeated losses of blood. If over two years of age, we should bleed from the arm—from three to four ounces may be taken; under this age leeches should be employed; they should be applied beneath the scapula; from four to fifteen leeches may be applied according to the age of the child. If the inflammatory symptoms persist, and the pulse and condition of the patient warrant it, the bleeding or leeching may be repeated the following day, or leeching alone may be had recourse to. Immediately after the bleeding, tartar emetic may be administered to children over three years of age; but in infants its employment is of doubtful propriety; if there be much accumulation in the bronchi, it may be given in sufficient quantity to vomit, and afterwards administered for its contra-stimulant properties. A quarter of a grain may be exhibited every fifteen minutes till free vomiting ensues, and afterwards one-eighth or one-fourth of a grain may be given in solution every three or four hours for twenty-four hours; its action must be watched, however, and its administration should be confined to decidedly sthenic cases, in which depletion is demanded. In younger children, ipecacuanha should be substituted, when an emetic is necessary; sufficient may be given to provoke vomiting, and it is afterwards to be continued in combination with calomel. Dr. Condie combines it with a small quantity of digitalis with advantage. At the commencement of the treatment, from two to five grains of calomel may be administered, followed by castor oil, or magnesia, or enemata. Subsequently, calomel may also be combined with tartar emetic and Dover's powders.

26. R.—Calomel. gr., vj.

Ant. et potass. tart., gr. i.—iss.

Pul. Ipecac. gr. iij.

M.—Div. in pulv., vj.

Sig. One every four hours, for a child four years old.

If the calomel produce too much action on the bowels, mercurial ointment may be substituted—one drachm of mercurial ointment may be rubbed into the thighs or the axillæ three or four times a day, in children four years of age. On the appearance of mercurialization, calomel should be omitted for a day, to be resumed according to circumstances. Mucilaginous drinks often allay the irritation in the throat. After the violence of the disease has subsided, a powder of calomel, ipecacuanha and hyoscyamus is often of advantage, or the compound honey of squill may be given. Blisters are of doubtful benefit in most affections of children, and in pneumonia they cannot be of service. When revulsives are necessary, sinapisms will be found very useful.

TREATMENT OF CONSECUTIVE PNEUMONIA.—In secondary pneumonia, depletion should be sparingly used, or not at all; tartar emetic is generally of doubtful utility; mercury is a valuable remedy in this form of the disease, and may be advantageously employed in the form of inunction. Stimulants may now be resorted to with great benefit; wine is often as indispensable as in the pneumonia of adults, and ammonia may be given with decided advantage. The aromatic spirits of ammonia in milk, which conceals its disagreeable pungency, is the best form, perhaps, in which it can be administered. The syrup of senega is also an excellent stimulant expectorant at this time. If diarrhœa does not exist, strong beef tea, or veal broth is the best form in which nourishment can be given; but if the bowels are relaxed, the farinaceous articles, or the white decoction of the French Hospitals, may be substituted. The latter is made by boiling half an ounce of hartshorn shavings, and the inside of a roll, in three pints of water, till reduced to a quart. Sinapisms or mustard poultices will materially relieve the severe paroxysms of dyspnœa.

GENERAL MANAGEMENT.—The following judicious regulations for the general management of patients are given by Dr. West in his excellent Essay on the Pneumonia of Children. “It is desirable, in all cases of pneumonia at all severe, that infants should be taken from the breast, and that the mother’s milk should for a time be given them from a spoon. This is of importance on two accounts: partly because the thirst they experience induces them to suck overmuch, (hence it is well that barley-water or some other diluent be given to them frequently instead of the milk, in order that they may quench their thirst without overloading their stomach;) partly because the act of sucking is in itself mischievous, since, as must at once be perceived, it taxes the respiratory functions to the utmost.

“A second important point is never to allow the children to lie flat in bed or in the nurse’s arms, but to place them in a semi-recumbent posture in the arms, or propped up in bed. By so

doing, respiration is facilitated, since the diaphragm is relieved from the pressure of the abdominal viscera, and that stasis of the fluids in the posterior parts of the lungs is prevented, which has been shown by French writers to be so prejudicial to infants or children labouring under pneumonia.

“The only point to which I will allude is, that when pneumonia has reached an advanced stage, or has involved a considerable extent of the lungs, the children should be moved only with the greatest care and gentleness, lest convulsions should be brought on. Whatever may be the explanation of this occurrence, the danger is by no means an imaginary one, for I have seen instances in which children have been seized with convulsions immediately on being lifted somewhat hastily from bed and placed in a sitting posture; and on this account I have referred to what might seem to be a trivial matter.”]

SECTION IV.

[GANGRENE OF THE LUNGS.]

This affection was hardly known to the older writers, though Boerhaave has traced its prominent features in his usual lucid and concise manner. “*Tandem si bronchialis arteria, vel et pulmonalis vehementissimâ inflammatione corripitur a causâ internâ vel externâ, brevi nascitur gangræna, et inde citò sphacelus, ob copiam motuum, et ob motum assiduum visceris tenuissimi. Id futurum docent: 1°. signa violentissimæ peripneumonice nullo casu, nec arte sedata: 2°. debilitas summa cita, pulsu se imprimis manifestans: 3°. frigus extremorum et jam natam scimus, si hæc prægressa, sputa ichorosa, tenuia, cenerecea, livida, atra, fetida; inde autem cita mors.*” (Aphorisms, 844.) Many of the cases of ulcerated phthisis recorded by Bayle, were doubtless instances of gangrene of the lungs. It is, however, to Laennec and Cayol that we owe the first correct researches into the nature and phenomena of this disease, which has since been very accurately studied by Andral, Bouillaud, Récamier, Foville, Cruveilhier, Piorry, Laurence and others. Gangrene of the lung is the destruction by sphacelation or mortification of the whole or part of that organ. It is not a common disease; Laennec met with it only seven or eight times, and Grissolle saw about the same number of cases.

CAUSES.—Gangrene of the lung is most commonly met with in adults, though it occasionally occurs in children. It is exceedingly rare under six years of age. It is much more frequent in males than females. All Laennec’s cases were males. M. Laurence (L’Expérience, 1840,) states the proportion between the sexes to

be as fourteen to three. In eighteen cases of gangrene of the lungs occurring in children between two and a half to fifteen years, collected by MM. Rilliet and Barthez, twelve were boys and six girls. It most commonly occurs in individuals of intemperate habits and debilitated constitutions. M. Guislain, (*Gaz. Méd.*, t. iv., Jan., 1836,) states, that a large number of insane, who refuse obstinately to take food for any time, die of gangrene of the lungs. M. Foville (*Dict. de Med. and Chir. Prat.*), frequently found in the lungs of idiots who died in a state of great exhaustion and filth, and who had gangrenous ulcers over the sacrum and trochanters, small gangrenous cavities, especially along their anterior border; no symptoms during life had led to a suspicion of their existence, and he believes that they were produced by the absorption and deposition of putrid matter in the lungs. Where it occurs in consequence of the general vitiation of the system, it is very frequently associated with gangrene in other parts. In the eighteen cases collected by MM. Rilliet and Barthez, gangrene of other parts existed in ten. It is also a termination of pneumonia, but a very rare one of acute sthenic inflammation of the lungs, for of three hundred and five cases analyzed by Grisolle, not one terminated in gangrene, and of seventy published cases carefully collected by him, seven only could be considered as positive instances of this mode of termination. Nor in these rare instances can the cause of this termination be determined; age appears to have no influence in its production, and nothing can be more clearly established than that the chances of gangrenous disease are not directly as the violence of the inflammation. M. Genest regards pulmonary apoplexy as a common cause of gangrene, and MM. Rilliet and Barthez, from the cases which fell under their observation, think that it is possible that gangrene may supervene from the putrefaction of the effused blood. Valleix, (*Guide du Med. Prat.*, vol. ii. p. 342,) however, regards the hæmorrhage as secondary, and as the result of the erosion of the pulmonary vessels. Louis has observed abundant hæmoptysis in gangrene of the lungs, but it occurred in the course of the disease, and not at the commencement. Gangrene of the lungs supervenes sometimes in the course of the eruptive fevers, and MM. Rilliet and Barthez consider them, and especially measles, to be the most common predisposing cause of the disease in children. Tonnelè (*Arch. Gén. de Méd.*, 1830), asserts that it sometimes complicatés puerperal fever. M. Genest has published several cases which he supposes were due to purulent resorption; and Cruveilhier believes that capillary phlebitis may occasionally be a cause. Cruveilhier and Piorry each mention a case, where the obliteration of an artery supplying a lobule was followed by gangrene, and Dr. Carswell gives an instance of compression of a vesicular branch by a tumour being followed by gangrene.

PATHOLOGY.—Laennec has divided gangrene of the lungs into two species—circumscribed and non-circumscribed. When the gangrene occupies a considerable extent of a lung, and has no distinct limit, the pulmonary tissue of the affected part is engorged, humid and easily broken down, its colour varying from a dirty white to a deep green, or blackish hue, intermingled occasionally with brown or brownish-yellow spots. In some points the infiltration of blood gives a livid aspect to the tissues. Other portions of the diseased tissue are converted into a putrid mass, which escapes on an incision in the form of a turbid, thick, sanious, greenish-gray fluid. The whole mass exhales a strong gangrenous odour. Of the circumscribed variety, there are three degrees. In the first you find irregular jet black, or dark-green masses, moist, resisting pressure, and compared by Laennec to the eschars on the skin produced by vegetable caustic; around these masses the pulmonary tissue is inflamed, the process of elimination going on. In the second degree, the gangrenous mass is reduced to a state of putrilage, is of a dirty greenish-gray colour, sometimes tinged with blood, and readily washed away by a slight stream of water. Finally, either from the eschars being detached in a mass, or from the removal of the softened mass by expectoration, an irregular anfractuous cavity remains, which is lined with a soft, grayish or greenish false membrane, and traversed by similar bands, more or less thick, and contains a sanious fluid, exhaling a fœtid odour. The pulmonary tissue immediately surrounding the seat of the gangrene, offers several conditions. Sometimes there is a simple, serous, sanguinolent engorgement, of a violet or slaty or livid tint; at other times it is gorged with blood, and is jet black, like the masses of pulmonary apoplexy; more frequently it is in the second stage of hepatization—the inflamed tissue being of some extent, of a dull red colour and very friable. In two cases recorded by Cruveilhier, there was found in the midst of one of these cavities containing pus, a fragment of soft, whitish, pulmonary tissue, evidently sphacelated, with traces of the bronchial ramifications and blood-vessels, and not fœtid. These he regards as instances of dry gangrene of the lungs. One of the patients survived thirty-five days; the expectoration had been bloody, puriform and inodorous.

The right lung would appear to be more frequently the seat of this lesion than the left. In sixteen cases occurring in children where the seat of the disease was accurately noted, ten were in the right, four in the left, and in two both lungs were attacked.

SYMPTOMS.—When gangrene of the lungs occurs as an idiopathic affection, with previous pneumonia, the phenomena of invasion vary. Sometimes fever with oppression and pains in the chest

precedes the appearance of the characteristic sputa. Generally, however, there is, for a period varying from a day to several weeks, decided malaise, with debility and anorexia, wandering pains in the chest, and cough—symptoms indicative of some disorder of the respiratory organs, without revealing its exact nature. In the cases occurring in the insane, recorded by Guislain, there were no chest symptoms, until after expectoration had taken place. When the disease is a termination of pneumonia, the characteristic symptoms of gangrene suddenly supervene. The most prominent of these is the peculiar odour of the expectoration and the breath. The sputa vary very much. At the commencement they are mucous, milky white, opaque and slightly fœtid; they subsequently become of a brownish-yellow or greenish hue; sometimes they are of a dirty grayish colour and sanious. After a cavity has formed, the peculiar gangrenous sputa are mixed with muco-purulent matter. The sputa are never viscous, or tenacious. Their odour is of the most repulsive kind, resembling that from external gangrene, but more penetrating and insupportable, and much more perceptible after a paroxysm of cough. Louis, according to Valleix, (*loc. cit.*) has noted several times a very strong fœcal odour, without any thing extraordinary having been noticed at the autopsy. Sometimes the patient is aware of the odour and is incommoded by it, but generally he seems unconscious of it. When no communication with the bronchi exists, expectoration will be wanting. Cough is a constant symptom except in the insane, where, according to Guislain, it is absent; it is generally feeble, though sometimes sharp and painful. The pulse is frequent, and is generally stated by writers to be small, but Louis, who has observed carefully several cases of gangrene of the lungs, only noticed this condition at the termination of the disease, when the prostration was very great. The skin is dry and hot; the face greatly altered, and the expression hippocratic; the patient very feeble; and the decubitus dorsal. The teeth, tongue and gums are usually covered with a black fuliginous coating; when the progress of the disease is rapid, delirium and restlessness occur, though ordinarily there is stupor. Towards the termination of the disease there are sub-sultus tendinum, a fœtid diarrhœa, sloughs over the sacrum and trochanters, with other symptoms of extreme adynamia.

The *physical signs*, before excavation has occurred, are flatness on percussion, over a space of more or less extent; in the same region a subcrepitant rhonchus is heard, with bronchial respiration and bronchophony; after a cavity has formed, there will be cavernous respiration, gurgling and pectoriloquy.

The progress of this disorder is variable; sometimes it is very rapid, running through all its stages in a few days; at other times it is prolonged for several months; Louis has seen several cases last for five or six months. It sometimes terminates in perforation

of the pleura and pneumothorax. Cicatrization of the cavity may take place. Cruveilheir (*Anat. Path.* liv. xi. p. 2), has figured several gangrenous cavities in progress of cicatrization.

DIAGNOSIS.—In the course of a well-marked pneumonia, if the breath and sputa acquire a gangrenous odour, and the expectoration is sanious, purulent, opaque and not viscous, and with these symptoms there is great prostration, there can be no doubt of the existence of gangrene of the lungs. We shall have the same certainty, if, besides the gangrenous odour of the breath and expectoration, there is dulness, over a limited space, in the chest, with subcrepitant rhonchus, bronchial respiration, bronchophony, followed by cavernous respiration, gurgling and pectoriloquy.

The walls of tuberculous cavities sometimes become gangrenous; the history of the case and careful physical exploration will generally define the character of the case.

PROGNOSIS.—Can gangrene of the lungs terminate favourably? Many instances of recovery from gangrene of the lungs have been published, but of all these, a solitary one, observed by Louis, is the only case in which there is no doubt as to the real nature of the disease. Recovery, therefore, though rare, is possible. Death may occur in the second or third stage of the disorder.

TREATMENT.—In the treatment of gangrene of the lungs, the most prominent indication is to support the patient by nutritious diet, and the administration of opium, wine, quinine, &c. In addition to these means, the chloride of soda may be administered internally and by inhalation. This treatment should be persevered in for some time after the fœtidity of the expectoration and breath has ceased.]

SECTION V.

[PULMONARY APOPLEXY.

THIS disease was scarcely noticed by or known to pathologists, until it was investigated and described by Laennec. It is a congestion of the lung accompanied with the effusion of blood into the air-cells of one or more lobules, or into the substance of the organ itself, lacerating and destroying its structure, and in some cases even rupturing its investing membrane. It is a disease of by no means common occurrence.

CAUSES.—Organic disease of the heart is the most common predisposing cause of apoplexy of the lungs. Of twenty-two

cases examined after death by Dr. Townsend, (Cyc. Prat. Med., art. Apop. of the Lungs,) fifteen, or rather more than two-thirds, occurred in individuals labouring under heart disease; in two instances it was connected with tubercles; in one it was caused by external violence; and in four he was unable to trace the hæmorrhage to any local impediment to the circulation, or to any organic disease of the heart or lungs. In most of the cases reported by Laennec, Andral, Bouillaud, Rousset, Cruveilhier, Bricheteau, Law, &c., there was organic disease of the heart, affecting principally the right cavities of the organ. Dr. Watson declares that the heart disease is in its left chambers, and very frequently consists in contraction of the mitral orifice. "No example of pulmonary apoplexy," he says, "even *apparently* dependent upon hypertrophy of the *right* side of the heart, has ever fallen under my notice." Although the majority of cases of apoplexy of the lungs is secondary, it sometimes occurs without any apparent derangement in the pulmonary system, or rather premonitory symptom, and must in such instances be regarded as an idiopathic affection. Of six cases proving suddenly fatal, recorded by Dr. Townsend, three were in the enjoyment of perfect health up to the moment of seizure; a third was a robust man in the prime of life, who had occasionally suffered from bronchitis and constipation; a fifth was in the advanced stage of typhus fever; and in one case only could the disease be traced to any organic disease of the thoracic viscera. According to Louis, apoplexy of the lungs was not an uncommon lesion of the yellow fever at Gibraltar in 1828.

SYMPTOMS.—An attack of pulmonary apoplexy is sometimes very sudden, its progress rapid, and a fatal termination speedy. The patient is seized without any premonition with intense dyspnœa, amounting almost to suffocation; this with great anxiety, a profound alteration of countenance, and occasionally hæmoptysis, sometimes copious, sometimes slight, is frequently the only symptom present. These are instances of the *apoplexia fulminans* of the ancient writers, and the *apoplexie foudroyante*, of the French. When the invasion is less violent, there is first usually an uneasy feeling or constriction about the chest, with heat, and sometimes actual sharp pain; the respiration soon becomes embarrassed, is deep, interrupted and irregular, and genuine orthopnœa may supervene. When the oppression is very severe, the inspiratory muscles contract violently and elevate the shoulders, and tracheal respiration may be heard at some distance; if there be fluid in the bronchia there will be gurgling; there are alternate redness and paleness of the face, with chilliness of the surface, and a sharp cough, followed, sometimes, by the expectoration of bright-coloured frothy blood. This latter symptom has been variously

estimated. According to Laennec, hæmoptysis is one of the most constant and important phenomena of apoplexy of the lungs, the blood being generally voided in considerable quantity, pure and fluid. Bricheteau, Louis and others deny, on the other hand, that hæmoptysis ever occurs in pulmonary apoplexy. This difference of opinion has arisen from too great exclusiveness in the views of these writers. It would appear from the observations of Andral, Bouillaud, Rousset, &c., that the hæmoptysis is most frequently limited to the expectoration of sanguinolent sputa, that sometimes it is more abundant, and that it is frequently altogether wanting. When the sputa are sanguinolent, the blood is not intimately mixed with them; it is more or less red, with a tendency to coagulation. When the symptoms we have just enumerated, have acquired much intensity, the face becomes pale or livid, the body is bathed in a cold sweat, there are great anxiety and suffering, the pulse is frequent, soft and feeble, with sometimes a peculiar vibration.

The signs afforded by physical exploration are by no means satisfactory. Those considered as pathognomonic by Laennec,—absence of respiration in a circumscribed space, corresponding to the seat of the lesion, with a border of sub-crepitant rhonchus,—have not been by others found to be by any means so constant. Persistent weak respiration immediately over the seat of the extravasation, or if it be extensive and superficial, suppression of the respiratory murmur within a limited space, with harsh and exaggerated, bronchial and even blowing respiration, beyond the limits of the effusion, and mucous rhonchus, if there be hæmoptysis, and slight bronchophony, are more usually considered as the ordinary physical signs derived from auscultation, though still frequently wanting. On percussion the clearness and duration of the sound are diminished, and the resistance of the parietes is increased, in proportion to the degree and extent of the lesion. When the lesion is limited nothing can be expected from percussion, and even Dr. Piorry confesses that much less is obtained from it than we had reason to anticipate.* These signs will of course vary, and be modified according to the situation of the hæmorrhage. According to Laennec, the most common seat of apoplectic effusion is the central part of the lower lobe, or towards the middle and posterior portion of the lungs; it is consequently in the posterior inferior regions of the chest that we are to search for the physical signs.

PATHOLOGY.—The anatomical lesions of apoplexy of the lungs have been studied with great care. Considerable congestion, either of one or both lungs, or of considerable portions of the

* *Traité de Médecine Prat.*, &c., t. iii. p. 173.

lung will be found. The vessels are greatly distended, the lungs red, voluminous and heavy, and when cut into the blood, flows slowly. Generally, however, another lesion is present, which occurs in two forms. In the one we find a number of hard, firm, circumscribed masses or knots, of a dark colour, varying in size from a marble to a hen's egg; when cut into they offer more resistance than hepatized lung, the surface of the incision is dark red or black, granular, the granulations being larger than those of hepatization, the edges are defined, terminate abruptly, and exhibit a strong contrast with the surrounding tissue, which is ordinarily sound, soft and crepitant, or else slightly infiltrated with blood. In the other form of pulmonary apoplexy there are fewer of these masses, sometimes only one, and that large, diffused, and occupying a whole lobe, or sometimes nearly an entire lung; in such cases the parenchyma is broken down, and reduced to a soft fluctuating mass, and there is a quantity of extravasated blood partly fluid, partly coagulated, with traces of the original structure found; the colour of the mass gradually deepens towards the centre, which is formed of a black clot of blood. Corvisart, Bagh, Andral, Ferguson, &c., report cases where laceration of the investing membrane occurred, with the escape of the effused blood into the cavity of the pleura.

In the first of these forms the solid, dark-coloured masses, are caused by the effusion of blood into the air cells of one or more lobules, and its subsequent coagulation. This may be satisfactorily proved by examining in a strong light the granular surface of a section, and by gently scraping it with a scalpel, so as to turn out the little rounded coagula from the cells,—resembling dried, or, according to Bouillaud, boiled blood,—after which the distinct cellular tissue of the part is evident, resembling a section of the corpus cavernosum penis. Here there is no solution of continuity, but a simple infiltration of the vesicular structure, the exact circumscription being due to the isolation of the lobules one from the other. The solidity is due to the absorption of the serum, and the coagulation of the fibrin, for when death is immediate, the masses are much softer. The dark colour is caused by the stagnation of the blood.

The concurrent lesions are, usually, cardiac disease, sometimes pulmonary tubercles.

DIAGNOSIS.—From what has been said, when treating of the symptoms, the difficulty of forming a diagnosis in pulmonary apoplexy, will be easily understood. The absence of respiration and the flatness on percussion, regarded as pathognomonic by Laennec, are, as we have seen, frequently absent, especially if the lesion is deep seated, or even when present, are very difficult to ascertain.

The accompanying subcrepitant or mucous rhonchus is due to hæmoptysis, which may be wanting or present. These difficulties caused Bouillaud to say that pulmonary apoplexy was rather to be guessed at than diagnosticated. Still there are cases where the physical signs before enumerated, conjoined to the rational symptoms, will enable us to make out a diagnosis with tolerable certainty and precision. When in a circumscribed portion of the lung, generally in the middle or lower lobes and posteriorly, there is diminished clearness or decided dulness on percussion, with the respiratory murmur in the same spot feeble or absent, the sputa sanguinolent, the blood and mucus not being intimately mixed, with great oppression and anxiety, and when all these symptoms have appeared suddenly, we may diagnosticate with tolerable certainty apoplexy of the lungs, especially if there coexists cardiac disease.

Pneumonia is the only disease with which at first sight pulmonary apoplexy could be confounded; but the error will be avoided if attention is paid to the difference in the general and physical signs. The absence of fever and gastric derangement, the difference in the character of the expectoration, and the absence of crepitant rhonchus, and decided blowing respiration and bronchophony will elucidate the diagnosis.

PROGNOSIS.—Apoplexy of the lungs must always be viewed as a very serious disease, and in the majority of instances terminates fatally. In some cases death occurs very suddenly, but usually the progress of the disorder is slower, the symptoms gradually augmenting in intensity, until the patient dies asphyxiated. Its duration is seldom more than a few days. Considerable embarrassment in the respiration, great anxiety, coldness of the extremities, quickness and smallness of the pulse, and finally, the symptoms of cardiac disease in an advanced stage, announce certain death. Gangrene of the lungs sometimes supervenes on pulmonary apoplexy, and our prognosis should always contemplate the possibility of such an event, especially where the lesion is considerable and the constitution of the patient such as to favour gangrene. In one instance Dr. Townsend, (*Cyc. Prat. Med.*, art. *Apop. of the Lungs*), was enabled to trace the different stages of the disease from the formation of an apoplectic extravasation into a gangrenous mass.

TREATMENT.—The principal indication in the treatment of pulmonary apoplexy is to relieve at once the local congestion and arrest the hæmorrhage. With this view one or more veins should be immediately opened. We must bleed freely at the outset, and until relief is afforded and a decided impression made on the pulse, or until partial syncope is induced. A prompt and active cathartic should then be administered.

27. R.—Olei Tiglii, gtt. ss.
 Ext. Col. Comp., gr. x.
 M.—Div. in pil., ij.

Nauseating doses of tartar-emetic, either alone or in combination with the nitrate of potash, will be found of great service in relieving the congestion, reducing the action of the heart, and equalizing the circulation. Sinapisms should be applied to the extremities and between the shoulders. If this course of treatment should be so successful as to relieve the imminent distressing symptoms, we ought then resort to such means as will prevent further congestion and hæmorrhage. Total rest and silence, with a severe antiphlogistic regimen, must be prescribed. Nitrate of potash, or tartar-emetic, may be given in suitable doses. The acetate of lead has been highly praised by the late Dr. McIntosh. Digitalis or prussic-acid may also be of service in controlling the action of the heart.]

SECTION VI.

PULMONARY ŒDEMA.

ŒDEMA of the lung consists in an effusion of serum into the tissue, probably both between and within the cells and minute tubes.

ANATOMICAL CHARACTERS.—Its anatomical characters are, that the lung is heavier and paler than usual, pits on pressure, crepitates little under the finger, and when cut, exudes a frothy serum. [On opening the thorax an œdematous lung does not collapse: its colour is a clear or reddish gray, less deep anteriorly than posteriorly, where it is sometimes of a violet hue. When thrown into water, the lung floats entire or in parts. Its consistence is normal. According to Andral, œdema of the lungs in adults is situated at the inferior posterior part of these organs. Rilliet and Barthez have not, however, found this to be the case in children. Their observations, founded on seventy-seven autopsies, exhibit the lesion more constantly in the superior than inferior lobe. The quantity of fluid in the organ varies: sometimes on the section of the lung there is a mere oozing; at other times the lung is greatly distended by it, and on cutting into it, it escapes in large quantity. Air is generally mingled with the contained liquid, but it is occasionally wanting. Laennec regarded this as an evidence of the age of the disease. Air is wanting also when the œdema coincides with pneumonia or carnification. Laennec considered the seat of the œdema to be always the pulmonary vesicles; but it seems probable that it is also interlobular.]

It should be borne in mind that in many instances œdema of the lung is a post-mortem phenomena.]

CAUSES.—It is seldom idiopathic, but like œdema of other parts, results from some loss of balance in the circulation, an obstruction to the return of blood, or in a few instances an excess of exhalation. Thus it may arise from the obstructions occasioned by organic diseases of the heart, lungs, or liver, or from the increased exhalation supervening on exanthematous fevers, particularly scarlatina and rubeola, or on those diseases of the kidneys which interfere with their excretory function, and are accompanied by dropsical effusions in various parts. [Œdema of the lungs is not an uncommon affection in children, although it has attracted very little attention. It is nearly always secondary, and very frequently terminal; it frequently forms part of those sudden serous congestions which follow scarlet fever, and so much endanger the life of the patient. Albuminous nephritis is one of the most frequent causes of œdema of the lungs. It is probable that this affection may occur with general dropsy, independent of any local pulmonary lesion.]

SYMPTOMS.—Being thus a sequel of other disease rather than a pathological condition distinct in itself, the symptoms accompanying œdema must vary greatly according to the cause which produces it. When extensive, it occasions dyspnœa, cough, and thin mucous or serous expectoration.

The *physical signs* are a crepitant or subcrepitant rhonchus, with the breathing less fine and even than that of pneumonia, and giving proof of the presence of more liquid by the mucous rhonchus in some of the larger tubes. The natural vesicular murmur is rendered indistinct, especially at the lower and back part of the chest, where also the sound on percussion is impaired. These signs are very like those of the first stage of pneumonia; and the distinction is chiefly to be found in the general symptoms; the fever, rusty expectoration, and progressive increase of pneumonia being absent, and there being present œdema of other parts, or other signs of disease that may be supposed to produce it. [We have no positive signs furnished by auscultation by which we can recognize pulmonary œdema. One cause of this difficulty is that this lesion is nearly always a secondary affection, occurring conjointly with bronchitis, pneumonia, pulmonary or bronchial tubercles, &c.; the signs of these affections being mingled, its recognition is obscured.] From our own observation we should say, that the lungs are less liable to œdema than the external cellular tissue; and they are rarely so affected unless there be also anasarca, or œdema of the limbs.

TREATMENT.—This must depend on the nature of the cause,

and be adapted to the character of the organic lesion which is generally present. The œdema which follows scarlatina and measles generally yields to hydragogue purgatives and digitalis; in addition to which general or local bleeding may, in some severe cases, be required.

SECTION VII.

PHTHISIS PULMONALIS, OR PULMONARY CONSUMPTION.

Under this head we propose to include all those forms of disease of the lungs which arise from the formation of tuberculous matter, or of depositions and indurations which are allied to it, in the substance of the lung. By the names, *phthisis*, *consumption*, and more properly by that of *decline*,* is implied the wasting of the body from the effect of a disorganizing process going on in the lungs. A disease so varied in extent and course as phthisis is, can scarcely be comprehended in a definition by symptoms, but its most general character may be stated as follows: cough, with at first little or only transparent expectoration, occasionally hæmoptysis, afterwards opaque, purulent, and copious expectoration; quick pulse and fever, particularly in the evening, and ending with night sweats; dyspnœa, or shortness of breath, gradually increasing; progressive emaciation and debility. The chief physical signs are, irregular expansion of the chest, dulness on percussion, with imperfect or bronchial sound of respiration in some of the upper parts of the chest; afterwards cavernous rhonchus, respiration, and pectoriloquy; indicating partial consolidation of the lung, followed by the formation of cavities, communicating with the air-tubes.

But it would be irrational and tedious to enter into any details of the symptoms and history of the disease, without first considering the pathological nature of those changes which it causes in the lung; and as these are chiefly learned by a study of the anatomical characters of the lesions, we shall premise a brief sketch of these; and by tracing out their progress through their stages and complications, we may be enabled better to comprehend the nature of the disease, and the signs and symptoms which accompany it.

ANATOMICAL CHARACTERS.—When we examine the lungs of persons who have died of consumption, we find them greatly changed from their natural condition: they are more or less consolidated in irregular masses; and on cutting into them, they are

[* The Irish name of phthisis is very significant and expressive, *seilgean-as*, a shrinking of one's self.]

also generally found excavated into hollows of various sizes and shapes, which are either empty, or contain a thick liquid matter.

The morbid conditions may be arranged under the following heads :

1. On pressing the softer parts of the lung between the fingers, there are felt in it a number of hard little bodies ; and on cutting into them, they are found to be roundish granules, of a light semi-transparent reddish drab, or skin-colour, sometimes more gray or ash-coloured, more rarely devoid of colour and quite transparent ; of sizes varying from a pin's head to a hemp-seed. Their hardness is considerable, sometimes almost equalling that of cartilage ; these are the *miliary granulations* and *miliary tubercles* of Laennec and other writers. They are sometimes found isolated, and studding a tissue otherwise healthy : but more commonly they are in groups of several together : and then they are either clustered in bunches like little berries, or they form a considerable mass, with the interstitial tissue consolidated and indurated between them. They are most commonly distinct in the inferior lobes ; in the upper parts, and near the root of the lung, they are usually conglomerated in masses. In the upper parts, too, it is most common to find in them opaque specks of a yellowish-white colour, which are generally in the centre of the granules, sometimes at their margins. In the distinct granulations, the opaque part is little more than a speck ; but in those which form a conglomerated mass, the opacity is often seen extending from granule to granule ; and in others it constitutes a mass of considerable size within the indurated cluster of granulations.

[MM. Andral, Rilliet and Barthez have described another origin of tubercular matter, consisting of small, numerous white or yellow spots, which they call *tuberculous dust* (*poussière tuberculeuse*) ; smaller than the gray granulations, often less than a grain of sand or grits, it resembles the very small eggs of an insect. Often these granules escape the sight from their extreme tenuity, and it is only after looking at the organ for some time steadily that you are enabled to recognize them. You then see indistinctly a quantity of yellow dust sowed through the tissues, and on regarding with attention the diseased surface, you are enabled to distinguish each grain of this dust, perfectly round, elliptic or oval. More or less numerous in the same spot, they are not close enough to form a continuous yellow surface ; sometimes they are placed in small groups, like the eggs of flies, without being perfectly in contact with each other. Occasionally, however, these grains by their union, form well-marked tubercular masses ; in such cases pressure will often squeeze out a drop of blood—a certain proof that vessels still exist in their intervals. At other times it is impossible to prove the presence of vessels. The tissue in which this dust exists, is generally invaded by acute and chronic inflamma-

tion, sometimes by gray infiltration, and is nearly or entirely impermeable to air. If you press between the fingers a portion of the pulmonary tissue thus affected, a serous or sanious, non-aërated liquid escapes, but the dust preserves its integrity, a proof that it is not fluid.

The identity of this dust and yellow tubercle is probable, and for these reasons: the dust has only been found in tuberculous lungs; the difference between the dust and miliary tubercles is apparently only in volume; and thus an intermediate series up to crude tubercle can be shown. Another proof of their being identical is the fact that masses of this dust united, form tubercular masses.]

2. A consolidation of another kind is also commonly found. It is diffused through some extent of the pulmonary tissue, of no particular shape, except that sometimes it seems to be limited to single lobules; it varies in consistence; it is often as nearly as hard as the miliary granulations, and in parts has somewhat of their semi-transparency and colour; but generally it has a darker hue, from the colour of the blood and the black pulmonary matter in it. The consolidation is pretty complete, and the pulmonary texture cannot be distinguished in it, except here and there the coats of a large blood-vessel, bronchus, or interlobular septum, which are often thickened and partake of the induration. In other cases the consolidation is less perfect; there being still some air in the tissue, and the adjoining portion of lung being often emphysematous. In these indurated masses, are often to be seen, here and there, more opaque light-coloured spots, which are sometimes quite distinct, and of a dead yellowish-white, like those seen in the miliary granulations: but they are here less regular in their shape and size; being sometimes in streaks, curves, and angles, and mottling the dark consolidated texture with spots and patches of a lighter and opaque hue. In the lightest and most opaque spots, we recognize what must be described as the next class of morbid appearances to be met with in phthisical lungs, namely,—

3. Opaque yellowish-white masses of various form and size, generally somewhat rounded. Some of these are nearly as solid as the dark or semi-transparent indurations, but they are much less tough; others have more or less of a cheesy consistence; and some are found in parts approaching to a state of grumous fluidity, still retaining their light colour and opacity. These opaque masses are commonly found within the indurations from which they appear to be formed, and they are just of the same character as the specks before described as occurring in some of the single or aggregated miliary granulations. In fact, as these specks are seen (in some in greater number and extent, and preceded by an intermediate state of opacity), in parts to pervade the whole mass, it may

be fairly concluded that the clusters and nodules of granulations are also converted into this same opaque friable yellowish-white matter. This matter, which is indisputably entitled to be distinguished as tuberculous, is occasionally found also in other situations, unaccompanied by any induration; such as in the interior of dilated vesicles and bronchial tubes, in masses under the pulmonary pleura, and in the bronchial glands. In these instances, it is commonly of a more friable and cheesy consistence, and has not the hardness which it seems to retain for a while when it has originated in the indurated tissue. But this yellow tuberculous matter, however tough and hard it may be in the first instance, tends to soften, partially or wholly; and thus the masses are sometimes found consisting of loose clots in a puriliginous fluid, or wholly reduced to a curdy or cheesy kind of puriform matter. The tuberculous matter is also not unfrequently found diffused through a considerable extent of the pulmonary texture, constituting the *infiltrated tubercle* of Laennec. In its earlier condition, the lung in this state closely resembles the advanced stage of hepatization, when the opacity which precedes suppuration shows itself. It is very much mottled or marbled; for, besides the yellowish-white opacity, which is seen in different degrees, there is the black pulmonary matter, giving it a gray or greenish colour, besides the white coats of vessels and interlobular septa, and red spots of tissue less affected. When the lung in this state is cut or torn, which it commonly may be with facility, its anterior presents a granular surface like that of hepatization; and except that its colour is more varied, and it has generally more of the light opacity of tuberculous matter, it resembles a hepatized lung very closely. But in it there are often found what are rarely met with in hepatized lungs—circumscribed abscesses or cavities containing a fluid matter. To this softened and fluid state, then, all the conditions which we have been describing tend to pass, and thus are formed *vomicæ*, the matter of which being evacuated into the bronchial tubes, leaves the form of lesion next to be mentioned.

4. Lastly, we find cavities or excavations very various in number and form, and of sizes from that of a cherry-stone upwards to the extent of a whole lobe. Sometimes they contain more or less of the remains of the softened tubercle, or a more liquid pus, or a mixed serous, mucous, and purulent fluid tinged with blood, or they may be empty. They communicate with the air-tubes, and often with each other,—the process of softening and ulceration having opened the passage; but blood-vessels and interlobular septa are often found to have escaped the destructive process, and form cords or bands across the cavities. The blood-vessels are, however, almost always impervious in these cases, and the septa are thickened by the deposition of lymph. The walls of the cavities are composed of the consolidated tissue of the lung, rough,

and sometimes sloughy; or of an irregular coat of lymph; or, in old cavities, of a kind of new membrane, which in some cases is thin and fine like a mucous membrane, and in others thick, rigid, and more of a fibro-cartilaginous character. [Around the caverns and suppurated tubercles you constantly find an induration of the parenchyma. The tissue of the organ is of a slaty hue, more or less gray, very hard and completely impermeable; if it is cut into or torn, the granulated appearance of hepatization is not visible. This gray matter has an opaline appearance, which cannot be ascribed to the presence of gray granulations, inasmuch as they are absent; it is traversed by white, thick, cellular septa, quite as distinct as those of non-tubercular chronic pneumonia; it is exsanguineous, and when pressed or divided, generally yields. Not unfrequently you find disseminated on its surface a number of gray granulations, or even crude or suppurating tubercles. According to Dr. Chomel, this peculiar induration of the lung is but a few lines in thickness, but Dr. Grisolle has found that in some cases it has acquired that of nearly half an inch. Its extent of surface is much greater, for it follows in all their windings the tubercular excavations, of which it forms a part of the walls.] When these cavities approach to the pleural surface of the lung, there is often a coating of lymph or false membrane on the pleura at the part, which either thickens in it, or unites it by adhesions to the costal pleura. Sometimes, however, there is no such deposit or adhesion; and it occasionally happens, that the pleura is also ulcerated, and being perforated, allows the contents of the cavity, and the air from the bronchi, to pass into the pleural sac, causing pneumothorax and pleuritic inflammation. There is this remarkable in the position and size of the cavities,—that they are almost always largest and most numerous near the summits of the lungs; there being often one or more cavities there, when in the inferior lobes there are only scattered indurations. In fact, it may generally be observed of all the lesions connected with phthisis, that they affect the upper and posterior more than the lower and anterior lobes; and that they are also more advanced in the former. This is, however, more remarkable with the circumscribed indurations and tubercles; for with the diffused consolidations, especially of the light opaque kind, (tuberculous infiltration,) the middle and inferior lobes are often also affected, and cavities are commonly found in every part.

Besides these chief and more essential changes of the lungs in phthisis, many others are often found of a more accidental character, such as hæmorrhagic effusion and consolidation; inflammatory congestion and hepatization of the lung; products of inflammation of the pleura; inflammation, ulceration, thickening, and dilatation of the bronchial tubes; irregular dilatation of the air-cells, sometimes with increased flaccidity, sometimes with rigidity;

enlargement and induration of the bronchial glands, with yellow tuberculous matter in its different states in them. The last affection is of common occurrence in children; and, according to Dr. Carswell, sometimes exists to such an extent as to cause the glands to swell and press on the trachea near its bifurcation. [In about one-sixth of the whole number of patients dying of phthisis, there is recent pneumonia, which almost always occupies the lower lobe; it consists of engorgement or red hepatization. It occurs in about the same proportional frequency as in other chronic diseases, and tubercles and tuberculous cavities have little or no influence on its development in the terminal period of phthisis. Adhesions between the lungs and costal pleuræ are constant, for of one hundred and twelve subjects, Dr. Louis found one only whose lungs were perfectly free in every point of their surface. There is always a direct proportion between the amount of adhesions and the degree of pulmonary disorganization, and this constant relationship shows the influence of tuberculous cavities on the generation of the pleural adhesions. Tubercles or gray semi-transparent granulations are found developed on the attached surfaces of the costal pleura, with or without attendant false membranes on the corresponding free surface. Recent pleurisy occurs at the close of life in about one-sixteenth of the cases. A pleuritic effusion from one pint and three quarters, and upwards, sometimes occurs rapidly before death. The two pleural lesions proper to phthisis are the cartilaginous cap investing the summit of the lung, and the tubercles met with either in pleuritic false membranes, or beneath the attached surface of the serous tissue.]

Besides, in the lungs, various lesions are frequently found in other organs in the consumptive. The trachea or larynx is not uncommonly ulcerated, particularly in those parts over which the matter expectorated most commonly passes. Hence the side of the trachea and branches next to large cavities in the lungs, and the under surface of the vocal cords and epiglottis, are more commonly the seat of these ulcerations. Louis met with ulceration of the larynx in one-fifth of the cases of phthisis which he examined, and of the trachea in a third; whilst these lesions were met with only once in one hundred and twenty-two cases not phthisical. MM. Trousseau and Belloc have also shown that ulceration of the larynx is generally, but not constantly, connected with pulmonary tubercles. The ulcers are very various in number and size, and they do not often extend below the mucous and submucous membranes.

[The trachea, larynx, epiglottis and bronchi are very frequently the seat of ulceration. The mucous membrane of the trachea, when the seat of ulcerations, is commonly of a bright red colour, though sometimes it retains its natural whiteness; sometimes it is slightly thickened and softened. When small, the ulcers are dis-

tributed generally over the entire circumference of the trachea, are of a rounded or oval form, and one line in diameter, with flat edges, and a fundus of cellular tissue with or without thickening, and look as if cut out with a punch. From the flattening of their edges and their pinkish hue, these ulcerations will escape the sight, unless the trachea be carefully washed and examined. When larger, they are generally congregated at the fleshy part of the trachea. Sometimes the sub-mucous tissue is destroyed, and the muscular structure, considerably thickened, is laid bare. Occasionally the ulceration extends to the cartilaginous rings, which, in one case of Dr. Louis, were actually perforated, and five times there was total destruction of the mucous membrane of the trachea.

Ulcers of the larynx are commonly deeper than those of the trachea, irregular in outline, and vary in extent from one to ten lines; their colour is grayish or whitish; the point of junction of the chordæ vocales is their most common seat; next the chordæ vocales themselves, especially their posterior aspect; then the base of the arytenoid cartilages, and the upper part of the larynx.

Ulcers of the epiglottis are commonly superficial, though sometimes deep seated, and are almost invariably seated on the laryngeal surface.

Ulcerations of the air-tubes increase in frequency, from the epiglottis to the lungs, and are much more common in the male and female. Tubercles are, according to Dr. Louis, never found in the upper air-passages after fifteen years of age. The development of these ulcerations would seem to be, in a large majority of cases, due to the direct irritation of the sputa, during its sojourn in the air-passages. Ulcerations of the air-passages become more rare the further those passages are from the lungs, for the sputa remain longer in contact with the mucous membrane near their place of secretion than higher up.

From Dr. Louis's observations, and from a careful analysis of the facts, it would seem that these ulcerations, when not syphilitic, are exclusively a secondary lesion of phthisis.]

Tuberculous disease is found in other parts besides the lungs, in a large proportion of consumptive cases; the situation of its prevalence varying with the age of the subject. Thus Papavoine found it, in children, especially to occur in the cervical and mesenteric glands; in the spleen, pleura, liver, and small intestines; less frequently in the peritoneum, large intestines: and rarely in other parts. In the consumptive cases above the age of fifteen, examined by Louis, tubercles were found in the small intestines in one-third of the whole; in the mesenteric glands in a fourth; in the large intestines in a ninth; in the cervical glands in a tenth; in the lumbar glands in a twelfth; in the spleen in a fourteenth, of all the cases; and in other parts in smaller proportions. In

by far the greater number of cases, the tubercle in these different parts seems to be of more recent date than those in the lungs.

[In 1825, Dr. Louis announced the law that after fifteen, whenever tuberculous matter is present in any organ or tissue, it also exists at the same time in the lungs. In the recent edition of his celebrated work, (1843,) he states that his experience since that period goes to prove the truth of that statement. The experience of all other credible observers is the same. In children, this law, however, is far from holding good. Of three hundred and twelve tuberculous subjects, Rilliet and Barthez found that the lungs were only forty-seven times (one-sixth) free from tubercles.

The exceptions are much more common from three to five years, than at any other period; they are about equal from one to two and eleven to fifteen, and are less from six to ten.

According to MM. Rilliet and Barthez, we find tubercular matter in children in the lung more frequently than in any other organ; next the bronchial glands; afterwards, but at some distance, the mesenteric glands, and small intestines; after these organs, the pleura and the spleen are most liable, and then the peritoneum, the liver, the large intestine, the meninges, the kidneys, the heart, stomach and pericardium. The same order exists with regard to the amount of tuberculization; those organs in which we most frequently find tubercular matter, are those, in general, in which we find it most abundantly.]

The intestines are very commonly more or less ulcerated in pulmonary consumption. Louis found this lesion in five-sixths of his cases; and in the large intestines, besides ulceration, there were thickening, softening, and increased redness; and out of the whole number which he examined, in three instances only were the large intestines found quite healthy. [In the small intestines semi-cartilaginous and tubercular granulations are common. The former of these are white, hard, and resemble cartilage in their aspect; they are generally small, about the size of a pin's head, but may attain the volume of a pea. Generally very numerous, they exist sometimes in the whole length of the intestine, at a distance of from one to three inches from each other, and their number and size, in such cases, usually increase in proportion as they approach the cæcum. Their usual seat is in the interspaces between the glands of Peyer, and indifferently on the circumference of the intestine, but they not unfrequently are situated on the glands themselves; they are always placed immediately beneath the mucous membrane, in the sub-mucous tissue, which leads Dr. Louis to believe that they are the muciparous glands inordinately developed. When small, the mucous membrane around them is sound; but when they attain the volume of a pea, it becomes red, softens, is thickened, and finishing by being destroyed; and subsequently, they themselves are partially destroyed,

and are replaced by an ulceration, with white, hard and opaque edges. Tubercular granulations are less numerous; they are found in and around the ulcers; between muscular fibres, and immediately beneath the peritoneum. They are as numerous on the glands as in their intervals; and are always most numerous in the neighbourhood of the cæcum. These granulations soften, when the adjacent mucous membrane reddens, inflames and ulcerates; this lesion is very common, being found in about one-half the cases of phthisis. As a general rule the ulcers found in the small intestines of phthisical patients are the result of the softening of the tubercular granulations; but there is every reason to believe that they may be developed independent of their existence. Their number and dimensions are greater in the lower third of the small intestines, where they are most commonly met with, though sometimes they extend their whole length. Their size varies from one line to six inches in diameter; when small, they exist on the glands of Peyer, which are partially or entirely destroyed; when very large, they occupy the entire circumference of the bowel. Their form varies with their dimensions; when small they are round or oval, like the granulations; when situated on the glands, they are elliptical; sometimes they are round, or even linear; their colour is whitish, and gray-red, or black. Their structure varies with their age; when recent the mucous membrane is alone destroyed; subsequently the sub-mucous; and finally the muscular, the peritoneum forming the base of the ulcer; and rarely complete perforation occurs. Sometimes when extensive, the ulcerations are formed by the union of a number of small ulcers, and the intervening tissue less altered, resembles bridges or isles. According to Prus, ulceration of the intestines is met with in no other chronic disease.

In the large intestines, tubercular granulations rarely exist, but ulcerations are nearly as frequent as in the small; they are generally small, though sometimes their dimensions are considerable. They would appear to be, in many cases, at least in their development, independent of inflammation. They occur in other chronic affections, but to a much less degree.

The co-existence of fistula in ano with phthisis has been greatly exaggerated. Andral states that he has only been able to find it once in eight hundred cases. Louis says that he has not been more successful. The proportion in this country strikes us as somewhat greater, though still very rare, but we have as yet not sufficient data to pronounce on the exact proportion.]

Louis remarked, that in two-thirds of his cases the stomach was remarkably distended, sometimes acquiring double or treble its usual size, and reaching down to the pubis; a condition rarely to be met with in other diseases.

[The mesenteric glands are not unfrequently in a tuberculated condition; it exists nearly always as yellow tubercle; the glands

are usually red and softened; the tubercular degeneration does not generally implicate the entire gland; those nearest the cæcum suffer most. The meso-cæcal, meso-colic, and lumbar glands also sometimes contain tuberculous matter.]

A very remarkable change is often found in the liver of phthisical subjects, caused by the deposition of a kind of fatty matter in its structure. The bulk of the organ is generally increased; it is softer than usual, and of a paler colour, and on being cut greases the knife, or more evidently shows its oily quality on a slice of it being heated on paper. This state of the liver does not occur in all cases of phthisis, and is more common in females than in males: it is found in rapid as much as in prolonged cases. The function of the liver does not seem to be much impaired by this change, for the ducts contain bile as usual. [The fatty degeneration of the liver is extremely frequent in this country and France. The organ is enlarged, but not altered in form, and of a faded leaf colour; its specific gravity is diminished, and when cut into, in the advanced stage, it greases the scalpel; when less developed, by gently heating a slice on paper, it will grease it. It is four times as frequent in females as males; it would appear to be almost peculiar to phthisis. This transformation may occur very rapidly.]

According to the researches of Drs. Louis and Biot, the heart in phthisis is ordinarily small and softened, with a disposition to fatty deposition.

Independent of tubercles developed in the pia-mater, it is very common to find amongst phthisical patients granulations which Dr. Louis regards as morbid productions, and not glands, as was supposed by Pacchioni and other anatomists, and to which he has given the name of arachnoid granulations, and which spring from the surface of the cerebral arachnoid, and rarely from that part lining the dura-mater.

Tubercular matter is found sometimes in the uterus, Fallopian tubes, prostate, kidneys, spleen, &c.

The peritoneum, also, not unfrequently contains tubercular matter, and chronic inflammation of that membrane is probably always tubercular.]

PATHOLOGY OF PULMONARY TUBERCLE.—The characteristic changes which anatomy discovers in the lungs of the consumptive, may for the most part be reduced to two. 1. Consolidation, generally indurated, either almost colourless and semi-transparent, or pearly gray, or reddish drab, or of a dark red or more dingy colour. 2. An opaque yellowish-white or parsnip-coloured friable matter, of various degrees of consistency, being first more or less hard, and afterwards becoming soft and forming vomicae; this lighter opaque matter, which is properly called tuberculous, is

produced commonly within the consolidations just named, but sometimes elsewhere. We proceed to advert shortly to the opinions of some eminent modern pathologists on the nature and origin of these lesions.

Laennec considered tubercles "accidental productions—that is, real foreign bodies—which spring up in the substance of the lungs, and may be developed in any other texture of the body." We owe great respect to the name of Laennec, but we must in candour confess that his views of the nature and origin of tubercle are neither satisfactory nor altogether intelligible. It may be collected from his writings, that tubercles are parasitical bodies originating in an unknown way, possessing a life and structure of their own, growing by attracting matter to them, and tending by their own inherent properties to go through a certain series of changes. The transparent miliary granulations of Bayle, the gray miliary tubercles, the gray diffused induration, and a kind of gelatinous infiltration, he looked on as varieties of these bodies in their first stage, and as all tending, *per se*, first to become opaque and yellow, or crude tubercle, which is still hard; and afterwards to soften into a cheesy or pasty liquid, which is the mature tubercle. Now this view involves several assumptions little supported by analogy;—for instance, that bodies so different in physical character and texture are the same; and that the stages through which they pass are produced by assumed inherent properties, and not by the modified properties of the tissue of the organ;—and it further assumes what has been disproved by extended observation,—that the opaque yellow tubercle is always preceded by the gray or semi-transparent, and that the gray induration must always in time become yellow tubercle. Whilst we admit the accuracy of Laennec's observation, that the gray and semi-transparent indurations tend generally to become yellow tubercle, we must consider his view of the change to be too hypothetical and unsupported to be received as satisfactory.

The view of M. Andral is far more simple, and involves fewer assumptions. He considers tubercles generally to be the result of a modified nutrition of the textures; and that they are produced and go through their changes by the agency of the vessels of the part, and the blood which circulates in them. Although he admits that the miliary and diffused indurations precede the production of yellow tuberculous matter, he supposes them to be not an early stage of this matter, but the result of chronic inflammation affecting the individual vesicles, or the general texture. The chief peculiarity of this view is, the explanation of the regular form and size of miliary tubercles, by locating them in the individual air-vesicles, just as the same author first accounted for the granulations of a hepatized lung. That the diffused induration, called by Laennec the first stage of tubercle, is the result of chronic inflam-

mation, has been admitted by Chomel and Louis, who otherwise rather incline to Laennec's views.

The most recent writer on this subject is Dr. Carswell, who has developed his views in his admirable *Illustrations of the Elementary Forms of Disease*. He neither adopts the opinion that the indurations are an early stage of yellow tubercle, nor does he admit that they are more than accidentally connected with it. He supposes yellow tubercle to be a peculiar secretion, which takes place especially from mucous membranes; but that it may accompany other secretions, such as that of inspissated mucus in the air-vesicles, or of dense false membranes on the pleura or peritoneum; and thus he accounts for the gray miliary bodies with specks of yellow tuberculous matter, and the similar admixture of this matter with deposits on serous membranes. But on minutely examining the miliary granulations of the lungs, we find no *inspissated mucus* in them to account for their hardness; the induration is obviously in the texture itself, and not merely contained within the cells. Dr. Carswell's view, therefore, throws no light on the manner in which yellow tubercle is produced in the gray or dark indurations, whether miliary or diffused; yet this is a point as well established as any in the pathology of phthisis.

It would take more space than we can spare, to enter into further particulars of the different opinions which have been held in regard to tubercle. If we consider the subject of the pathological changes of the lungs in phthisis, rationally, and in connection with what we have learnt of those in other textures, and other diseases, we may hope to attain a more consistent and satisfactory view of the subject. The researches and opinions of Professor Alison have led the way in this inquiry, and we are indebted to him for some of the succeeding observations.

If we examine the induration that commonly precedes the production of yellow tubercle, we find that it differs from the healthy structure, certainly in these respects,—that it contains a greatly increased quantity of matter, and that this matter is generally harder than the healthy tissue. Now, this increase of substance implies either increased secretion or diminished absorption: that absorption is not diminished in the tissue, is plain from the fact that portions of the healthy texture are at the same time removed by this process, around the indurations; and that increased secretion is present, is proved by the fact, that the indurated texture presents new characters, and is not a simple accumulation of the matter of the natural tissue. Now, to produce an increase in the nutritive secretion, there must, according to a well-established pathological law, be an increased determination of blood to the part. Let us now inquire, whether increased determination of blood in other cases leads to the production of matter like that of

the indurations ; and as the most distinct form of determination of blood, we first take inflammation.

In treating of pleurisy, we found that acute inflammation of the pleura causes an overflow of the nutritive secretion, in the form of coagulable lymph, which may soon become well organized into a soft cellular or serous membrane ; but when the inflammation is of a lower and more chronic character, the effused matter is slower in the process of organization, and forms a harder texture of lower vitality,—a kind of fibrous or fibro-cartilaginous structure. The same observations will apply to the parenchyma of the lung. The overflow of the nutritive secretion, caused by acute pneumonia, we have found to constitute red hepatization, whether granular or diffused ; but on examining the effect of lower and more prolonged inflammation on the tissue of the lung, we formerly described a dark consolidation with increased density, in no essential particular differing from some forms of the indurations of phthisical lungs. Thus the hard, compact, granular consolidations occurring around excavations, gangrenous as well as tuberculous, and admitted, even by Laennec, to be the result of chronic inflammation, has sometimes the colour and consistence of the indurations which precede the formation of yellow tubercles ; and as we have shown that there is a non-granular form of acute hepatization, so it is reasonable to expect that there may be a uniform or diffused kind of consolidation, resulting from chronic inflammation, affecting the interstitial more than the vesicular tissue. To such a condition, the gray diffused induration, called by Laennec the first stage of tubercle, so exactly answers, that Andral, Chomel, Louis, and Carswell, all concur in considering it a chronic form of hepatization. When it is the sequel of the acute disease, or of long continued pulmonary congestion, there is often much redness in the induration ; but where the irritation has been of long continuance, and unattended with the more sthenic degrees of vascular action, or a very congested state of the lung, the texture is more semi-transparent, dense, and gray, or variously modified by the black pulmonary matter in it. The more uniform or colourless masses occasionally present, may be traced to be the interlobular septa, or cellular tissue around the vessel, in a state of indurated hypertrophy. In these bloodless and almost cartilaginous portions, we see the exact characters of the matter of which the miliary granulations or gray miliary tubercles are minute samples ; and if we adopt the view of Andral, that the regular size of these depends on the chronic induration being located in the coats of individual vesicles, we shall see a sufficient reason for their being regular in form, and isolated or in clusters. Moreover, as we have traced the diffused consolidations of the lung through various gradations, from acute soft red hepatization, down to gray induration, so M. Andral has found the miliary bodies presenting the

same gradations; being sometimes soft and red, in other cases livid and harder, whilst the same lung may contain also the granulations similar in size, but pale or gray, and of different degrees of induration. We have twice met with the more rare transparent miliary granulations of Bayle, on the pleura and peritoneum, in conjunction with dense false membranes, and without any yellow tubercles there or elsewhere. As to the common pale granular deposits on serous membranes, they are the acknowledged products of chronic inflammation, and their numbers and circumscribed form constitute another point of resemblance to the miliary indurations, which in the lung pass into the state of yellow tubercle. Without, then, going so far as to assert that the miliary indurations of the pulmonary tissue are always dependent on chronic inflammation, we may fairly say that both they and the diffused induration are more akin to the products of this process, than to any other that we are acquainted with.

The condition of the blood will be found to be a material element in determining the products of inflammation in the case of pleurisy; so, doubtless, it is likewise concerned in the modified putritive secretions of other textures. The more vital and organizable products are furnished by blood rich in fibrin; and they are easily reabsorbed; or if organized, are mobile, and sufficiently like the tissues of the part, not to incommode or irritate them. But if the blood be poor in nutrient matter, the deposit from it may be susceptible of only a low degree of organization, and will consequently be only more difficult of absorption, but less assimilable to the texture of the part, and more calculated to irritate it as a foreign body. It will thus appear, that although the lowest degrees of inflammation may be alone capable of producing the chronic indurations, when the blood is healthy, yet, when it is diseased, various degrees of inflammation or congestion—nay, even the ordinary nutrient process, without hyperæmia, may be accompanied by the deposition of a lymph of degraded character, and organizable only into a dense semi-cartilaginous tissue.

[In the earliest stage of tuberculization, whilst both the rational and physical signs are few and uncertain, there is always a great diminution in the quantity of the red globules in the blood. In no instance did Dr. Andral find them attain their physiological mean, 127. The most elevated number that they reached was 122; the minimum, 99; and they generally oscillated between 120 and 100, being usually more near the latter than the former. The blood of patients labouring under incipient phthisis resembles that of individuals suffering from commencing anæmia, or of patients who have undergone several copious bleedings. The state of the blood in the first stage of phthisis, and probably in the condition of the system which immediately precedes the development of tubercles, is precisely similar to that of individuals,

where from some cause, the vital forces have lost their energy. This initiatory state corresponds to the discoloration of the skin and general debility which characterize the commencement of tuberculization. As the disease advances, the red globules continue to diminish, and reach their minimum when the lung is filled with cavities, which is never, however, as low as that of chlorosis, where they sometimes fall below 30; in phthisis they never descend lower than 72. We have no right to conclude from this fact, however, that the essential nature of the disease consists in a diminution in the quantity of the red globules of the blood, for in other affections, chlorosis particularly, there is an equal or even greater decrease in the red globules, and there is no evidence which goes to show that chlorotic patients are more liable to phthisis than others, or that chlorosis ever passes into phthisis.

Whilst the tubercles are crude, the fibrin remains at its natural standard, but when they commence to soften, the quantity of fibrin immediately increases. This is due to the local inflammations which the softening causes. In the third stage, towards the termination of the disease, where there is great exhaustion and debility, the fibrin, which during the second stage increased, again diminishes, and sometimes falls below the physiological mean.

The blood drawn from phthisical patients at the commencement of the disorder, generally presents a small dense clot, which is produced by the diminished quantity of red globules, whilst the fibrin is relatively in excess. But, as the disease advances, the clot is less voluminous, and is covered with a buffy coat, which is thick and well formed in proportion to the degree to which the pulmonary disorganization has advanced. This is owing to two causes; *a.* the increase of fibrin, common to this stage; and *b.* the diminution of the red globules, which disturbs still more the ratio between the fibrin and the globules. The existence of a buffed coat in the blood at this stage of phthisis is as common as in pneumonia or acute rheumatism. (For further information on this subject, consult *Carpenter's Human Physiology*, Am. Ed. by Dr. Clymer, p. 431; and *Williams's Principles of Medicine*, Am. Ed. by Dr. Clymer, p. 112.)]

The semi-transparent gray or dark induration is not always converted into crude yellow tubercle. Sometimes it is the seat of vomicae which contain a dirty or bloody pus; and although even in this the curdy matter of tubercle is sometimes seen, it is plain that these vomicae result from a more direct and speedy process of ulceration or irregular suppuration; another analogous result of continued irritation in the condensed tissue.

Let us now pursue the same inquiry with regard to the opaque pale yellow matter which characterizes the second class of phthisical lesions. Laennec calls this the second stage of tubercle;

but neither for its formation, nor for its subsequent softening, does he assign any other cause than an assumed and unintelligible "inherent property." Dr. Carswell is more explicit on this point; and all his descriptions of tubercle apply only to this kind of matter. He considers it to be a secretion *sui generis*, totally destitute of organization; and effete matter, continually separated from blood in an unhealthy state; thrown out chiefly on the free surface of mucous membranes: and producing bad consequences only in proportion as it accumulates in organs, impedes their functions, and acts on them as foreign matter. This opinion, so far as it relates to the nature of tuberculous matter, does not differ materially from that long since published by M. Andral, who regards tuberculous matter as a peculiar secretion, formed under the influence of a particular diathesis or condition of the blood, and especially in connection with an irritation, inflammation, or congestion of the blood-vessels of the part.

If we survey the general characters of tuberculous matter, consisting of pale opaque albuminous particles, generally deposited in a tissue previously consolidated, and the manner in which it tends to become liquid, forming circumscribed collections, like abscesses, or infiltrated through the texture, from which it is expelled like foreign matter, we cannot fail to see some general resemblances to the process of suppuration. We have found that the consolidating lymph of a hepatized lung becomes opaque and light-coloured before it softens into pus; but the changes here are too rapid to admit of their being fully watched. But when an analogous process goes on more slowly, and in a simple structure as the pleura, we can better trace the resemblance. Thus, in the latent and more protracted forms of pleurisy, the lymph first effused forms a dense tissue of low vitality, and resembling cartilage in hardness and colour. If the irritation still continue, this new structure throws out a lymph of still lower vitality, in friable shreds, and in some instances in the form of a curdy matter, totally incapable of organization, which, mixing with the effused serum, constitutes one kind of empyema. Now such a process in the pulmonary tissue would resemble all the changes which we have been describing in the production successively of the gray induration, crude tubercle, and softened tubercle. Thus a portion of this tissue (whether a single vesicle, or part of a lobe) generally under the influence of chronic inflammation, or local congestion, becomes indurated by the effusion of lymph susceptible of a low organization. The original irritation continuing, or the very induration itself determining an increased flow of blood to the part, the new structure evolves, in the looser parts of its substance, a still less organic form of albuminous matter, a pale, opaque, curdy substance; but as this cannot be (like that from the pleura) thrown off, it presses on its

indurated matrix, and causing its absorption, accumulates in its place: thus is effected the conversion of the gray induration into crude yellow tubercle. This entirely inorganized substance, acting as a foreign body on the adjoining tissues and the remains of the living texture within it, causes irritation, ulceration, and the effusion of serus and pus, which, as M. Lombard first explained, softens and breaks up the crude tubercle into the curdy grumous matter of the mature tubercle. The same irritation and ulceration give vent to the matter through one or more bronchial tubes; and thus are formed the tuberculous cavities.

But we have seen that yellow tuberculous matter is produced not only in the gray indurations, whether granular or diffused, but also in softer consolidations like that of hepatization. It is sometimes seen in rounded circumscribed masses in a hepatized lung; in other instances, it pervades, with its opaque yellowish-gray or mottled colour, a whole consolidated lobe. In this—the *infiltrated tubercle* of Laennec, the *gray hepatization* of Andral—there are often here and there cavities containing a curdy pus, and communicating with the ulcerated bronchi. There are also occasionally found in it circumscribed indurations and tubercles of older date; but in other instances, no other form of chronic lesion is present, and the lung has the appearance of inflammatory engorgement in some parts, of common red hepatization in others, whilst other portions of the same consistence have the opaque yellowish colour of tubercle; and these conditions pass by such imperceptible gradations into each other, that it is impossible to avoid the conclusion that they are parts of the same process. We see a similar variety sometimes poured out by the inflamed pleura, where one part is covered with good lymph, another with a curdy matter like crude tubercle, whilst many albuminous particles, also in an unorganizable state, are thrown off with the liquid into the sac. So, also, in the very masses of coagulable lymph that an inflamed pleura or peritoneum throws out, there have been found distinct purulent and tuberculous deposits. Nor is this surprising, when we consider that lymph, pus and tubercle are the same albuminous matter, and differ from each other in mechanical condition, and susceptibility of organization, rather than in their chemical nature. According to the microscopic researches of Gendrin, part of which we have followed, lymph is composed of regular globules, which, by a vital attraction, string themselves into fibres and films, which may become organized and form membranes. Pus consists of larger and less regular globules suspended in serum; but these globules have no vital attraction for each other, and remain loose, and consequently insusceptible of further organization. Tuberculous matter is wholly devoid of organic form; its particles not even being globular, but irregular, like those of mere dirt or clay; and it must

remain where formed, a dead, inert mass, until decomposed by chemical agency, or changed by the operation of the surrounding tissues. It is obvious that these different properties, although possessed by matter chemically the same, and from the same source, may lead to all that variety of results which we know to follow organizable, purulent, and tuberculous deposits. But the characters of these matters are not always distinct; lymph is not always equally organizable; nor is it always free from the greenish colour and less coherent globularity of pus, nor even from the lifeless curdy particles of tubercle; and tuberculous matter often contains flakes or films of imperfect lymph. The diffused tuberculation or infiltration of the lung from inflammation, lately noticed, generally presents matter in this transition state. It is neither good organizable lymph, nor wholly unorganized tubercle; and the albuminous effusions on serous and mucous surfaces not unfrequently present such an intermediate state, that it is difficult to determine to which class they belong.

But, lastly, we have found that tuberculous matter is sometimes deposited in tissues bearing no marks of inflammation or other disease. The structures thus affected are commonly those either very vascular naturally, or peculiarly liable to congestion of blood; and viewing tuberculous matter as a deposit of unhealthy fibrin from the blood, we see a reason, as Dr. Carswell observes, why it is most likely to be found in those organs where the blood accumulates or passes slowly. Whatever be the cause which in these cases determines the deposit of tubercle, we know that pus also is sometimes secreted in parts unaffected with inflammation, as in the purulent deposits in the viscera after injuries or surgical operations; and in the profuse purulent discharges from the bronchial membrane, where it is found after death free from all trace of inflammation; nay, something like pus has been found in the blood and in the centre of fibrinous coagula in the heart, when no suppurating surface existed in the body: so, likewise, tuberculous matter has been met with in coagula in the heart, spleen, and blood-vessels. This tends to show that the fibrin of the blood is liable to be converted into tubercle independently of any action of the vessels; it loses its vitality, and may, in proportion, be merely deposited in tissues or on surfaces, independently of irritation. Here, again, as with the gray indurations, we are led to trace to the condition of the blood one cause of consumptive disease of the lung; and it is probably a diseased state of this fluid that constitutes what is called the tuberculous or scrofulous diathesis, in which there is a tendency, by vessels in different degrees of activity, to deposit tubercle instead of lymph; and when this diseased state exists to a great extent, the tuberculous matter is excreted from the blood without any increased vascular action, and merely as an accompaniment of the natural secretion

of a membrane, or instead of the ordinary nutrient deposit of a tissue. Whatever, in such cases, determines the first deposition of tubercle in a tissue, will, with greater facility, effect its increase, by the addition of similar matter to a ready-formed nucleus. The tendency to the deposit of yellow tubercle independently of irritation, implies a condition of the blood even more depraved than that which leads, under the same circumstances, to the formation of the chronic indurations; it is an ulterior degradation of the fibrinous nutriment of the tissues, replacing them by a matter not merely inapt in texture, and of lower vitality, but wholly destitute of life, the principle of organization. When, therefore, tuberculous matter is found in an uninflamed tissue, it may be regarded as a sign of the most decided constitutional taint. In such conditions of the system, tuberculous depositions may take place with great rapidity; and as they are already almost ripe for elimination, the ulceration and destruction of the lung will soon follow. But nothing can give development to the tuberculous disease with such fearful rapidity as the occurrence of acute inflammation in the pulmonary tissue. It is, we believe, from this process in a highly tuberculous constitution, that the general tuberculous consolidation, called infiltrated tubercle, takes place. The matter deposited is often a mixture, or intermediate state of lymph and tubercle, one product predominating in some parts, and the other elsewhere; but it is altogether beyond the reach of the sorbefacient remedies, which avail in pneumonia, to promote the absorption of simple lymph; and if it do not destroy life by its solid interference with the function of the lung, it speedily runs in many points into softening and suppuration, and the patient is carried off by a *galloping* consumption. In this case the lungs are found extensively solidified, and, on incision, incipient cavities are seen almost in every part; but there is no induration; the most solid parts have scarcely more substance than a hepatized lung, and they even more readily break down under the fingers.

[Recent microscopical investigations into the structure of tubercle almost demonstrate the correctness of the views of Dr. Williams as to the nature of this product—a degraded condition of the nutritive material from which the old textures are renewed, and new ones formed, and that it differs from fibrin or coagulable lymph, not in *kind*, but in *degree* of vitality and capability of organization. Mr. Gulliver and others have detected in tubercle the materials of lymph, but in a degenerated and confused state—the cells being few, irregular, shriveled, with imperfect nuclei and incapable of further development; no fibres are perceptible, and the main substance is composed of granular or amorphous matter. If a tubercle, or even the tissue of the lung near it, be slightly compressed between two slips of glass, and moistened with a drop of water, it will crumble down and break to pieces, the fluid becoming at the

same time quite white and milky. This white appearance is attributable to a great number of minute objects, the assemblage of which constitutes the substance of the tubercles. They consist, for the most part, of molecules, granules and granulated corpuscles of various sizes, of aggregated granules without any tunic, and of collapsed tunics without any granules. These objects are mingled with a great many shapeless flakes and filaments, which are no doubt fragments of the membranes of the air-cells, and of the minute blood-vessels, which, when involved in a tubercle, become so extremely brittle, that they must necessarily form a considerable proportion of the objects occupying the field of the microscope. The granulated corpuscles of a tubercle are sometimes very large, ($\frac{1}{800}$ or $\frac{1}{1000}$ of an inch,) and the molecules and granules which are very conspicuous, may frequently be seen on the point of escaping from them. The semi-transparent forms of tubercle and tubercular infiltrations owe their peculiarity to a great relative amount of cells; whereas the opaque white forms of tubercle are attributable to great numbers of isolated granules. (See *Gerber's General Anatomy, Gulliver's Appendix*, p. 87. *Addison's Experimental and Practical Researches, &c., Trans. Prov. Med. and Surg. Association*, 1843, p. 287-88. *Carpenter's Human Physiology*, Am. Ed. by Dr. Clymer, p. 445. *Williams's Principles of Medicine*, Am. Ed. by Dr. Clymer, p. 309-10.)]

The development of the indurations is a work of more time, and their structure makes the destructive process which they induce more tardy; nay, the diffused indurations which form the walls of softened tubercles and vomicae seem to be a provision of nature against the spread of the consuming disease; but under certain circumstances, even the indurations are formed to such an extent and so soon, that the patient is destroyed by their first development, or rather by the effusion of mucus or of serum which they excite. In most cases the first formation of granulations is not sufficient to prove fatal; but as some of these are becoming changed to tubercle and vomicae, another deposition or crop of them (as Laennec terms it) takes place and causes suffocation.

After what has been stated, it will hardly be necessary to discuss the question of the seat of the hard gray and the yellow tuberculous deposition. If the tubercle be, as we suppose, a degraded condition of the fibrin or nutrient principle of the blood, we may expect it to be deposited wherever the nutritive or the secreting process is carried on, wherever lymph or pus is occasionally found,—wherever, in short, blood-vessels run. We cannot assent to the opinion of Dr. Carswell, that tuberculous matter is in the early stage of the disease secreted in equal abundance from all parts of the mucous membrane, and that the only reason why it accumulates sooner and more in the upper lobes is, that their smaller extent of motion prevents its perfect elimination from

those parts; were this the true view, how easy would be the diagnosis of consumption in its earliest stage! For there would be abundant expectoration of tuberculous matter from the lower lobes, whilst the accumulation takes place in the upper; yet it is rare to see any expectoration in the earliest stage, except a thin transparent mucus. More probable is the opinion of Broussais, that the upper lobes are the first and most extensive seat of tuberculous change, because the bronchial tubes are shorter, and more readily permit inflammation and irritation to pass to the cells. But we apprehend that the real reason of their peculiar liability is in their greater abundance of interstitial tissue in them. The bronchi instead of being lengthened out into mere membranous tubes before they terminate in cells, divide more immediately and abruptly into short branches and cells; and the delicate vesicular structure is thus mixed up with a good deal of the interstitial cellular tissue that everywhere surrounds the earlier bronchial divisions. The smaller capability of motion possessed by the upper lobes of the lungs may, too, have a share in disposing them to become the seat of tubercular deposit, not by permitting it to accumulate, but by favouring bronchial obstructions to the respiration, and causing local congestions of blood, which may promote the formation of tubercles. It is not the yellow tubercle chiefly that predominates in the upper parts of the lung; it is rather the gray indurations which become afterwards converted into yellow tubercle. Primary tuberculous deposits are nearly as common in other parts of the lung as at the apex.

We have described the ordinary changes of tubercle from its primary deposition to its softening and evacuation, and the formation of an ulcerous cavern. These caverns become, if life last, lined with a deposit of a mixed nature, but with an albuminous lymph for its basis; and this is commonly mingled with tuberculous and purulent matter. Hence it seldom lasts long, but is broken up, detached, and expectorated. When the constitutional powers are stronger, and the lung less extensively diseased, the coating of the cavity is susceptible of organization, and in time forms a fibrous or fibro-cartilaginous membrane which pretty smoothly lines the cavity. If the cavity communicate pretty freely with the bronchi, it will be kept by the pressure of the air from any considerable contraction to which it naturally tends: but in some instances the tubes become obstructed, and the membrane contracts, and tends to obliterate the cavity, sometimes leaving only a cicatrix. Such contracted cavities and cicatrices are not unfrequently met with in the lungs of old people; but they are rarely quite empty; they contain more or less of a pale yellow plaster-like matter, consisting chiefly of carbonate and phosphate of lime; and sometimes there are concretions of the same matter. The contraction is evident from the puckering of the pulmonary

tissue visible on the pleural surface near the cavity, and some of the adjoining vesicles are generally dilated to fill up the space. There are often, also, some remains of gray induration around them. The cretaceous matter is probably secreted by the walls of the cavity; but it may be the debris of tuberculous or purulent matter, the animal matter being absorbed away, and the earthy insoluble salts left, accumulated from successive depositions. This earthy matter is sometimes connected with an earlier stage of tuberculous formation. We have, in lungs not extensively diseased, found pale yellowish tubercles, composed of concentric layers of almost cartilaginous hardness; in another part of the same lung, these layers are loosened by a plaster-like gritty matter of a calcareous nature; and in another part, a whole tubercle may consist of this, having only a few flakes of albuminous matter in it, and sometimes containing concretions. This more resembles what is commonly called the ætheromatous structure, which especially invades the coats of the arteries and the fibrous parts of the valves of the heart. It is to be classed with gray and yellow tubercle, in so far as it is another variety of matter, low in the scale of organization, and formed of lymph of defective vitality. In these latter cases, there is no puckering or contraction about the tubercle until it has evacuated its contents; which it is very slow to do; for it has not the tendency to soften and cause ulceration that makes common scrofulous tubercle so destructive. We have repeatedly seen a few of these tubercles in lungs otherwise healthy, the individuals having died of some other disease.

SYMPTOMS.—As we have made the anatomical and pathological changes of phthisis the basis of our description of this disease, it will be convenient and instructive to classify, as far as we can, the symptoms, in reference to these changes. The course of consumption is generally divided into three stages, according to the state of the lesions of the lungs. The *first stage* is that of the formation of the indurations, granular or diffused; the *second* is that of the conversion of these into yellow tubercle, with the extension of this lesion to other parts; the *third* is that of their softening and evacuation, and the formation of vomicae.

FIRST STAGE.—The symptoms produced by the indurations may be divided into those of irritation, and those of obstruction.

The indurations are generally accompanied by various irritations, both local and general. Of the local irritations, the earliest is cough, which at first is generally slight and merely hacking, but more or less constant; at least, although it may not be frequent, it does not cease for a whole day together. It is either dry, or accompanied by a thin transparent expectoration. Another occasional sign of local irritation is pain in the chest, commonly re-

ferred to the sternum : in some instances, it is a stitch in the side ; sometimes it is a soreness, or an unusual sensibility to cold or exertion, more than actual pain ; not unfrequently it is absent. These varieties of pain are sometimes merely irritations ; but not unfrequently they are the result of real local inflammation, excited in the lungs, the bronchi, or the pleura, by the indurations. Of the more general irritations, quickness of the pulse is the most constant ; but even this is not universal. The quickness is often not uniform at first, but depends on any cause of excitement, however trifling ; and the pulse may be very slow and weak in the intervals : but as the organic lesion increases, it gradually becomes more constant, and is accompanied by an irritated state of other functions ;—a general febrile state. But even then there is not power enough in the circulation to maintain a general or constantly increased heat ; it is manifested most towards night, after the accumulated excitements of the day, when the fulness as well as the frequency of the pulse increases, and there is a flushing of the face and heat in the palms of the hands and soles of the feet, where the thickness and hardness of the cuticle prevent the perspiration and evaporation which moderate the temperature of other parts. Like other weak and intermittent febrile movements, this generally terminates by perspiration more or less profuse, which, occurring in the night, leaves the pulse lowered, but the frame weakened and exhausted in the morning. It is only in the severe cases that this general irritation, or hectic fever, as it is termed, becomes marked at this early stage of the disease. Often there is gastric irritation, with a white tongue, red at the edges, thirst, costive bowels, and turbid urine. These symptoms are generally more remarkable in this than in the after stages, when the irritation is more confined to the organs of circulation and respiration. They are almost always attended by some diminution of flesh and strength, which, however, varies greatly in degree in different instances.

The symptoms from obstruction comprehend those from obstructions to the passage of the air, to that of the blood, and to the motions of the lungs in respiration. The indurations, granular and diffused, when extensive, by obstructing the passage of air to more or fewer of the air-cells, cause the shortness of breath, felt at first only on exertion, so common even in the early stage of consumption. Nay, cases happen, in which an abundant formation of miliary tubercles, together with the œdema, or bronchorrhœa, which they excite, prove fatal in the first stage, by the obstruction which they cause to the passage of the air. In such cases there is generally considerable fever, with short frequent cough, very quick pulse, and heat of skin, with other symptoms resembling an acute attack of bronchitis or pneumonia ; for which they may be mistaken, but for the less sustained character of the

fever, the greater permanency of the disorder of the respiratory organs, the physical signs, and the expectoration, which, instead of exhibiting the peculiar aspect of that of pneumonia, or the successive changes of that of bronchitis, continues mucous and frothy, sometimes abundant, but often in small proportion to the cough and dyspnœa. Partial indurations sometimes cause shortness of breath, not only by their direct impediment, but also by occasioning a dilatation of the air-cells.

The indurations, by obstructing the blood-vessels, give rise to many formidable pathological effects. They may thus cause sanguineous congestion, hæmorrhage, inflammation, œdema, gangrene, and atrophy of the pulmonary texture, hæmoptysis, profuse bronchial secretion, effusion into the pleura, disease of the heart, &c. ; and the symptoms which these lesions produce may be variously grouped in the history of different cases of phthisis. The hæmoptysis occurring in the early stages of phthisis is generally from this cause ; and it is a serious symptom, not only because it may endanger life by loss of blood or direct suffocation, but also because it is often accompanied by hæmorrhagic consolidation and rupture of the texture of the lung, which tend to accelerate the disorganizing process, and promote the further deposition of tubercle. In some instances, however, hæmoptysis is followed by decided relief to the dyspnœa and cough, having removed a congested state of the blood-vessels.

Obstruction to the motion of the lungs may be caused by the same circumstances which impede the free admission of air to them ; but in case of extensive solid deposition, it may also result from their mechanical resistance to the motions of the chest ; and this not only constitutes a phthisical sign, which we shall hereafter consider, but it also keeps the intervening unaffected tissue in a fixed state, liable to constant congestion and further deposit, and thus adds further to the incapacity of the organs. When once the integrity of a nicely adjusted apparatus like that of respiration is extensively injured, disorder begets disorder, and unless the counteracting or respiratory powers soon come into operation, unless the indurations are soon diminished, or the blood-vessels closed, the whole of that part of the lung may soon become a solid mass. Thus, we believe, sometimes arise those extensive masses of induration which are so commonly met with in the upper parts of the lung.

SECOND STAGE.—On the conversion of the gray or dark red indurations into crude yellow tubercle, and during the original deposition of this matter, beside the symptoms of irritation and obstruction, which still continue, there are indications of increasing cachexia, languor, loss of flesh and strength, and a general depression of the functions. The pulse loses strength, although

it is as frequent as before; the evening chills are more severe; the fever is of shorter duration; the sweats are more profuse. Except at times of excitement, the colour of the cheek fades, or is reduced to a circumscribed hectic patch: the expectoration becomes more abundant, or less thin and transparent, and particles of curdy or cheesy matter can sometimes be detected in it; occasionally it is streaked with blood; and in a few cases, there may be hæmoptysis to a considerable extent. There is often less feeling of oppression or pain in the chest than before, but the shortness of breath on exertion is undiminished, if not increased; and there are frequently transient pains in the shoulder or under the clavicle of one side, which the patient commonly considers to be rheumatic.

THIRD STAGE.—The more truly consumptive symptoms which had begun to manifest themselves in the second stage, are developed fully when the tubercles become soft, partially or entirely liquid, and are evacuated, by the aid of the secretion and ulceration of the adjoining textures. Then comes on, in addition to the symptoms before described, a copious and heterogeneous expectoration of pus, mucus softened and occasionally solid tubercle, blood, shreds of lymph, and rarely portions of pulmonary tissue in a sloughy fetid state. Then occur the usual constitutional concomitants of extensive unhealthy suppurating ulcers, confirmed hectic with its successive chills, heats, and sweating, occasionally diarrhœa, and the increasing marasmus, in this case rendered more pronounced by the importance of the organ affected and the relations which it bears to the process of sanguification. Then are the dyspnœa and cough increased by the continual discharge of matter into the air-passages, and by the extension of the diseased depositions and ulcerations of the tissue. Yet it is a curious circumstance, that these symptoms are often inconsiderable in proportion to the terrible extent of the organic mischief which has been produced: the dyspnœa often is not painful like that of asthma; it is a state of breathlessness rather than of distressing oppression; the cough is commonly less violent than in chronic bronchitis; the pain may be slight, or there may be none at all; the countenance, though thinned, tremulous, with the sharpened nostrils habitually moving at every breath, may have a clearness in it, with colour in the lips, and a brightness of the eye which are never seen in other serious diseases; and the frame of mind is often in the same unconscious and hopeful state, indicating a degree of freedom from those painful struggles in which the vital powers commonly contend with other serious disorders. Now, we apprehend the chief reason for this exemption from suffering lies in a sort of balance that is maintained among the injured functions. The available parts of the lungs are reduced to a great

extent ; but so is the mass of blood that has to pass through them. The free expectoration and the colliquative discharges from the skin and bowels are continually bringing down the bulk of the circulating fluids to the lessening capacity of the remaining lung. The night sweats, especially, are a periodic discharge of the amount of fluid which is beyond what the reduced system of blood-vessels can quietly hold ; they often cease when the fluid ingesta are judiciously reduced. So the secondary pulmonary irritations, congestions and inflammations are continually relieved by the purulent expectoration ; it is a safety valve which gives vent to these local lesions before they cause much distress ; and although the destructive process is perpetually proceeding, the lungs decaying, the body wasting, and the strength failing, yet it is all by even degrees, a *facilis descensus* : the thread of life dwindles away, fibre by fibre, without struggle or shock ; and gentle is the parting of the last filament, when the body drops to earth and the soul rises to eternity.

But the progress of consumptive disease is by no means generally thus painless and unharassed : the sufferings from dyspnœa, cough, pain, chills, heat, and feelings of extreme weakness and faintness, are sometimes very severe. In some persons, the animal sensibility is more acute than the organic life is active ; to such, any disorder is distressing ; and even in consumption, the cough, the pains in the chest, side, or shoulders, the alternate chills and heats, the oppression of dyspnœa, the languor and faintness of debility, besides various pains and aches in different parts of the body, are perpetual sources of complaint. But without any unusual sensibility in the subject, the course of consumptive disease may be rendered rough and painful by what may be called the accidental or accessory lesions contingent upon it. Intercurrent congestions, hæmorrhages, and inflammations taking place in the lungs or in their investing membranes, are very common, and may give rise to the symptoms of these several acute lesions superadded to those of phthisis. Hence the increase of cough, dyspnœa, and fever, occasionally with pain, in case of bronchitis, pneumonia, or pleurisy, occurring in the course of the disease ; and hæmoptysis, with the faintness and other effects of loss of blood, if this be considerable, or with greatly increased oppression if the effusion is more confined to the tissue of lungs. We can confirm the observation of Dr. Stokes, that free expectoration tends to prevent these accidental complications ; and accordingly their occurrence is often preceded or accompanied by a suppression of this discharge, or an alteration in its quantity. But there is an accident which especially tends to ruffle and hasten the course even of the most latent forms of consumptive disease ; this is perforation of the pleura, and the consequent pneumothorax and acute pleurisy which it produces. As we shall hereafter de-

scribe this lesion and its symptoms, we need here only remark how characteristic the sudden increase of dyspnœa and cough and accession of sharp pleuritic pain must be in the cases that were before most insidious, and how much the addition of these lesions must increase the distress of the patient, and hurry him towards his grave. Spontaneous perforation of the pleura seems to occur chiefly where the constitution is decidedly tuberculous; and it implies a want of that self-preserving energy by which the mischief of ulceration is bounded by the timely effusion of plastic lymph. This is a part of the nutrient function; and perhaps it is because this function is more active in women than in men, that perforation of the lung is comparatively rare in females. Such, at least, is the result of our experience, not having met with one instance in about thirty cases of this complicated lesion that have fallen under our observation; and there are very few instances recorded by others of its occurrence in females. In a few instances, the perforation appears to have been the result of adhesions partially attaching the lung to the walls of the chest, and thus exposing it, in case of external violence or internal pressure, to a lacerating force, as noticed under the head pneumothorax.

Other symptoms unconnected with the chest frequently attend pulmonary consumption. The larynx is very often the seat of disease, and hoarseness or loss of voice is frequently an early symptom, sometimes taking attention from the seat of the more important lesion. It appears from the researches of MM. Trousseau and Belloc, that ulceration and other structural disease of the larynx do sometimes occur when there are no tubercles in the lungs; but these are very rare cases, and in by far the majority of instances these lesions are associated with tuberculous disease of the lungs, and perhaps in all are connected with a tuberculous constitution. Dr. Stokes considers this complication to be universally fatal; but it is not always speedily so, for we know at present three instances in persons now alive of its having lasted from five to eight years.

The disorder of the digestive organs, which, in the earliest and irritative stage of the disease, had something of the gastric character, with red-tipped tongue, thirst, sometimes pain or oppression after eating, occasionally tenderness of the epigastrium, and other symptoms of indigestion, generally passes away as the pulmonary irritation is relieved by the discharge. In a few instances, occasional severe pain of the stomach and vomiting continue to the fatal termination, greatly adding to the distress and weakness of the patient. [The condition of the tongue in phthisis is very variable. Dr. Louis gives the results of a comparison of its state with that of the mucous membrane of the stomach in a considerable number of cases, which indicate a great degree of independence in the condition of the two organs.]

(a.) *In 19 cases of softening with attenuation of the mucous membrane of the stomach :*

Tongue natural in 9 cases; in the remaining 10, red at the tip or edges; in 4 of them for 15 or 20 days; in 6, for 2 or 3 days only.

(b.) *In 8 cases of inflammation limited to anterior surface of the stomach :*

Tongue pale or red an equal number of times; and in one instance the redness was quite temporary.

(c.) *In 17 cases of inflammation affecting the whole or part of the fundus :*

Tongue natural in 10 cases; in 7, slightly red at the edges, either towards the close of life, or for a few days at an earlier period.

(d.) *In 19 cases of mammillation more or less general and marked :*

Tongue of a more or less florid red colour for a variable time in 8 cases; natural in 11.

(e.) *In 14 cases of various associated lesions of the stomach :*

Tongue unnaturally red for one or several weeks in 6 cases; natural (it is to be inferred) in the rest.

(f.) *In 19 cases in which the mucous membrane was perfectly healthy in respect of colour, consistence and thickness :*

Tongue more or less red in 10 cases; in 1 of these the redness persisted through the whole course of the disease, and was attended at one period with dryness; in the remaining 9 (it is to be inferred), natural.

Another condition of the tongue occurred in one-eighth of Dr. Louis's cases of consumption—albuminous exudation on its surface. There is no connection between it and any particular condition of the stomach. It is of very bad augury, occurring generally a few days before death.] In most instances, sooner or later, the bowels become disordered; constipation and diarrhœa alternately prevail, dependent on inflammation and ulceration, often complicated with tuberculous deposition in the follicular structure of the mucous membrane of the intestines. [Of one hundred and twelve of Dr. Louis's patients, five only escaped diarrhœa. In one-eighth of the cases it was coeval with the disease, thus lasting from five to twelve months. In some few cases, where the disease was of four or five years duration, the individuals suffered during the whole time from chronic diarrhœa. In by far the largest proportion of instances, the diarrhœa belonged to the last period of existence, not commencing until the third stage was reached, and in some cases not till the closing days of life.] The mesenteric glands frequently

become involved in the same disease, particularly in young subjects; and thus arise additional causes of exhaustion and atrophy, in the colliquative discharges and obstruction to nutrition that ensue. There is often but little pain with all these serious lesions. The alvine secretions sometimes show a deficiency of bile; but this is a symptom which more frequently precedes phthisis than accompanies it. Sometimes there are great tenderness and even pain in the abdomen during the whole course of the disease, with occasional exacerbations: these symptoms generally depend on granular or tuberculous depositions on the peritoneum, combined occasionally with inflammation of the membrane, which may lead to the agglutination together of the folds of the intestines.

[The symptoms of tubercular peritonitis are generally mild, not numerous, and frequently are unnoticed. They are, however, quite sufficient to warrant a positive diagnosis. The invasion of this disease has no fixed relation with the main affection, and may occur at any period of its progress. The first symptom of chronic peritonitis is enlargement of the abdomen, denoted by the uneasiness in his clothes which the patient experiences, if up and about. With this there is dull abdominal pain, sometimes general, (either singly or coexistent,) increased by pressure and percussion, and unaccompanied by diarrhœa. Later, and at a very variable period, physical exploration, however, reveals fluctuation, and meteorism, to a greater or less degree, will be ascertained. After increasing, to a certain extent, fluctuation will diminish, whilst the gaseous distension persists. Where abdominal meteorism is present from the commencement of the disease, without appreciable effusion, it will diminish after some time, leaving the abdomen firmly resistant under pressure, knotted, and the intestinal convolutions marked on the surface; and this tense elasticity persists with complete relaxation of the muscular parietes. Nausea and vomiting rarely occur, unless acute peritonitis should supervene. There is great diversity in the intensity of the rational symptoms; sometimes the feeling of uneasiness, or even positive suffering, is so great as to occupy constantly the attention of the patient; at other times there is entire absence of pain, and the physical signs alone announce the existence of the affection. Ordinarily, the symptoms just enumerated persist, or increase, till death occurs; but sometimes, when the disease is intensely chronic, the abdominal symptoms disappear, and the thoracic symptoms only attract notice. This happened in the first case. Sometimes the abdominal effusion is absorbed with great rapidity, and, on examination after death, you find only general intestinal adhesion by recent false membrane, when, but a few days before, there was positive evidence of fluctuation.

The symptoms of chronic peritonitis, though few, are of great value, from their constancy and regularity, in reference to diag-

nosis. Dr. Louis places the greatest confidence in them, and states (*Recherches sur la Phthisie*, 1843, p. 272), that through them he has been led to the successful diagnosis of phthisis in persons in whom there was little or no cough, and where the most careful physical exploration gave no evidence of thoracic disease.

To resume, we may say, that where we have general abdominal pain, of moderate intensity, but still sufficiently annoying, without diarrhœa, accompanied with increase in the size and sonorousness of the abdomen, with the supervention of manifest fluctuation, and independent of any organic affection of the viscera, as the liver especially, kidneys, or heart, with subsequent absorption of the effused fluid, leaving a slight, but general, gaseous distension, with the intestinal convolutions well defined, and with this, great loss of strength, which cannot be referred to the condition of the lungs or of the excretions,—when, we say, we have this combination of symptoms, we may, with great safety, diagnosticate tubercular peritonitis.

Tubercular peritonitis may be confounded with cancerous peritonitis. The different epochs of life at which, in general, the two affections occur, the co-existence of cancer in some other organ, the great rarity of cancer in tuberculous patients, with other differential symptoms, will usually serve to distinguish the two diseases.]

More rarely tubercles occur in the brain or spinal marrow, or their membranes, and cause symptoms of mental disorder, convulsions, or paralysis. Acute hydrocephalus seems to have connection with scrofulous or tuberculous disease further than what can be traced to the existence of tubercles in the encephalon; for it sometimes coexists with tuberculous disease in other parts, when none can be detected in the brain. [Although the subject of granular or tubercular meningitis in children, has been fully investigated by Drs. Ruzf, Gerhard, P. Hennis Green, &c., little was said or known about the same affection in the adult, until the publication of the second edition of Dr. Louis's work on consumption, in which a new section is dedicated to the consideration of this affection, and the thesis of Dr. Lediberder. Tubercular meningitis is not unfrequently an intercurrent affection in phthisis, and its diagnosis may actually lead, (like that of the kindred affection, tubercular peritonitis,) to the detection of the primary disorder. The diagnosis of this affection is often easily accomplished; occurring at various periods of the primary disease, granular meningitis commences with intense and continuous frontal cephalalgia and vomiting, which is almost constant at the very outset, and which, when occurring in connection with cephalalgia, is strongly indicative of the presence of tubercles in the meninges; the face at the same time becomes alternately pale

and red ; the intelligence is dull, and paralysis sometimes, though rarely, occurs at this period. The violent headache persists from three to twelve days, accompanied with sharp cries from time to time ; the face assumes an expression of astonishment, speedily followed by one of stupor. The pupils at first contracted, subsequently become dilated. From the fourth to the sixth day, delirium, generally of a mild type, sometimes accompanied with agitation, and increase of the general sensibility, appears. Somnolence, and eventually coma, occur in the intervals of the delirium. When hemiplegia occurs, it is generally some days later than cephalalgia. A considerable portion of the face, or one eyelid only, may become paralyzed ; and persistent contraction, instead of paralysis, sometimes is seen. Meanwhile the circulation and respiration undergo remarkable changes. The respiration becomes less frequent, and less deep ; the dyspnoea diminishes or disappears, except during the last days of life, when it increases in proportion to the degree of somnolence. Even in those cases where large pulmonary caverns exist, the fever disappears during the earlier period of the meningeal affection, but it returns with intensity towards the termination of the disease. Irregularity of the pulse is very rare. The temperature of the body rises and falls with the alterations of the pulse. The duration of the disorder varies from eight to fifteen days.] The catamenia, in females, are generally defective, or absent, at an early stage of consumptive disease ; but they are not so constantly so as Laennec supposed. Their suppression is, on many accounts, an unfavourable sign. [One female only, of all those observed by Dr. Louis, continued to menstruate to the last month of life. The period at which suppression of the catamenia occurs, varies. When the disease lasts less than a year, the menstrual discharge ceases to appear, on an average, about the second stage of the affection ; if from one to three years it continues frequently until the third period. When the affection runs a rapid course, the cessation of the menses coincides with the establishment of fever. In chronic phthisis, Dr. Louis failed to detect any cause, either retarding or accelerating the time of alteration in the catamenia.] We have not space to dwell on the details of other symptoms arising from the irritations or obstructions, the weakness or the wasting, which tuberculous consumption brings in its train. The emaciation in the last stages is very great, especially in the less acute cases ; yet it is surpassed by that from scirrhus of the stomach, and tabes mesenterica. There is a blanching with the emaciation, which is more remarkable than its degree ; the blood-vessels are reduced, as well as other textures ; hence it is rare in tuberculous consumption to see the redness of the knuckles, and distinctness of the veins of the hands, which accompany even greater degrees of emaciation from chronic diseases of the abdomen.

PHYSICAL SIGNS.—We proceed to trace the physical signs in the different stages of the textural lesions which we have described as the essential causes of pulmonary consumption.

FIRST STAGE.—In proportion as the indurations which characterize the first stage are of great or small amount, and are concentrated within a small space, or scattered widely through the lung, they will produce more or less appreciable signs. Thus, the miliary indurations, even in considerable number, may be scattered through the tissue of the lung without producing any distinct diminution or change in the respiratory sound, or in the resonance of the chest on percussion. Sometimes there is a general sub-mucous or sub-crepitant rhonchus; but this proceeds less from the tubercles than from the secretion which their irritation causes in the bronchial tubes: it is the sign of a partial bronchitis or bronchorrhœa, therefore, and can be taken in evidence of the probable presence of tubercles, only when it continues permanently, or recurs in the same places day after day, instead of tending to become sibilant, and to cease, as the rhonchi of common bronchitis do. But it seldom happens that even the early indurations are equally scattered through both lungs. Their tendency is to accumulate in greater numbers in little clusters near the apices of the lungs, and generally more on one side than on the other. Here there will be a concentration of their effect, and an inequality between the two sides of the chest; and on exploring the corresponding regions outside, which are the clavicles and the space below them, and the upper ridge of the scapulæ, we may find differences in the sound on percussion, or those of respiration, and the voice, which, according to known principles, may be interpreted as signs. The clavicle on one side, when lightly struck downwards on its centre, yields a sound duller than that on the other; and especially if this difference extends to the other parts just mentioned, it is exceedingly probable that there is consolidation of the lung in that part. Great care must be taken to strike both clavicles at the same point, or both infra-clavian spaces in the same mode, or the comparison will not be a fair one. To avoid error, the parts should be quite uncovered; and various kinds of percussion should be tried in doubtful cases, as tapping with a single finger, and with the flat of several fingers, and in different stages of the respiratory act, on a full breath, and after exhausting the lungs. Sometimes the gentlest possible patting of the subclavian spaces is the only mode in which any difference can be discovered. In the posterior region, and on the scapular ridge, strong mediate percussion with the finger is necessary to elicit any sound, comparison being made, as usual, of the sounds on the two sides. Differences in the sounds are to be sought where differences ought not to exist; and although

the mode and force of percussion should be varied at different times, they should be carefully the same in each act of comparison. Between the scapulæ is not an unfrequent seat of dulness, especially in children, where the disease occupies the bronchial glands.

The eyes should likewise be used to scrutinize the motions of the chest, when the patient is placed in a good light opposite to the observer, and is desired to take a full breath several times. It requires more consolidation than is common in the more doubtful stages of the disease, to produce any considerable irregularity in the shape or motions of the chest; but we can often perceive a slight difference between the two sides; the upper ribs do not move quite so much on one side as on the other.

The stethoscopic signs are more delicate, and, perhaps, more equivocal, than those of percussion. The indurations may form slight partial obstructions to the passage of air, and thus cause a permanent slight wheezing, whistling, or roughness in the respiratory sound, not removed by full inspiration or cough. If more numerous or extensive, they may transmit the sound of whiffing or bronchial breathing in parts where naturally the vesicular only is heard, whilst the soft vesicular breathing is impaired in its force. The sound of expiration may become unusually audible, so as nearly or quite to equal that of the inspiration, which naturally is almost the only sound heard in pure vesicular respiration. When, as it often happens, the partial indurations are accompanied by a dilated or emphysematous state of the neighbouring air-cells, the sound of percussion will be less changed than usual; but the breathing will be more whiffing, or more obscure, according as the dilated cells are more flaccid or more rigid than usual. The sound of the voice is transmitted by the indurations in an unusual degree; sometimes only in a diffused resonance; sometimes in a more circumscribed vocal note, but without the articulation of the oral voice. So, also, below the clavicles, the sounds are sometimes transmitted with unusual clearness from the subjacent arteries, being either double from those of the heart, or single from the mere impulse; and occasionally the single pulse is accompanied by a whizzing or blowing confined to the part, which, probably, indicates a partial obstruction of the subclavian arteries by the pressure of indurations at the apex of the lung. This has been noticed by Dr. Stokes as a sign of incipient phthisis. It is not to be depended on, as such a murmur is not uncommonly induced in some healthy subjects under slight excitement, probably from the artery pressing on the clavicle or upper rib. It often intermits, being confined to certain stages of the respiratory movements.

All the stethoscopic signs derive their importance directly from the situation in which they are heard, and from their comparison

with the sounds of other parts. There are often natural bronchophony and bronchial respiration near the sternum, between the scapulæ, and in the axillæ: such signs in these parts, therefore, are not to be considered morbid, unless they be either much more distinct on one side than on the other, or accompanied by dulness on percussion. They may be better trusted towards the humeral end of the clavicle: the angle formed by this bone and the shoulder is the proper stethoscopic corner, and the signs heard there, and at the humeral portion of the scapular ridge, are the most unequivocal; but even here a permanent discrepancy between the two sides gives the surest indication of disease, for the natural sounds present some variety. It is also necessary to bear in mind that the vocal resonance is often slightly louder on the right than on the left side. In the early stage of numerous diffused granulations, there is sometimes dulness on percussion with obscure or submucous respiration in the lower dorsal regions of the chest, probably dependent on congestion of the pulmonary plexus of vessels in these parts.

Besides the more direct physical signs of the indurations, the mucous or submucous rhonchus caused by the secretion of the bronchial tubes may render their existence probable when it continues long, or returns frequently to the same part. This observation was first made by Dr. Stokes, who has well remarked that this symptomatic bronchitis differs from simple bronchitis in being first circumscribed and confined to the upper lobes, whence it may spread downwards; but before it reaches the middle and lower lobes, the common seat of ordinary bronchitis, the tubercles in the upper become manifest by various obvious signs.

The diagnosis of the early stage of phthisis is often a matter of extreme difficulty; depending as it does, on a proper consideration of the general symptoms, as well as on a careful examination and interpretation of the physical signs, it cannot be mastered without considerable experience as well as tact on the part of the observer.

SECOND STAGE.—The conversion of the semi-transparent, gray, or dark consolidation of the lung into yellow tubercle is a point only deduced from anatomical examinations, for there are no certain signs of this change during life. There is sometimes an abatement of the more irritative symptoms during this change, and at the same time an increased expectoration, and the submucous and mucous rhonchi become more marked. But the change to yellow tubercle can scarcely take place without some augmentation of the consolidation; the indurations increase in extent, and some yellow tubercle is sometimes deposited in other parts. Hence there is often a fuller development of the signs of an increased density of the lung; the partial dulness on percussion

becomes more marked; the respiration becomes more obscure or more bronchial, and it may be accompanied by a permanent fine crepitation. The vocal resonance may also increase in degree and extent, and altogether the signs become more localized, and therefore less equivocal. These, taken with the change in the general symptoms before described, may be taken in evidence that the consolidations have become more or less tuberculous.

THIRD STAGE.—But the softening and evacuation of tuberculous matter, produce the most remarkable and cognisable changes in the physical signs; and these also often give to the expectoration something of the precision of a physical sign. The sputa before may have been sometimes opaque and muco-purulent, as in bronchitis; but they now become decidedly purulent, often sink in water, and, if narrowly examined, may sometimes be found to contain particles of a curdy or clotted matter, like cheese softened in water, which is tuberculous; it is not fœtid like the similar concretions from the tonsils. There may also be little streaks or even clots of blood; but this is uncertain. There is generally, besides, more or less mucus, which gives tenacity to parts of the expectorated matter; but on close examination, it may often be seen that some sputa are opaque purulent clots, almost without mucus; it is these which come directly from the cavities. In whatever part of the chest these changes take place, generally under one of the clavicles, or above the spine or one of the scapulæ, there may be heard a clicking or bubbling sound, which is coarser, and gives the idea of being produced in a larger space than any of the common sounds of these parts. This sign is the more conclusive, the finer and more completely vesicular is the natural structure of the lung in the part in which it is best heard. In listening for it the patient should be desired to cough or to take a full inspiration; when at first there may be heard only one or two clicks from the entry of single bubbles: but as the evacuation of the softened matter proceeds, and there is more room for the entrance of air, there is then a more continued bubbling or gurgling sound, and this will be coarse and distinct in proportion to the extent of the vomica and its communication with the air-tubes. This gurgling or *cavernous rhonchus* will also somewhat vary according to the quantity and liquidity of the contents of the cavity, becoming less crackling and more whiffing as these diminish. When it is heard over an extended space, there are probably several cavities communicating with each other, and all containing more or less liquid. It may present other varieties, which are quite intelligible when the mode of its production is known.

The softening and evacuation of the vomica being complete or nearly so, there is left an ulcerous cavity or cavern, which becomes

the seat of further phenomena. Even before all the liquid is evacuated, we sometimes hear, in the corresponding part of the chest, with the gurgling, a hollow whiffing or blowing sound ; and when the patient speaks, a sort of *snuffling* voice interrupted, broken up by the gurgling. When the cavern is empty, these pass into *cavernous respiration* and *pectoriloquy*. Cavernous respiration resembles that heard on listening with the stethoscope to the front of the neck over the wind-pipe ; but it is more circumscribed, and does not give the same impression of a rush of air. It may better be imitated by blowing into shells or thimbles of different sizes. It may present considerable variety, according to the size and shape of the cavity, and the freedom with which the air passes into and out of it from the bronchi. When of very large extent, the sound becomes amphoric, like that produced by blowing into an empty phial, and precisely on the same principle. All these phenomena are best obtained with quick forcible respiration or slight coughing, which increases the force and velocity of the passing air, and exaggerates the sounds.

Pectoriloquy is another very striking sign of a cavity in the lungs. Its value was perhaps overrated by Laennec ; but we think that it has been neither appreciated nor understood by subsequent writers. We formerly explained that the voice, although formed in the larynx, vibrates in full strength, through the wind-pipe and its branches, until it becomes broken up and muffled in the smaller tubes and soft porous tissue of the lung. But if a cavity be formed in this parenchyma, communicating freely with the tubes in which the voice is strong, it will form a part of those tubes, and the vibrations will be continued *in system* from them to it ; and there may thus be heard near the surface of the lung, a voice from the chest like that heard over the trachea,—its distinctness and intensity being more or less perfect, according as the cavity is adapted to receive the vocal resonance from the tubes, and to transmit it to the walls of the chest. Laennec made an artificial distinction between the degrees of pectoriloquy, according to whether the voice does or does not give to the ear the impression of passing up the stethoscope when the stopper is in. In the *perfect* kind the words are so distinct that it seems as if the patient had his mouth to the tube : where this impression is not produced, the pectoriloquy is *imperfect*. But this is only a difference of degree, and of doubtful importance. We consider the character of the sound and its circumscribed position a more serviceable distinction. The sound is not a mere vocal resonance, like the bronchophony from consolidation, which is often as loud or louder, and may seem to pass up the tube quite as much ; but it is an articulate although indistinct speaking, and sometimes accompanies a loud whisper as well as vocal utterance. There is in it another feature which is characteristic, and distinguishes it from

bronchophony; it is accompanied or followed either by whiffs of cavernous respiration, which give the pectoriloquy a snuffling character, or by a hollow or fistular resonance, like that produced on speaking at the orifice of the tube of a Pan-pipe, the pipe of a large key, a shell, or any such hollow body. This accompaniment is sometimes heard when the pectoriloquy or the transmission of the articulate voice is very imperfect; but we have found it to be more distinctive of a cavity than the loudest vocal sound without it. It may be supposed to depend on the same physical cause as that of the similar sound in the hollow bodies to which we have compared it; the cavity in the lungs being in the same relation to the bronchial voice, as they are to the oral voice. When the cavity is large, the resonance is more amphoric or bottle-like; and if the communication with the bronchi be at the same time narrow, the voice may be scarcely transmitted to it, but excites in it only a tinkling echo—a metallic tinkling, as in pneumothorax. All these hollow, fistular, or tinkling characters may be also perceived in the breathing and cough, especially in the latter, but not in a proportionate degree, and sometimes are only perceptible with the voice. These differences must depend on the relations of the cavity to the air-tubes communicating with it: if this open into them so as to catch the current of air passing through them, its interior will be thrown into vibrations; otherwise the air in the cavity may only receive the stronger and more pervading vibrations of the voice. So, also, if there be much consolidation about and beyond the cavity, there may be very little passage of air in the tubes, and therefore but little cavernous breathing.

The circumscription of pectoriloquy is another of its peculiar characters, and by this it may generally be distinguished from the loud bronchophony of condensed lungs, which is diffused over some extent of surface. To observe this difference, it is necessary to limit the point of examination, by using the stopper in the stethoscope. By this mode we can trace the precise boundaries of the pectoriloquy of a cavity; but when we try to trace where the resonance of the bronchophony ceases, we find no exact limits; it gradually loses force as the tubes become smaller, or the superjacent lung more porous. Pectoriloquy is most characteristic when it forms a *little island* of voice under a clavicle, and little or no sound is transmitted nearer the sternum. The pectoriloquous bronchophony of a lung consolidated by inflammation, or compressed against the walls of the chest by a liquid effusion, never has this isolated character, but is generally louder in proportion to the size of the tubes involved in the condensation. It is however true, that sometimes the pectoriloquy of phthisis is not circumscribed; for besides the cavities there may be extensive consolidation of the lung, and, consequently, free transmission of

the voice over an extent of surface. Even in this case a practised auscultator can distinguish the peculiar phenomena of cavities, in the snuffing, blowing, or tinkling, and the more articulate voice that certain spots present, or in a coarser gurgling if there be liquid. It is obvious that all these phenomena are liable to be interrupted or modified by the accumulation of the matter secreted by the cavities and adjoining tubes; and that, after cough and expectoration, a spot that before gave no sound in common breathing, and gurgling on forced breathing, yields the cavernous breathing and pectoriloquy. So, also, as in time the disease advances, the excavations become extended, and the gurgling first, and the pectoriloquy afterwards, are heard in new spots.

Although, after the excavation of tubercles, there is more air in the chest, yet the sound on percussion generally remains dull, for there is much solid deposit about the walls of the cavities, and the irregular density and flaccidity of the parts, as well as the defect of air in the peripheral structure of the lung, still tend to check and to muffle the vibrations of the walls of the chest, and prevent them from yielding a clear sound. Even where the cavity is so large as to be the seat of a tinkling echo, the resonance on percussion is irregular and imperfect; and thus may this case of metallic tinkling be distinguished from that of pneumothorax, in which some part of the chest must have an unnaturally clear sound. Sometimes the percussion is clearer in consequence of a general dilatation of the superficial cells; and as this is commonly of the flaccid kind, it may be accompanied by a sharp puerile kind of respiratory sound: both these circumstances may disguise the phthisical signs, but only partially, for there will still be some decided irregularities in the sound of percussion, and enough of the signs of the subjacent cavities to declare the case to the wary observer. Occasionally a hollow or bottle-like sound is produced by percussion over a cavity; this is when its walls are pretty dense, and it communicates freely with the bronchi. More commonly there is an opposite condition: the walls of the cavity are loose and yielding; and if it be large, percussion may sometimes cause a motion of its contents, and a gurgling or tinkling expulsion of air from it, which gives a muffled metallic sound, like that of money in the nearly closed hands, or more like the imitation of that noise which may be made by striking the hands hollow and closed upon the knees. Laennec compared the sound to that emitted by a cracked jar when it is struck.

With the irregular and deficient sound on percussion, generally most evident under the clavicles or in other parts of the upper regions of the chest, there is very commonly associated a collapse or sinking in of the walls of the chest, forming below the clavicles a hollow, generally more conspicuous on one side than on

the other. There is very commonly, also, some defect and irregularity in the movements of the chest, the upper ribs of one side being but little raised, and the lower parts altogether exhibiting the most motion. But there is rarely that complete fixing of the side that we see in chronic pleurisy, in which case, too, the upper part is generally more mobile than the lower.

We might class with the physical signs the characters of the sputa in the third stage of consumption, if they came only from the cavities which are peculiar to it. The expectoration of distinct portions of tubercle, or of pulmonary tissue, which are seen in a few cases, constitutes a physical sign of the clearest character; they must come from cavities. If patients could save all their expectoration, and this were inspected daily, this unequivocal sign might be more frequently met with. But the inflamed air-tubes are, in great measure, the source of the expectorated matter, which therefore presents much of the same aspect as in chronic bronchitis. The large size, and almost perfectly purulent character of the masses sometimes expectorated, which are like irregular balls of flock or wool of a yellow or greenish colour, sinking and breaking down in water, go far to prove the existence of cavities in the lungs. These have been particularly noticed by Dr. Forbes. A dirty yellowish-brown or greenish matter, occasionally fringed or streaked with blood, flattening like a piece of money when separate, and in masses forming a smooth sluggish purilage, are more characteristic of phthisis, and generally occur in the most advanced stage. The general pulmonary congestion which frequently precedes death, is often announced by the darker reddish or green hue of the purulent sputa. Profuse hæmoptysis does not often occur in the advanced stages of consumption; for the vessels soon become plugged with fibrin, and obliterated in the diseased portions of lung, and the mass of blood is reduced to the capacity of those that remain free.

COMPLICATIONS.—It is very common for phthisis to become complicated with other diseases of the chest, particularly bronchitis, pneumonia, and pleurisy; and the attacks of these additional lesions sometimes prove fatal, even when the phthisical changes are not extensive. Partial bronchitis is an almost constant concomitant of tuberculous disease of the lung; but more general attacks also sometimes occur from the ordinary causes, such as exposure to cold, the epidemic prevalence of influenza, and febrile diseases: they then bear a character more formidable than usual, being themselves less tractable, and may cause suffocation; or they may accelerate the progress of the phthisical disease. It is also very common to find general pneumonia attacking a lung in which there are miliary tubercles, which must have existed prior to the inflammation, and would probably not have run their course

for several months. This complication greatly increases the danger of the pneumonia also, which, unless it be stopped at its very onset, generally proves fatal. In some instances, especially in the young, we find a reason for the intractability of such a pneumonia, in the tuberculous character of the hepatization, which has the grayish or boiled-liver aspect, with considerable softening, instead of the redder deposit of common hepatization; on the pleura there is sometimes seen, at the same time, an opaque friable lymph which borders closely on real tuberculous matter. In other instances, where the disease has not advanced far enough to present these appearances, we can still understand that there may be in the deposit enough of that defect of vitality, which renders tuberculous matter so difficult of absorption. The supervention of the signs of an extensive pneumonia, crepitation with increasing dulness on percussion, affecting the posterior lobes of one or both lungs, together with the increased heat, febrile disturbance, and the rusty tinge of the sputa, must be looked on as indicative of extreme danger to patients with any extent of phthisical disease; for if it do not itself prove fatal, as it commonly does, the inflammatory attack will not fail to hasten and increase the phthisical disease. It is different with the circumscribed pneumonia which sometimes attacks portions of lung in the progress of tuberculous disease: these come on without much disturbance, and subside without causing much mischief, being probably the result of mere local obstruction or irritation. [When pneumonia supervenes in phthisical patients still able to pursue their avocations, in whom emaciation or debility to any extent have not occurred, it presents the same series of symptoms characteristic of the affection in previously healthy persons; but these symptoms are generally not severe, and the disease almost always terminates happily, even when tubercular cavities exist at the apices of the lung. On the other hand, when pneumonia occurs at the close of phthisis, it is almost always fatal. When supervening at this advanced period, and when of limited extent, it is not usually announced by any symptom. When implicating a considerable mass of lung, the ordinary symptoms are developed.] The same remark applies to the slight pleuritic attacks, which are very common in phthisis; the effects of which are seen in the adhesions of the pleura, so generally found in phthisical subjects. We have repeatedly heard a sound of friction in a part of the chest which lasted for several days, and the chest after death exhibited adhesions at this point. Probably the inequalities occasioned by the deposits in the lung, as well as the textural irritation, cause these local inflammations of the pleura. They rarely produce much effusion, but soon terminate by adhesion. Liquid effusions do occasionally occur, from a more general cause of inflammation, such as the bursting of a vomica into the pleura. If

the vomica also communicate with the bronchi, there will be pneumothorax as well as liquid effusion. In either case, the pleurisy is a serious and untractable addition to the consumptive disease, and may prove fatal in a few hours. [Perforation of the lung may occur at almost any period of phthisis. In the last edition of his work, Dr. Louis relates with great minuteness the case of a female, twenty-three years old, in whom the physical signs of phthisis had existed only fifteen days, when perforation of the serous membrane took place. As a general rule it does not occur until an advanced stage of the disorder, but it not unfrequently supervenes at a comparatively early period. Perforation of the pleura appears to be about twice as frequent on the left as on the right side; of fifty cases of this lesion, thirty-three were on the left side, and seventeen on the right. Perforation of the lung is by no means necessarily mortal, as some of the French pathologists are inclined to think. The cases of Drs. Stokes, Barlow, Houghton and others, conclusively show the inaccuracy of this statement; and it is not improbable, as suggested by Drs. Stokes and Barlow, perforation may be the means of prolonging life, and temporarily arresting the constitutional symptoms of phthisis—the obliteration of the diseased lung, acting on the constitutional state of the subject, as the removal by art of a scrofulous joint.] Pulmonary hæmorrhage is another serious accident, most commonly occurring in the early stages of phthisis. It may prove fatal, by loss of blood, or by suffocation; or the effusion of blood may break up the tissue of the lung to a great extent, and the patient may sink from the sloughy suppuration which ensues; or after the hæmorrhage has ceased, inflammation may arise in and about the hæmorrhagic consolidation, and involve the lung in a destructive suppuration, which may be more or less of a tuberculous character.

VARIETIES.—The varieties which pulmonary consumption presents are very considerable, and even recent authors, such as Laennec, Clark and Stokes, have thought several deserving a distinct consideration. Laennec recognizes five: 1. Regular manifest phthisis; 2. Irregular manifest phthisis; 3. Latent phthisis; 4. Acute phthisis; 5. Chronic phthisis. Sir James Clark also notices five: 1. Acute; 2. Febrile; 3. Chronic; 4. Latent; 5. Infantile. Dr. Stokes specifies no less than six varieties of phthisis besides those diversified by complications; 1. Acute non-suppurative; 2. Acute suppurative; 3. Chronic progressive; 4. Chronic ulceration following pneumonia; 5. Tubercle consequent on chronic bronchitis; 6. Tubercle consequent on the cure of empyema. None of these divisions is sufficiently comprehensive to include all the varieties of pulmonary consumption, which may take a peculiar stamp from the nature of its causes; from the

constitution of the subject; from the predominance of particular symptoms, such as those of irritation or those of colliquative secretion and decay; from the extent and progress of the local lesions of the lungs; and from the complications with lesions of other organs. It is highly important to observe these differences in relation to the diagnosis, prognosis and treatment of individual cases; but to describe them all as distinct varieties would lead to needless refinement and prolixity. It will be sufficient for our purpose to distinguish two kinds of consumption, the *acute* and the *chronic*, without however professing that the line between them is always well-marked, and admitting that each may present considerable variety in its predominant symptoms.

ACUTE OR RAPID PHTHISIS.—Sir J. Clark states, from collating the observations of Heberden, Bayle, Andral, and Louis, that the average duration of consumption ranges from nine months to two years; in the acute form it may prove fatal, in from three weeks to two or three months. In some of such cases the symptoms and stages do not differ from those already described, but they are unusually severe and rapid in their course; emaciation does not proceed so far; and the physical signs during life, as well as the examination after death, show that the extensive tuberculous deposit, and the consequent lesions of the lung, have been the sufficient cause of this rapid progress. This is what is popularly called “galloping consumption;” it commonly occurs in very scrofulous constitutions, particularly in young subjects, and is often developed by an attack of inflammation of the lungs or their membranes. In other cases, miliary tubercles are developed in such great numbers, that they prove fatal in their first stage, few of them having suppurated. In such instances there is generally a predominance of the signs of irritation and obstruction; dyspnœa; frequent cough, with little or only bronchitic expectoration; much fever and quickness of pulse; frequently palpitation; sometimes hæmoptysis; and the disease may prove fatal in from three weeks to two months, often without considerable emaciation, but with increasing oppression to the function of respiration. The lungs are found thickly studded with miliary tubercles, or with numerous nodules of tuberculous consolidation of a gray or a drab colour and moderate consistence, none of which have become excavated, except perhaps in the upper parts of the lungs, where a few have become soft and have formed small vomicæ. The intermediate tissue is sometimes in the first stage of inflammation; sometimes it is unaffected or partially emphysematous. The bronchi are almost always inflamed, and filled with a spumous mucus, and not unfrequently they are partially dilated. This non-suppurative variety of acute phthisis is noticed by Dr. Stokes as usually succeeding to fever, particularly that of a typhoid kind. From the

general prevalence of fever throughout its course, Sir J. Clark terms it *febrile phthisis*; but he does not sufficiently distinguish it from his other acute variety, in which the tuberculous changes are more complete, and in which the tuberculous deposition is often in the infiltrated or diffused form. From the general symptoms, this form of acute phthisis is liable to be mistaken for bronchitis or pneumonia, and it is only by attention to the physical signs, as well as the progress of the whole case, that the distinction can be made. Of this we shall speak under the head *Diagnosis*.

CHRONIC PHTHISIS.—Tuberculous consumption, is in its ordinary career, a chronic disease; but the cases that especially deserve this title, are those in which the disease lasts for many years. Bayle and Laennec record instances in which patients appear to have had the disease thirty and forty years. But it is not to be supposed that in chronic cases the disease is always progressive. It owes its long duration to its limited extent; and although the lungs are never free from some of the lesions described as characteristic of phthisis, yet the continuance of the disease is chiefly marked by many successive attacks and partial recoveries, dependent on the partial development of new tubercles and their successive changes and elimination. As the rapid form of the disease occurs chiefly in young subjects, so this in most instances is met with at or after middle age; but it is by no means confined to any period of life. In many instances it wears the garb of a common pectoral catarrh, recurring frequently in cold weather, and in great measure subsiding during the warm season; but on attentive observation it will be found that the attacks, although in great measure bronchitic, are attended with more purulent expectoration, hectic fever, and loss of flesh than those of simple bronchitis, and that the cough is never entirely removed, and the patient rarely quite recovers his flesh and strength. He may return to his usual pursuits, and consider himself recovered, but he is somewhat short-breathed, and suffers from any unusual exertion, which may sometimes induce hæmoptysis. With the return of winter the pectoral symptoms recur, to be again alleviated or removed in the summer, until at last one attack, more severe than the rest, proves fatal, or the disease makes more rapid and decisive progress in consequence of the failure of the constitution or the spread of the local disease. The physical examination of such cases, even at an early period, generally furnishes pretty clear evidence of the existence of phthisical lesions; for although these are limited in extent, they produce signs the more contrasted with those of the healthy parts of the lung. Hence, under a clavicle, at a scapular ridge, or in some circumscribed spot in the chest, there are dulness on percussion, deficient or bronchial respiration, and

undue resonance of the voice, or, as the disease advances, the different signs of a cavity before described. In such cases the long continuance or frequent recurrence of bronchial rhonchi in one particular spot, affords, as Dr. Stokes has observed, strong presumptive proof that tubercles are there irritating and pressing on the air-tubes. It is this chronic or limited form of tuberculous disease that affords the best chance for the remedial powers of nature and art; and there can be little doubt that a considerable number of cases are cured. The lungs of those who have died of chronic phthisis present appearances that can be distinctly referred to different dates. In the upper parts there are often old cavities lined with a false membrane with hard black tissue around them, the exterior of the lung being irregularly puckered and nodule by the indurations, the contraction of false membranes, and the emphysematous distension of the uncondensed texture. The old date of these changes is plain from their hardness and gray colour, and the complete organization of the false membranes lining the cavities, or uniting their sides. Near the same parts, but more abundantly in the middle and lower parts of the lung, there may be cavities of more recent formation, with their walls comparatively soft, ragged, or imperfectly lined by albuminous matter; and there may be likewise more or less of the different kinds of consolidation—circumscribed and diffused, gray, red, and dark-coloured,—which constitute the earlier stage of phthisical lesions, in parts generally exhibiting the changes into crude and soft tubercle. It is sometimes not difficult to recognize, in these different appearances, the lesions which have been connected with the several successive attacks which the history of the patient records. Laennec adverts to these successive productions of tuberculous disease, which he calls *crops* of tubercles.

But many of those affected with chronic phthisis, or circumscribed tubercle of the lung, die sometimes from other diseases connected with this lesion, such as hæmoptysis, pneumonia, bronchitis, pleurisy, perforation of the pleura; sometimes from causes unconnected with it, such as fevers, inflammations of other viscera, accidents, &c. These cases give us the opportunity of seeing consumptive disease in its slighter forms; and they are so common beyond middle age as to have been met with in more than half the cases in which we have thoroughly examined the lungs of subjects who have died of various diseases in London and Paris. It is easy to discover these partial lesions, on feeling the lungs between the fingers, and cutting into any resisting or indurated portion, which will be found to be a gray or red induration, a yellow or cretaceous tubercle, or the remains of one, a smooth cavity or a cicatrix, to which may sometimes be traced obliterated bronchial tubes. In a few instances we have met with cavities of a considerable extent, without any remains

of tubercle, the walls only being composed of condensed pulmonary tissue, smoothly lined by a false membrane, which sometimes is opaque, fibrous, and rather thick, and sometimes as thin as mucous membrane. We shall presently revert to these facts as proving that phthisical lesions are generally destructive, on account rather of their extent and constitutional origin than of their nature.

Laennec and several subsequent writers have treated of *latent* phthisis as a distinct variety: but seeing that the cases falling under this denomination differ from the common, the acute, or the chronic forms of consumption, only in their general symptoms being less marked than usual, or being disguised by the symptoms of various other affections with which the disease is complicated, it does not seem correct to separate them into a distinct variety. But it is highly important to know that all the varieties of phthisis may present very different degrees of prominence in the usual symptoms, and that they may be masked, even to their last stages, by affections of other organs, particularly of the stomach, intestines, and liver, and by various fevers, as well as by previously existing or concomitant affections of the respiratory apparatus, especially bronchitis, laryngitis, pleurisy, and pneumonia. In all these cases the physical signs will generally furnish the means of diagnosis: but in many instances, the general symptoms, likewise, if attentively studied, will indicate the nature of the disease; and it is from inadvertency on the part of medical men, and from their preconceived notions and those of the patients, as much as from the obscurity of the symptoms, that phthisis is so frequently overlooked. We think it necessary to warn the young practitioner not to conclude that a cough is merely a "stomach cough," a "liver cough," or an "hysterical cough," because there is marked disorder of the corresponding organs, nor that shortness of breath and night-sweats proceed from general debility; nor that symptoms are not phthisical because the patient has long suffered from pulmonary catarrh or chronic laryngitis, until he has found, on repeated examination, no physical signs of phthisis in the chest.

ORIGIN AND CAUSES.—If we attend to the history of different cases of pulmonary consumption, we shall find that they may be classed in three groups. 1. Those in which the individuals had enjoyed very good health until they were attacked with one or more severe colds, or inflammations of the chest, or a fever accompanied by pectoral symptoms, sooner or later after which the phthisical disease commenced. 2. In other cases, again, the cough and other symptoms begin very gradually, without any very obvious cause, and, with as little apparent external reason, soon increase to a serious extent, and the consumption runs a more

or less rapid career. 3. In a third class of cases, the patients have been out of health, in a debilitated or cachectic state before the commencement of the cough and other local symptoms, which become developed after exposure to cold, the stoppage of an habitual evacuation, or some other cause likely to occasion local irritation or plethora.

1. In the first class of cases we have the development of phthisis from local inflammation or irritation without any evidence of prior constitutional disorder, unless an hereditary predisposition, which may be traced in some of these cases, may be considered as such. The acute inflammation, whether pulmonic, pleuritic or bronchial, imperfectly treated and only partially subdued, passes into a chronic form, and either immediately develops phthisical indurations in the lungs, or by generally lowering the vital powers, leads to their formation from perverted nutrition, or from the irritation of any fresh exciting cause. Under any of these circumstances, chronic inflammation, either by its own local effects, or by its depressing influence on the constitution, or by both combined, becomes a sufficient cause of pulmonary consumption. As it might be anticipated, consumptive disease arising in this way is often more limited in its extent, and manageable in its course, than that arising from a prior constitutional disorder. As the cause is more local, so the lesion is more confined to a part; and we see instances of it in the very partial indurations and other phthisical lesions, or the traces of them, which we have lately noticed as occurring frequently in the lungs of persons who have died of other complaints. The physical character of these lesions in many such cases clearly identifies them with those which in greater extent constitute chronic phthisical disease.— Yet the same local causes that produced these limited or solitary tubercles may engender many; and the greater the number that the local cause thus develops, the more effect will it have on the constitution which, in a manner, takes on a disposition to evolve the new production; hence, therefore, out of a local cause, such as latent or neglected pneumonia, pleurisy, or peritonitis, may arise a general tuberculous disease, involving more or less the whole system. [Pneumonia and pleurisy play a much less important part in the development of phthisis than is generally supposed. Dr. Louis denies their influence almost entirely. The seat of pneumonia is the base of the lungs, and the larger proportion of persons afflicted, is males; whilst the seat of phthisis is the summit of the lungs, and females are incontestably more liable to it. Pleurisy does not appear to exercise a more decided influence in the production of consumption. The very extensive researches of Dr. Grisolle confirm those of Dr. Louis. It is probable that in those cases where tubercles follow apparently pneumonia, that they in reality existed previously, and were the cause of the pneu-

monia, and subsequently became developed to a greater extent. The influence of pulmonary catarrh, as a cause of tubercles, does not appear to be at all better established.] Among the local causes of consumption is to be reckoned the habitual inhalation of fine solid particles, which is contingent on certain occupations, such as those of needle pointers, dry grinders, stone-masons, miners, colliers, and such like. The lesions in these cases are, as might be anticipated, bronchial as well as parenchymatous; and it has been questioned whether the consolidation of the lung which is found is really tuberculous; but seeing that it tends in the same manner to softening and the formation of vomicae, that granular indurations and distinct yellow tubercle sometimes accompany it, and that the symptoms and signs are those of pulmonary consumption, we see no reason for distinguishing between them. The dependence of the disease, in these cases, on the mechanical irritation of the inhaled particles, is sufficiently proved by the fact that these particles have been found in considerable abundance in the indurated lung, particularly in the case of the Edinburgh stone-masons and the workers in coal mines, the texture being in the latter case completely blackened by the coal dust. In the case of the steel-workers at Sheffield, described by Dr. Knight, the fork-grinders, who grind dry, do not reach thirty-two years of age, whilst the knife-grinders, who work on wet stones, generally live to forty or fifty. The workmen employed in making gun-flints in the quarries of St. Rock are said by MM. Benoiston de Châteauneuf and Clozier to be sooner or later attacked with pulmonary disease, generally tuberculous; and, however robust originally, few pass the age of forty. [Dr. Andral, who visited these quarries, says that the siliceous dust cannot reach the mouth, and therefore cannot be inhaled; and he attributes the prevalence of phthisis in the workmen to the constant contact of their feet with the cold stones. In a constitution previously vitiated, this might possibly be a cause.] With such cases may be associated the results of the experiments of Saunders, Cruveilhier, and others, in which lesions resembling those of phthisis were produced in the lungs of animals after the injection of mercury into the air-tubes or blood-vessels. The inhalation of vegetable or animal dust or particles does not appear to be so injurious, except in the case of the feather-dressers, brush-makers, and flock-carders. According to M. Benoiston, the average mortality in the former from phthisis only amounts to seven and a half per cent. for males, and eleven and a half for females. The injurious character of these employments may be explained, when we consider the irritating character of particles of feathers and hair, and how little they can be softened or decomposed by the animal fluids. It has been maintained that the production of tuberculous disease in these different employments, is due as much to a bad state of the con-

stitution induced by confinement, abuse of spirituous liquors, &c., as to the local irritation: we do not deny that this may have a share; but the greater influence of the perpetual local irritation is apparent from the fact, that in other occupations in which the confinement and habits are quite as bad, not one-fourth so many die of consumption. [It appears to be demonstrated from the investigations of the authorities already quoted, as well as those of Patissier, Holland, Allison, &c., that those artisans who are exposed to the constant inhalation of particles of dust, are peculiarly liable to phthisis. Dr. G. Calvert Holland states that a large proportion of the cutlery grinders of Sheffield die of consumption, under thirty years of age, and Dr. Allison says that there is hardly an instance of a man regularly employed in heaving stones in Edinburgh, who does not suffer from phthisis before reaching fifty.]

2, 3. We may well consider the second and third classes of cases together, for in both the disease has its root distinctly in a state of the constitution, and they are distinguished only by an occasional or local cause being obviously added in one class, and not in the other. Unfortunately these form the most numerous group of consumptive cases, and those over which, when once formed, medicine has but little control. The cachectic condition of the system which precedes the formation of tubercle, as well as the circumstances that seem to occasion it, fully correspond with the pathological views which we have taken of its nature. Imperfect nutrition, whether from deficient or improper food, or from a permanently disordered state of the digestive or assimilative organs; unhealthy air, whether from closeness, humidity, or impurities; long-continued exposure to cold, as from insufficient clothing, where there is not enough vascular irritability to lead to inflammation; depressing passions, such as disappointed love, anxiety, or distress from reverses of fortune or other severe calamity; venereal excesses; repeated courses of mercury; profuse and very weakening discharges; adynamic fevers, and the atonic state that sometimes succeeds to exanthematous fevers; irregularities of the uterine function, especially those that lead to chlorosis; the sudden suppression of habitual discharges or of long established cutaneous eruptions; these singly or combined are the most common causes of the constitutional origin of tuberculous disease. They all tend to destroy the balance of the functions and diminish the tone of the system, and with it that rich fibrinous and vital condition of the blood, by which proper nutrition and the organic functions are sustained. The impoverished blood, defective in that vital albumen with which the tissues are fed and renewed, deposits in its stead a degraded matter, imperfectly or not at all organizable, like that resulting from the lower degrees of local irritation or inflammation. The lungs, the lymphatic

glands, and a few other organs, become the first seat of these deposits, because their textures are in fuller relation with the blood than those of other parts are; and if there be in these organs also a congestion, an irritation, or an inflammation, the deposition becomes more extensive and rapid in proportion: although the inflammation be acute, it may also produce organizable lymph, together with the degraded albumen, tubercle; so also we find, that according to the natural activity of the nutritive process will be the rapidity of the tuberculous deposition and the progress of the disease. In young persons nutrition is most active, so is consumption more commonly spontaneous and rapid; and at no period is this more manifest than between the ages of eighteen and twenty-five, when growth becomes completed, yet the vessels and their blood do not immediately lose their habit of deposition. This view also corresponds with the fact stated by Andral, Lombard and others, that of young persons, consumption shows itself earliest in females, in whom growth is sooner completed than in males. But throughout the whole period of childhood and of youth, tuberculous disease is very common, and under the influence of the causes already enumerated, is more easily engendered than when nutrition is less active. From the tables collected in the work of Sir J. Clark, it appears that more than one-fourth of those who die from birth to puberty are affected with tuberculous disease. We can understand why this morbid nutritive activity, this disposition to deposit tuberculous matter, should be particularly shown in women after the completion of utero-gestation, and in persons on the speedy healing of large suppurating wounds—circumstances which, as long as they continue, are known often to suspend the progress of consumptive disease.

Our limits will not permit us to go into many further details respecting the causes of tuberculous disease or of the cachectic condition on which it depends. Sir James Clark lays much stress on abdominal plethora, or congested state of the portal system of blood-vessels, as the chief cause of this condition; and there are many facts which favour the opinion that congestions of various internal parts frequently precede the development of consumption; but it is a question whether we may not take a link higher in the chain of causes, and view defective or irregular action of some of the principal secreting organs, or of the capillary circulation in general, as the precursor of these congestions. Signs of such defective action occur in scrofulous constitutions more constantly than those of abdominal plethora, and are manifested in coldness of the extremities, blueness of the nails, flushing of the face, a dry harsh or a flabby state of the skin, relaxed throat, scanty and high-coloured urine, irregular bowels, uncertain appetite and variable strength. In many cases pulmonary

consumption has been preceded by such a condition of the system, and in such instances the disease may begin very gradually without any very obvious exciting cause, or it may be suddenly developed by an inflammatory or febrile attack. It must, however, be confessed, that such a condition of the system is often met with without being followed by consumption; and not a few cases of consumption occur without appearing to be preceded by any such disorder of the health.

The hereditary origin of tuberculous disease is established by the concurrent testimony of almost all writers, and it may be considered as one of its most fertile sources. Sir J. Clark says that it is transmitted more often to the younger than to the elder children of a consumptive family; and he believes that a deteriorated state of the health in the parent from any cause, such as gout, severe dyspepsia, cutaneous diseases, debility from disease or from age, may give rise to the scrofulous constitution in the offspring. The same writer has very judiciously remarked, that even in those not inheriting it, a disposition to tuberculous disease may be readily induced by bad nourishment, confinement in impure air, and neglect of cleanliness during the whole period of their growth, and more especially in early years. A child under such circumstances, although born in health and of robust parents, becomes pale and thin, with a tumid abdomen and enlarged glands, and fœtid evacuations; and unless speedily removed from these unfavourable circumstances, soon dies of some form of tuberculous disease. The same thing is observed of the lower animals: thus, the cows confined in close stables in towns, become tuberculous; and rabbits may be rendered so in the course of a few weeks, by keeping them in a close damp place, and giving them only poor food. Partly to the confinement must be ascribed the fact that many of the monkeys brought to this country die tuberculous; but the change of climate must also be considered a chief cause, for negroes who come to this country are especially liable to phthisis.

Phthisis prevails more in temperate than in hot or very cold countries. It is the cause of nearly a third of the mortality in London, and not much less in Paris; whilst in Russia and in the East Indies, it is far less prevalent. In the West Indies, however, it appears from the table of Sir James Clark to be very destructive among the negro troops, where it constitutes one-half of a large mortality; and in the East Indies a considerable number of Malays, Caffres, and Indians, fall victims to the disease, which constitutes from one-eighteenth to one-seventeenth of the mortality, while among the Europeans it does not cause one in five hundred deaths.

DIAGNOSIS.—Having already entered pretty fully into the signs

and symptoms of tubercles of the lungs, it will not be necessary to dwell long on the subject of diagnosis. In the greater number of instances, the features of the disease, together with the physical signs, are quite distinctive; but it often happens that the early stages are rendered obscure by certain complications, and it becomes difficult to distinguish, whether, in addition to the more obvious disease, tubercles are present or not. These complications are chiefly bronchitis, pneumonia and pleurisy, and the diagnosis is to be made between them combined with tubercle, and the same simple.

[In the commencement of phthisis, the diagnosis is not unfrequently exceedingly difficult, and great care and caution are necessary in forming an opinion at this period, when a positive diagnosis is so important. The rational symptoms should be studied quite as attentively as the physical; one is as important as the other in the detection of phthisis in its incipiency, for one set of phenomena alone will not, in general, suffice; both should be employed, for they mutually correct and assist each other. Bearing this in mind, we shall find that, in a large number of cases, phthisis may be recognized by a few symptoms, easily ascertained, soon after its invasion.

Phthisis usually commences with a dry cough, and for which no appreciable cause can be assigned. These are two important circumstances, both being exceedingly rare in pulmonary catarrh. At a period, varying from one to six weeks, a clear white, and frothy expectoration takes place, which retains these characters for some time. This is not the case in catarrh. At the same time with these symptoms, dull, rheumatic pains in the chest are felt, which are located in the lateral parts of the chest, or between the shoulders; in bronchitis, the pain is burning and tearing, and is situated behind the sternum. Combined frequently with these symptoms is hæmoptysis, which, if copious, is almost positive evidence of phthisis. Of upwards of twenty-four hundred non-phthisical patients carefully questioned by Dr. Louis on this point—individuals who had not suffered from any violent contusion of the chest, nor were labouring under gangrene, or cancer of the lungs, or suppression of the catamenia—one only had had hæmoptysis to any extent. Acute bronchitis is commonly preceded by coryza; this is not the case with the cough in phthisis. In phthisis, fever, especially towards evening, is common from the outset; in bronchitis, it is not common, except where the catarrh is intense. With these symptoms, the occurrence of emaciation, without any appreciable cause, such as disease of the digestive organs, or hæmorrhoidal discharges, places the case beyond doubt. In the early stage, percussion generally gives no positive information, and as its results are very delicate, it should be performed frequently, and under various circumstances, before any opinion is

hazarded. When the tubercular deposition in the infra-clavicular regions is considerable, there is not only dulness, and even flatness, but, at the same time, increased resistance to the percussing finger, a sensation before referred to, and which is a valuable sign of consolidation from whatever cause, and which is readily acquired by a little practice.

Auscultation at the commencement of phthisis, sometimes gives but little assistance; but, in the majority of cases, this is not the case, and before any change in the sonoriety of the chest is detected, auscultation gives very important information. Frequently the earliest physical phenomenon is weak, diminished, or incomplete respiration, heard in the infra-clavicular region, on the same side with the pain; or the respiration may be harsh and blowing. If the latter phenomenon exist in the right infra-clavicular region, it is of less value than when it occurs in the left, for reasons already stated. (See p. 51.) At a later period, varying with the course of the disease, dry or humid crackling, or a few bubbles of subcrepitant rhonchus, will be heard at the summit of the lung which had offered previously the altered respiration. This is an indication only of the secretion of mucus, and may be co-existent with gray granulations. When the earliest symptoms are in abeyance, if we have the expiratory murmur slightly prolonged, with harsh expiration, slight bronchophony, and a few cracklings, with or without change in the sonoriety of the part, we may decide on the existence of tubercles with great certainty.

We also arrive at the diagnosis of phthisis indirectly through certain pathological laws, which have been ascertained, and which are found to be invariable. Thus the occurrence of double pleurisy,—which is never a primary or essential disorder, but always secondary,—warrants us in diagnosing with certainty the presence of tubercles in the lungs. Ulceration of the larynx and trachea has, as we have already seen, a signification nearly as positive, being always tubercular, except when syphilitic. The same with regard to chronic peritonitis, which, unless it is cancerous, is always tubercular; so that its occurrence in an individual after fifteen years, though he may present no rational or physical signs of phthisis, betokens the presence of tubercles in the lungs. The same may be said of the peculiar form of meningitis, before referred to, and which, after the same period of life, never occurs without tubercular depositions in the lung. An obstinate chronic diarrhœa, rebellious to all treatment, of from six to ten months duration, accompanied with more or less emaciation, should also lead to the suspicion of phthisis, and is frequently a valuable symptom.

As the disease advances, the symptoms, both rational and physical, already enumerated, become more marked, or give place to others, and others again are superadded. The sputa, after retaining for some time the characters just described, become thick and yel-

lowish, like those of bronchitis, and subsequently greenish and striated with white lines, and round (nummular); these characters of the sputa are very significant of the disease. The physical signs give very important information in this stage of the disorder. The sound on percussion becomes perfectly flat over the seat of the tuberculization, and the percussing finger receives a distinct sensation of resistance; occasionally the sound is clear, but of a different quality from healthy resonance, and is called the cracked-metal sound. The gurgling or cavernous rhonchus, with pectoriloquy, amphoric respiration and metallic tinkling, together with the general symptoms, leaves now no doubt of the nature of the disorder.]

Acute phthisis often begins with the signs of general acute bronchitis, accompanied by much febrile irritation. But when tubercles are present, the sound on percussion is more or less impaired; in some parts of the chest the quickness of pulse is unusually great; there is more tendency to night perspirations than in simple bronchitis; and the symptoms, instead of reaching an acme and then declining, with a change in the expectoration and in the character of the rhonchi, continue, and even increase whilst the patient daily loses strength and flesh. In the generality of cases, simple bronchitis prevails most in the middle and lower parts of the chest; that accompanying tubercles always extends to the upper, and often occupies these chiefly. The complication of tubercle with pneumonia, which is a very acute form of phthisis, may be generally distinguished from simple pneumonia, by its commonly occupying both lungs and progressing from above downwards: from the less rapid increase of the consolidation; by the decidedly hectic form of the fever after the first few days; and by the early production of the signs of cavities accompanied by copious purilaginous expectoration, and sometimes hæmoptysis; none of these signs are usual in simple pneumonia. To distinguish in a case of pleuritic effusion, whether tubercles are present or not, may be a matter of great difficulty. With regard to the compressed lung of the affected side, nothing can be determined, and as there is no longer a standard of comparison for the sound side, absolute signs alone can be depended on, such as decided dulness, bronchial or cavernous breathing, or pectoriloquy under the clavicle, or a permanent mucous or subcrepitant rhonchus. In the entire absence of these, and when the respiration is clear and puerile throughout that side, and the general symptoms and the aspect of the patient are not tuberculous, it may be presumed that there are no tubercles.

We have before adverted to the difficulty of distinguishing between simple chronic bronchitis and that accompanying limited or early tuberculous disease; and we must refer to the description of the physical signs for the chief means of diagnosis. Without attention to the physical signs, chronic pleurisy is very

liable to be confounded with phthisis; they never fail to furnish a diagnosis in the much more complete dulness and absence of respiration in pleurisy, particularly in the lower part of the chest, on one side only; in the enlargement of this part and the smoothness of the intercostal depressions, which contrast strongly with their sunken condition in phthisis. When the effusion has been partly removed, and partial contraction of the chest taken place, although from the dilatation of the tubes, there may be pectoriloquy and other signs of cavities, yet the alteration of shape affects the side more extensively than phthisis does, and a perfect dulness remains in the inferior parts, which is quite unlike the condition induced by phthisis. The different character of the expectoration also will form another ground of distinction. Dr. Stokes thinks that tubercles are not uncommonly produced during the absorption of an empyema, and mentions, as their signs, the occurrence of symptoms of new pulmonary disease, with hectic, quickened pulse, an increasing dulness and signs of irritation under the clavicle or scapular ridge.

Phthisis is sometimes disguised by chronic laryngitis; the affection of the voice, character of the cough, and other symptoms directing attention exclusively to the larynx; but we have before remarked that extensive ulceration of the larynx is very commonly accompanied or succeeded by pulmonary tubercle; and on careful examination, the signs of this may generally be found under one or both clavicles by the respiration or by percussion, if not by the voice.

There is one kind of lesion which, even in its physical signs, is liable to be mistaken for tuberculous excavations; this is dilatation of the bronchi. This may be the seat of a coarse gurgling rhonchus, cavernous breathing, and pectoriloquy; and the accompanying chronic bronchitis often causes also purulent expectoration. The situation, greater extent, and more stationary character of these lesions may serve to distinguish them; they most commonly occupy the scapular, mammary, and lateral regions, and not the infraclavian; they usually extend over a considerable space, but do not tend to spread as tuberculous cavities do. Again, if they arise from disease in the bronchi only, they do not impair the sound on percussion so much as phthisis does; and if they originate in the pleuro-pneumonia, the dulness is much more complete, is confined to one side, and is accompanied by a more marked contraction than that which occurs in phthisis. But the general symptoms should also be taken into account. There is seldom, with dilated bronchi, the degree of hectic emaciation which occurs in phthisis; and when they arise from condensation of the lung, there are often œdema and general dropsy, which are not common in simple phthisis.

[Phthisis may be confounded with pulmonary emphysema, where

the latter occupies one side of the chest, and is situated in the infra-clavicular region. In both disorders a difference in the sonorousness of the two sides of the chest exists, at the same time that there is a notable diminution in the respiratory murmur of the affected side. But the differential diagnosis is easy, when we reflect that in emphysema weak respiration exists on the same side with the increased sonorousness, and that there is no correspondence in the diminished sonorousness and the auscultative phenomena. The infra-clavicular region, moreover, is vaulted, and the subcrepitant rhonchus, when present, is heard at the inferior and posterior part of the chest, and not in the infra-clavicular region, as in phthisis.

The latent form of the disease not unfrequently occurs; in such cases there are no chest symptoms which direct attention to the lungs; emaciation, hectic, and obstinate diarrhœa alone existing. Their presence, under these circumstances, should lead to a careful exploration of the lungs, which generally confirms the suspicion entertained. Out of one hundred and twenty-three cases reported by Dr. Louis, the disease was latent in one-fifteenth. In one-half of these there were no general symptoms of any importance for a long time; in the remainder there was fever, with loss of appetite and emaciation, although cough and expectoration were absent.]

PROGNOSIS.—In a disease which causes so large a proportion of the mortality of the human race, it may well be supposed that the prognosis is generally most unfavourable; until Laennec discovered sure means of detecting tuberculous lesions, and also proved, by anatomical researches, that they are sometimes cured by a natural process, it was generally believed that they were quite incurable, and must sooner or later prove fatal. In making these discoveries, Laennec altered the state of our knowledge, chiefly by showing those to be cases of consumption which were formerly not admitted to be such, simply because they recovered. After the diagnosis has been distinctly made by aid of the physical signs, and the disease proved to be tuberculous, the prognosis is to be formed chiefly through the general symptoms. The extent of the pulmonary lesion may, indeed, only be determined by the physical signs, the dulness of percussion and respiration, the rhonchi, resonance of the voice, and signs of excavation, whether they are confined to a small space or extend to a considerable portion of both lungs; and, in the latter case, the rapid progress of the disease to a fatal termination may be at once prognosticated. But where, as is often the case, the physical signs establish the presence rather than the amount of the disease, we must refer to the state of the general health, to determine the probable time during which the constitutional strength may struggle against the disease, and the chance, if there be any, that it may get rid of it.

When the cough and dyspnœa are distressing, with copious purulent expectoration; the pulse constantly quick; the accessions of hectic severe, with or without night-sweats; the loss of strength and flesh considerable and progressive,—no hope can be entertained with regard to the result, which will terminate unfavourably in a short time. When the dyspnœa is considerable, death generally takes place before the emaciation is extreme; and this is commonly the case in acute phthisis, and where the fatal termination is caused by an inflammation or hæmorrhage of the lungs supervening on the tuberculous lesion. In such cases, œdema of the feet, face, and other parts sometimes precedes death. But in the less rapid cases, and those which run their full course, the emaciation is excessive, and nothing increases it and the weakness so much as the colliquative diarrhœa, which generally occurs in the last stage of the disease. Shortly before death, the expectoration is sometimes suppressed, and sometimes it is changed in appearance, being a dark dirty green, or a reddish purilage with no mixture of mucus or froth.

The progress of the more prolonged cases is rarely uniform; it is marked by a series of attacks of increased symptoms, with a temporary amendment between them. This increase is generally referred to the weather, or increased exertion, and under favourable circumstances, may be decidedly checked. Thus, patients often pass several years, losing ground in the winter and spring, and rallying somewhat during the summer, until, at length, they sink either under an attack severer than usual, or fairly consumed by the reiterated attacks of the disease. In some cases the improvement is more decided and lasting: the fever abates; the pulse loses its frequency; the cough subsides, and the expectoration becomes mucous and nearly ceases; and, in a few instances, the disease is entirely removed, and the flesh and strength restored. The local signs that countenance the hope that such an improvement may be lasting, are, a diminution of the pectoriloquy, cavernous breathing, and other signs of the excavations, the restoration of some vesicular respiration and sound on percussion to the part, whilst in the rest of the lungs the sounds are natural. There can be little hope of permanent improvement if there is strong hereditary predisposition, or marked symptoms of tuberculous cachexia, or any functional or constitutional disorder which materially impairs the general health.

[Of late years, strenuous efforts have been made to prove the curability of consumption, but, unfortunately, in almost every case, details of the alleged facts are wanting. The late Dr. Rogée, a young French physician of high promise, found, during a residence in La Salpêtrière, where all the patients are over sixty years of age, that over one-half of the women examined by him after death, indiscriminately taken, presented one or more calcareous or cretaceous

deposits in the apices of the lungs. These observations are confirmatory of those of Laennec, Andral, &c. The proofs, however, of the curability of consumption, drawn from the evidence of pathological anatomy, whilst, in the present state of our knowledge, they lead us to admit the possibility of the occurrence, do not really enlighten us at all on the essential points, as they do not furnish us with any of the circumstances; the history of the cases is wanting. Dr. Louis, in adverting to them in the last edition of his work on phthisis, says, "that it is difficult to believe that the symptoms dependent on the tubercles, of which Dr. Rogée discovered these traces, could ever have been of a very serious kind; or, that the little cretaceous masses described, could have succeeded to large cavities. It is more probable that the disease always followed a slow, inactive course; and it becomes a question when the anatomical change is so limited in extent, whether the disease commenced in youth or old age." These cretaceous deposits, when occurring, are invariably found in old persons, and we have no proof, as Dr. Louis suggests, that the tubercular matter was not deposited at an advanced period of life, when the vitality of the organ is diminished, and when calcareous deposits elsewhere are quite common. The nature of the circumstances, in the extremely few well-attested cases of recovery from phthisis, are utterly unknown, and were probably due to some individual peculiarities, which are at present quite beyond the reach of investigation.

Drs. Fournet and Hirstz have both, within a few years, endeavoured to prove the curability of phthisis in the early stage. Their works are lamentably deficient in facts to sustain their assertions, and an attentive perusal of these works will convince every one that they have utterly failed to establish their proposition by any thing like facts.

A prognosis with regard to the probable termination of the disease is frequently extremely difficult. As a general rule, it may be said that if the accompanying fever be severe from the debut, and the local symptoms advance rapidly, a speedy termination may be predicted. If, on the contrary, a dry cough persists for some time, if the febrile symptoms are absent, or are but slight, and the local symptoms are stationary, the progress will be slow. Still, we are frequently deceived. When the invasion has been severe and sudden, the disease may be suddenly arrested and remain in abeyance for some time. On the other hand, after having advanced for some time very slowly, it may suddenly, without any appreciable cause, advance to a fatal termination with great rapidity; or sudden accidents may supervene, as tubercular peritonitis, tubercular meningitis, perforation of the pleura, &c., and cause speedy death. Cases fully illustrative of these facts are given by Dr. Louis.]

TREATMENT.—We have been led to conclude that the most important elements in the production of phthisical lesions, are a state of constitutional weakness or defective nutrition, and a local vascular irritation or congestion: these elements predominate in various proportions in different cases, and will require a corresponding variation in the treatment; but in almost every case, both the constitutional and local causes must be duly investigated and treated, or success will be only a matter of the most incalculable and irrational chance. In treating of the causes of consumption, we arranged cases in three groups: 1. Those arising from local disease; 2. Those originating from constitutional disorder, or hereditary predisposition, without any known previous local disease; and, 3. Those arising from local disease in subjects of hereditary or acquired scrofulous or phthisical constitution. In the two last, constitutional causes are recognized; and in the first, the local disease may act, not only by developing in the lungs lesions which tend to run a phthisical course, but also by injuring the functions generally, so that here, too, a constitutional cause becomes added. In no case, therefore, should we exclude constitutional treatment from a prominent place in the management of consumptive patients. It is where local disease has been the chief cause of the mischief, that we have the best chance of curing consumption, and the more so in proportion as the local lesions are limited, and the constitutional powers little impaired.

The chief indications in the treatment of tuberculous disease are, to diminish those local irritations and congestions that lead to the formation of the indurations or tubercles; to correct the condition in the system which degrades the nutritive process, and disposes to the deposition of imperfectly organized products; to promote the removal of those already deposited; and to treat troublesome symptoms and accidental complications. These indications will predominate very differently in different cases, and in the different stages of similar cases; and although all should generally be kept in view, it will be more convenient to consider the treatment in relation to the stages of the disease than to these separate indications.

FIRST STAGE.—The symptoms of the early stage, that of the indurations, are those especially of vascular irritation and obstruction; hence this is the period at which antiphlogistic and counter-irritant remedies avail most. General blood-letting of from four to eight ounces, repeated every week or ten days, were highly recommended by Morton, Dovar, Fothergill, and Pringle, and more recently by Dr. Hosack, of New York, and Dr. Cheyne, of Dublin. The practice is still much pursued in this country; and if judgment be used with regard to vascular strength of the sub-

ject, it is one of the most important agents which can be employed. We would, however, with Sir J. Clark, limit its use to cases in which there are marked signs of plethora, or of pulmonary inflammation, congestion, or hæmorrhage; and, in other cases, and subsequently, prefer moderate local bleeding by leeches below the clavicles. The latter measure should be repeated whenever an increase of pain or cough, with a bloody tinge in the sputa, dullness on percussion, and irregular respiration or rhonchi under the clavicles, indicate a congested state of the lung about the suspected indurations.

In cases of greater debility, or where there appears to be a defect of blood in the system, blisters or other counter-irritants are more suitable than blood-letting. One of the best agents of this kind is a saturated solution of tartarized antimony, to be rubbed in below the clavicles twice a day, until a papular or semi-pustular eruption is produced. The friction should be renewed from time to time when this eruption dies away, as the symptoms may require it. We have sometimes added hydriodate of potash to the solution, with the effect of rendering it more irritating, and perhaps of acting favourably on the constitution by being partially absorbed. [Or croton oil, pure, or combined with olive oil, according to the susceptibility of the skin, may be advantageously substituted—

28. R.—Olei Tigllii, f ʒss.
 Olei Olivæ, f ʒj.
 Olei Cinnam., gtt. ij.
 M.]

Issues and setons cause too much irritation of the system to be useful in this stage. A more moderate and general counter-irritation may be produced by sponging the whole chest once or twice a day with salt and strong vinegar, or with a liniment of oil of turpentine, acetic acid, and olive oil mixed by the aid of the yolk of an egg, as recommended by Dr. Stokes, or with ammoniated liniment in various degrees of strength.

[29. R.—Olei Terebinth., f ʒiij.
 Acid. Acet., f ʒss.
 Vitel. Ovi, i.
 Aq. Rosar., f ʒiiss.
 Ol. Limon., f ʒj.
 M.]

Dr. Marshall Hall has recently extolled very highly the efficacy of an alcoholic lotion in the treatment of consumption. He considers that it checks the deposition and retards the softening of the tubercular matter. One part of pure alcohol is mixed with three parts of water. It is used tepid at first, and afterwards of the temperature of the atmosphere. It is applied in small quantity at the time, every five minutes, so that the application may always

consist of alcohol and water. If applied in larger quantity and less frequently, the alcohol would evaporate, and water alone would be left, and this would be the source of a feeling of discomfort instead of the feeling of glow which the alcohol induces. The application is easily made; a piece of soft linen, of the size of a very *large* sheet of letter paper, being folded in the usual manner, is then folded twice more, in lines parallel with the first, so that the whole consists of six folds. These are stretched, applied across the upper part of the thorax just below the clavicles, and fastened to the shoulder-straps, or other part of the dress, which latter is to be arranged so as to be readily opened and closed. A sponge, the size of a walnut, is then filled with the lotion, and pressed upon the linen along its whole course, the dress being opened for this purpose and immediately closed. This operation need not occupy five seconds. It should be repeated every five minutes. The application of the lotion should be incessant during the day and all waking hours, the dress being light, or even entirely removed, so as to allow the free and rapid evaporation. It is suspended during the night. Dr. Hall says: "It is by no means my wish to laud this remedy beyond its just value; but I have no hesitation in asserting that it possesses a power in checking the progress of the deposition and softening of tubercle in the lungs, beyond any other which I have ever tried. And the number of the patients who have recovered from incipient phthisis under its use, and who, after many years, are still living, and in apparent health, induces me to express myself in strong terms in regard to its extreme value."]

The efficacy of internal sedative or antiphlogistic remedies is more doubtful; except so far as they tend to diminish the irritation of the cough and the pain. Thus digitalis, hydrocyanic acid, and colchicum may, in some cases, subdue a temporary vascular excitement, and thus give relief; but the utility of continuing them long with the view to permanently reduce the pulse, may well be questioned; for they may thus do more damage to the constitution than give relief to the irritation. In case of increasing bronchial or parenchymatous inflammation, or of fever, salines, antimonials, and other means of increasing the fluid secretions, will be proper as usual.

The narcotic remedies, such as opium, conium, hyoseyamus, belladonna, aconite, and hydrocyanic acid,

[30. R.—Acid. Hydrocyan., gtt. xij.
Morph. Sulph., gr. j.
Syr. Amygdal., ℥ $\frac{1}{2}$.
Mist. Amygdal., ℥ $\frac{3}{4}$ v.]

M.

Sig.—A tablespoonful three or four times a day.]

are occasionally useful to allay cough and pain, especially when these symptoms are associated with high nervous sensibility or a tendency to spasm; but they have no influence on the incipient phthisical lesions, or on the inflammations or irritations accompanying them; and unless given judiciously, they may disorder the gastric and alvine functions, and thus injure the state of the constitution.

But are there no remedies that will promote the removal of the induration themselves? We can answer this but doubtingly; but if we may be guided by analogy, we might be led to hope that the removal of morbid deposits, when recent, may be facilitated by the aid of certain medicines. Thus we see tumours of various kinds, enlarged glands, and depositions in the joints, sometimes reduced under the use of mercury, of alkalies, or of iodine, and although there are many forms of deposit on which these remedies exercise no influence, and others in which their power is very equivocal, yet the limits of their action are not so defined as to prove that all the kinds of induration which precede tuberculous deposit are quite beyond their reach. The influence of these remedies in promoting the absorption of the simpler products of acute inflammation is scarcely doubted; and arising, as the lesions of phthisis occasionally do, from acute inflammation, and presenting various gradations which remove them only step by step from its products, it would be unreasonable to assert, without sufficient evidence to prove it, that they are wholly beyond the reach of such medicines. Dr. Stokes considers that the strumous inflammation which constitutes incipient phthisis, may sometimes be arrested by a course of mercury producing ptyalism; and he gives two or three cases to show the success of this mode of treatment. He admits, however, that its utility needs confirmation, and its exhibition must not be lightly attempted. It may, perhaps, be useful where the pulmonary lesion originates in acute inflammation, which has not proceeded to suppuration; otherwise its influence is generally so injurious in scrofulous constitutions, that we cannot advise its employment. This does not apply to its occasional use as an aperient, which is generally beneficial in this, as well as in other chronic diseases, in which the abdominal secretions need its aid.

Sir James Clark, on the ground of Dr. Carswell's view of the usual seat of tuberculous matter, has recommended anew the old practice of a course of emetics in the early stage of phthisis. The testimony of several English writers of the last century, Morton, Parr, Reid, Marryatt, &c., is strong in favour of the success of emetics in arresting and even curing the disease; but as we know that they did not possess the means of distinguishing phthisis in its early stages from other affections, we lose much confidence in their testimony. Nor are we disposed to trust implicitly the re-

port of the only recent authority, Dr. Giovanni de Vittis, whom Sir J. Clark adduces : he states that in less than four years, one hundred and seventy-six cases of phthisis were discharged from the hospital *perfectly cured*, forty-seven in the first stage, one hundred and two in the second, and twenty-seven in the third. But although these statements are too strong to be accepted without reserve, they are sufficient to warrant a further cautious trial of this method of treatment, in cases where there is sufficient strength to bear it. Various emetics have been recommended. Dr. De Vittis gave half a grain of tartar-emetic in a table-spoonful of sweetened infusion of elder flowers, repeating the dose in fifteen minutes if necessary. This practice was pursued every morning and evening ; the diet being farinaceous. Clark prefers an emetic of ipecacuanha or sulphate of zinc, or sulphate of copper, using only a little fluid during its operation, and for this purpose warm chamomile tea is best. It may be given every day or less frequently, according to the urgency of the symptoms. Several writers assert that emetics may be continued every other day, and even oftener, for months without inconvenience. Sir J. Clark says, "there can be no doubt that the physicians who employed emetics thus extensively, were fully assured of the advantages which they produced ; and their patients, we may conclude, must have been equally sensible of the benefit derived from them, otherwise it is scarcely credible that a practice so disagreeable would have been prescribed or persevered in." The same author supposes the action of emetics to be in a great measure mechanical, dislodging the tuberculous matter, which, according to Dr. Carswell's notion, is first deposited on the free surface of the bronchial membrane. We would rather ascribe their beneficial operation to their powerful impression on the whole vascular and secernent systems, which tends to remove local congestions and obstructions, and to render all the secretions more fluid and free. It is not probable that this unpleasant practice will be sufficiently adopted or pursued as to be extensively useful ; and there are many cases in which it cannot be even attempted.

We expect more from a much more manageable remedy, which we believe also to be capable of promoting the removal of phthisical lesions in their early stages, or of retarding their increase. This is iodine, in combination with different bases. We have been in the habit of giving it in incipient cases of consumption for the last twelve years. Dr. Baron of Gloucester, Dr. Morton of Philadelphia, and several others, have also spoken strongly in favour of this remedy. The form which we have found to agree best is the hydriodate of potash in small doses (two or three gr.) three times a day with twenty or thirty drops of liquor potassæ, in decoction of sarsaparilla, infusion of calumbo, or distilled water, according to the state of the system ; adding a little tincture of

henbane, digitalis, ipecacuanha, wine, or other medicine that the predominant symptoms may indicate. Where there is a tendency to feverish irritation, it may be given in a nitre draught; where there is vascular debility, it may be combined with mild tonic infusions. In chlorotic and in exsanguine scrofulous subjects, the iodide of iron is a suitable form; when it is borne, not causing headache and fever, or increase of cough, it rarely fails to improve the state of the general health; but it should always be combined with occasional local depletion, or external counter-irritation of the chest. When iodine agrees, (and by varying its form and combination it may generally be made to agree,) it increases all the secretions, and seems to give increased activity to the whole capillary system. In cases of gastric irritation, with pain in the stomach or heat in the throat, thirst and florid-tipped tongue, it should be suspended, and a dose or two of hydrarg. c. cretâ given, followed by a few small doses of castor oil or a saline aperient; and after a few days, the hydriodate of potash may be resumed, guarded by the frequent use of a farinaceous diluent.

[The protiodide of iron was first employed in the treatment of phthisis by Dr. A. T. Thompson, and since then has been extensively used in France, England, and this country. Dr. Dupasquier, of Lyons, published, as far back as 1835, a very favourable account of its specific action in consumption, and subsequently reiterated his statements. He says, "the protiodide of iron is borne well by phthisical patients to the amount of from twelve to thirty or forty drops daily, and exercises its influence especially on the lung. Its effects generally become manifest in the space of eight days; out of every *ten patients labouring under the disease in the third stage, at least six or seven derive notable relief from its use.* At the end of a few days, prompt diminution, amounting almost to suppression, of expectoration; relief of cough and dyspnœa; diminution and suppression of the sweats; diminished rapidity of the pulse; decreased heat and fever; increased strength and appetite are noticed. In some cases, in spite of the improvement of the symptoms, the patient grows weaker and weaker, and gradually perishes; but frequently, on the other hand, and in cases where the presence of a cavity has been satisfactorily ascertained, the amelioration becomes from day to day more evident, the patient recovers strength, the cough and fever disappear, the patient regains his gaiety, and leaves the hospital in a state of cure, which it is permitted to hope may sometimes be definitive." Dr. Louis, encouraged by the statements of Dr. Dupasquier, both as published and stated to him in conversations, employed the remedy, under the direction of Dr. Dupasquier himself, in upwards of sixty cases, in both private and hospital practice, and "*in not a single case did he observe any amelioration which could be attributed to the new agent.*" (Louis on Phthisis, 2d ed. 1843.) We have ourselves

experimented carefully and extensively with this remedy in phthisis for the last seven years, and a careful analysis of the cases thus treated, has led us to the same opinion. By a large number of phthisical patients it is ill borne, producing gastric distress, diarrhœa, cephalalgia, tightness in the head, epistaxis, and a good deal of febrile excitement.

Of late years a number of remedies has been proposed and many of them loudly extolled, as exercising a specific influence in retarding the tubercular deposition, or of effecting its removal. We shall take up the most prominent of these, and inquire into their real value.

1. *Chloride of sodium*, or common table salt, was introduced into the treatment of phthisis by Dr. Latour, and its immense utility greatly extolled. This treatment of consumption is exceedingly simple, and consists in giving common salt for two or three successive months, in gradually increasing doses, of from half a drachm to a quarter of an ounce daily. It may be taken either in broth, or mixed up with bread, and its action, aided by a succulent diet and mild bitters. On an average, according to Dr. L., the effects of the medicine are manifested in five or six days. Dr. Louis, with praiseworthy credulity and perseverance, gave this remedy in the doses and manner prescribed by Dr. Latour, to every phthisical patient admitted into his ward in the Hotel-Dieu, for a period of five successive months, in 1839, and in not one single case did he perceive any advantage to result from its use. Dr. McDowell, of Kentucky, has recently published a work in which he claims for the chloride of sodium the property of a specific in consumption. After a careful examination of his work, we have not found a particle of evidence in favour of the assertion.

2. *The subcarbonate of potassa* has been recommended by Dr. Pascal, of Strasbourg, on account of its discutient properties. He supposes that it will dissolve the albumen constituting the chief ingredient of the tubercular deposits. The publication of Dr. P. is so meagre in details, and in proofs of his assertion, that it hardly deserves attention.

3. *Muriate of ammonia*.—Dr. Cless, of Stuttgart, speaks highly of this remedy in the incipient stage of phthisis. The majority of cases treated by Dr. Cless, took from six to eight ounces of muriate of ammonia within a period of from a fortnight to a month; one of them took sixteen ounces in two months; and another nearly twenty-six ounces in the course of eleven weeks. In no case were the digestive organs put out of order by its use.

4. *Cod's liver oil—oleum jecoris aselli*.—Much has lately been said of the effects of this remedy in phthisis. Its alleged success in the treatment of kindred strumous affections, more particu-

larly those of the osseous system, induced Dr. Pereyra, of Bordeaux, to make a trial of it in phthisis pulmonalis, and he affirms the experiment met with considerable success. Other practitioners have since experimented with this remedy. After a careful analysis of their statements we do not think that its utility in consumption is at all, as yet, established. It is a highly nauseous medicine, and but few stomachs will bear it. The dose for an adult is from half or a third to a fluid ounce and a half, two or three times a day, in some vehicle which will disguise its disagreeable properties.

5. *Acetone, wood-naphtha, or pyro-acetic spirit.*—The extensive reputation which this remedy has acquired in the treatment of phthisis, requires some notice of it in this place. An insignificant London physician, by the name of Hastings, introduced it to the notice of the profession, about eighteen months since. The theoretical grounds on which he was led to its employment were absurd, and the statement that naphtha would dissolve tuberculous matter removed from the body, has since repeatedly been proved to be false. In his whole publication, there is not a particle of evidence in favour of the efficacy of acetone in any stage of phthisis. Falsehood and charlatanism are stamped on every page of it. Still the profession was attracted by the work, and the medicine has since been largely employed in this city and elsewhere in the treatment of phthisis in all its stages, and very contradictory statements regarding its efficacy have been made. We have given it a fair trial in twelve cases. In four of these the disease was confined to the first stage; in the remaining eight there were cavities of more or less extent. In two of those, in the first stage, an amelioration occurred in about two weeks from the commencement of its use, and in one continued ten months, and in the other two months, when the disease again resumed its progress. In the remaining ten, we have not the slightest reason to believe that it exercised the slightest influence on the progress of the disease. The amendment in the first two cases we should be very loth to ascribe to the acetone, as we constantly see an arrest in the progress of phthisis under every variety of treatment, or without any at all. On the accompanying bronchitis, its effect would appear to be more marked. The manner in which we gave the naphtha in the above cases, was to commence with fifteen drops three times a day in a wine-glassful of water. We continued it from three to seven months, gradually increasing the dose to fifty drops three times a day.

6. *The wine of tar, —vinum picis*—has been greatly extolled by some practitioners in this city. It is a favourite remedy in pulmonic complaints in some parts of Germany, and is known there as *tar or Jew's beer*. We have employed this remedy in several cases of phthisis, but we have been unable to satisfy our-

selves that it exercises any control whatever on the disease. Like the acetone, its action seems to be confined to the bronchial mucous membrane. It frequently disagrees with the stomach, when used in large doses, and continued for any length of time.]

But even in the cases in which phthisical lesions are most limited and merely nascent, we must never forget that it is not these lesions alone that we hope to remove. Their very presence in the system, or the operation of the constitutional or local cause that produces them, may lead to the formation of more; and in our treatment of the local causes, we should ever endeavour to remove those low degrees of vascular irritation, or that unhealthy condition of the nutrient matter of the blood, which, singly, or combined, occasion the deposition of tuberculous indurations. But the constitutional treatment is also of the utmost moment; and in this we should seek for all those circumstances and agents that may best promote the due action and balance of all the functions. The purest air and the most suitable climate for regular and ample exercise in it; the most nutritious food that the digestive organs can easily assimilate, and that the vascular system can bear without excitement; such remedial agents as give at once tone to the system, and promote the free action of all the secreting organs, together with friction, exercise and proper clothing to maintain the activity of the superficial circulation;—these are the means which are rationally indicated to fulfil the object of improvement of the general health. But these means must be much varied to adapt them to the wants and capacities of individual cases, and it is in the study of these, and in the power of adapting the means to them, that the ability of the practitioner is seen.

Of remedial measures, those already named in relation to the local lesions and particular symptoms, may be combined or modified so as to act favourably on the functions at large. This is especially the case with iodine. Occasional mercurial and saline aperients will be generally needed to prevent internal congestions, and to promote the sufficient action of the abdominal viscera; but they should not be carried to excess, and their operation should be aided by due attention to diet. So also the functions of the kidneys and the skin may, in particular cases, be ameliorated by the aid of medicines; but the more that can be done by clothing, diet, and regimen, the better. Clothing, in particular, should be most carefully attended to; we have in it the means of affecting, sometimes powerfully, the whole vascular system; and if so regulated as to maintain a permanently warm and supple, but not relaxed state of the whole surface and of the extremities, it would prevent many of those fresh colds and exacerbations which are the great bane of phthisical invalids. In case of these aggravations, which commonly consist in an increase of bronchitis, but

sometimes are pneumonic or pleuritic, the remedies for these affections must be cautiously resorted to ; always limited by the reflection that we are treating a subject that may already be weak from disease, in whom the restorative powers are lower than usual, and in whom the permanent source of irritation in the lungs will preclude that complete relief that antiphlogistic measures may give in simple inflammations.

In case of hæmoptysis, much care is required to remove the congestion or vascular fulness which occasioned it, before attempts be made to arrest it with styptics: otherwise the congestion may pass into inflammation, which, occurring in a lung tuberculated and consolidated with hæmorrhage, is particularly destructive. Moderate repeated bleedings from the arm, or by cupping, and the use of tartar emetic in small doses, not sufficient to cause vomiting, together with digitalis and nitre, and morphia in case of nervous agitation, are the measures we have found most availing. If, in spite of this, the hæmoptysis continue to any amount, the superacetate of lead, in the doses of two or three grains, with half a grain or less of the aqueous extract of opium, should be given every two hours, or as often as the urgency of the case may require. Fluid drinks in any quantity, especially warm, must be carefully avoided. Slight cases of hæmoptysis are sometimes effectually treated by a saline aperient, with diluted sulphuric acid ; and freely opening the bowels always aids to prevent the return of hæmorrhage.

Pure country air is almost indispensable to give any chance to the consumptive. If the disease be limited and chronic, and circumstances prevent him from giving up his employment in town, he should at least sleep in the country, and take every opportunity of longer absence. But the country must be dry, and not too much exposed to the east and north : otherwise it may only change the evil from cachexia to inflammation. There is no air which is so truly an antidote to the poisonous effects of a town residence, as that of a dry sea coast ; and the more open this is for the summer, and the milder and more sheltered for the winter, the better for the consumptive. The benefit that patients often quickly experience from the change is most striking, even in the more advanced stages of consumption. To profit fully by the influence of pure air, the patient should be as much out of doors as the weather will permit : and use as much gentle exercise, both by walking and riding on horseback, as the state of the strength will allow, without inducing much fatigue. To those who bear them pretty well, sea voyages are sometimes highly beneficial ; during the summer season, these may be confined to yachting about our coasts or crossing our seas ; but the voyage to India, the Cape, to Madeira, or to the Mediterranean, may, with advan-

tage, be made at a later season, with the view to pass the winter in these more genial climates. Of places for winter residence abroad, Madeira, Rome and Nice, are generally considered the choicest spots; we much prefer the former. Were there suitable accommodations for English invalids, we have reason to believe that parts of the north coast of Africa, particularly Tunis, would afford a climate better suited to the consumptive than any other of the Mediterranean. Of the milder spots in our own islands, the Undercliffe, in the Isle of Wight, Torquay, and Hastings, and the Cove of Cork, are those most favoured; but many places on the southern and western coasts also present many advantages in point of mildness and equality of temperature over all inland situations. When circumstances do not permit removal to these spots, and even in them in severe weather, the patient must be kept to rooms moderately and equally warmed, (from 55° to 65° , according to the feelings,) and as airy and well ventilated as they can be made without risk of draughts of air.

[Much difference of opinion prevails at present amongst medical men as to the most suitable climate for consumptive patients. The southern coast of Florida is probably the most equable climate in the world, and were the accommodations better, would prove the best residence for a phthisical patient during our winter months. In support of this opinion, the reader is referred to the annexed table, p. 394.]

The diet in the early stage of consumption should generally be of a mild and unstimulating character, consisting chiefly of milky and farinaceous food. Sometimes white fish and chicken may be allowed; and a state of vascular debility, or previous habits, may make the plainer kinds of meat necessary; but this is especially the period of irritation or congestion, and more mischief is likely to result from repletion than from moderation. For the same reason fermented liquors are not generally admissible at this period.

SECOND AND THIRD STAGES.—When the signs and symptoms announce that the tubercles are softened and cavities in the lungs formed, it will generally be necessary to modify the treatment in some degree, for the constitutional debility then commonly increases, and the irritations may have diminished, or at least have not kept pace with the progress of the disorder. Here depletions are less needed, and worse borne; and a somewhat tonic plan of treatment, with some of the preparations of bark or iron if they can be borne, and more generous diet, with meat and malt liquor, may often be adopted with advantage; still counter-irritation will prove useful in most cases, and in these stages those kinds which cause a purulent or muco-purulent secretion will generally produce

[Abstract showing the mean temperature for each season, each month, and the whole year,
At St. Augustine, Fort Brooke, Nice, Rome, Naples and Madeira.

Lat.	Mean annual temp.	Mean temperature of the seasons.				Mean temperature for each month.												Highest degree.	Lowest degree.	Range.	
		Win-ter.	Spr'g.	Sum-mer.	Au-tumn.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.				
		St. Augustine,*	72°24'	62.83	70.55	82.05	73.56	62.15	64.97	66.53	68.68	76.44	81.12	82.36	82.68	79.56	73.61				67.47
Ft. Brooke,*	27°57'	63.02	71.71	81.04	74.39	63.75	66.56	66.48	71.27	77.39	80.90	81.43	80.79	79.01	75.04	69.71	64.76	94	30	64	
Nice,	43°41'	47.82	56.23	72.26	61.03	45.85	49.00	51.45	57.00	63.00	69.00	73.50	74.30	69.35	61.85	53.70	48.60				
Rome,	41°54'	48.90	57.65	72.16	63.96	47.65	49.45	52.05	56.40	64.50	69.17	73.30	74.02	69.50	63.60	58.80	49.62				
Naples,	40°50'	48.50	58.50	70.83	64.50	46.50	48.50	52.00	57.00	66.50	71.00	75.00	76.50	72.50	65.00	54.50	50.50				
Madeira,	32°37'	59.50	62.20	69.33	67.23	59.50	58.50	61.06	62.50	63.00	65.00	70.00	73.00	71.50	67.50	62.70	60.50				

* For the years 1825, 1828 and 1830.]

most benefit. In fact, the same abatement of irritation which we have before described to accompany free purulent expectoration, will in some degree follow from this external suppuration, without the wasting and harassing effect of such a discharge from the lungs. With this external outlet as a sort of safety valve, strengthening medicines and nourishment may be borne; and there is less risk in restraining any excessive secretion which may take place from the lungs, the bowels, or the skin. Much attention is necessary to keep up the artificial discharge, whether it be by the formation of successive crops of pustules, by tartar-emetic solution or ointment, or some similar suppurating liniment, or by a seton or issue. If it be suddenly checked, there will, in all probability, be an increase of pulmonary irritation, perhaps attended by the deposition of more tuberculous matter. In slighter cases, or where the weakness and irritability forbid these measures, occasional blisters, or the frequent use of milder liniments, containing tartar emetic and hydriodate of potash, or diluted nitromuriatic acid and oil of turpentine, [or croton oil,] are often productive of some benefit.

In the softened tuberculous and ulcerated stages of phthisis, the constitutional powers especially need support; and it is then, more particularly even than in the first stage, that the general measures are required; but unless the disease be limited in extent, there is, for the same reason, less hope of their success. The disease has existed longer, and passed into a stage in which it is more likely to have tainted the system. The preparations of iodine and other tonic alteratives should be used more freely; and the general health supported by all the medical and hygienic circumstances that can be brought to bear on it. There are vomicae to be evacuated, and the object is to assist nature in effecting this object; in protecting the lungs from further injury during this process, and in effecting the healing of the fistulous cavities which are left. The means already recommended to strengthen the general health, are those which most conduce to these ends; but it is necessary to advert to some topical measures which have been supposed to promote greatly these objects. These are the direct application of certain gases or vapours to the lungs themselves, by means of inhalation. The only agents to which we need advert, as having been by good authority reported to be useful are chlorine, the vapour of iodine, and that of tar. The last was recommended by Sir A. Crichton. The vapour is diffused through the patient's chamber, by heating the tar to gentle ebullition, with a little carbonate of potash to retain the irritating pyroligneous acid. From the more extensive trials of Dr. Forbes, it appears that this remedy was often injurious and seldom of marked benefit in phthisis, but in bronchial disease it proved salutary. Dr. Morton of Philadelphia, and Drs. Hufeland and Neumann of

Berlin, are stated by Sir J. Clark to have reported more favourably. The inhalation of chlorine was first recommended by M. Gannal, and several French physicians have spoken favourably of it. Sir J. Clark states, that in several instances in which he tried it, it relieved dyspnœa and apparently suspended the progress of the disease. Our own experience of the inhalation of chlorine is not favourable; having generally found it increase the cough and other symptoms of irritation; Dr. Stokes reports to the same effect. But we should expect some benefit from it, where there is little disposition to inflammatory action, particularly when the expectoration is profuse and fœtid. [The curative influence of the inhalation of chlorine in phthisis has been carefully investigated by Dr. Louis. He analyzed carefully the published cases, and found that not a single one of them proved the real efficacy of the alleged specific. He submitted, moreover, fifty phthisical patients to the action of chlorine, and without obtaining a successful result in a single case.] The vapour of iodine has also been much extolled as a means of promoting the removal of tubercles and the cicatrization of cavities; but there is not yet sufficient evidence in its favour to warrant us in recommending it. The usual modes of inhaling these vapours (through tubes adapted to a bottle containing hot water with a certain addition of the chlorine or iodine to it) have always appeared to us objectionable, inasmuch as the tubes are generally too small, and the effort of inhalation is irksome to most patients. It would be much easier to use a large open vessel of hot water, such as a basin or jar, and add to it, by degrees, the required quantity of liquid chlorine, or tincture of iodine; or place it in a saucer floating on the hot water; the patient might then approach his nostrils as near as he can bear without causing him to cough. This might be repeated twice a day or oftener. Dr. Corrigan has devised an apparatus by which the liquid chlorine or iodine can be made to drop slowly into a vessel of water kept boiling by a lamp. He found that when iodine is diffused in this mode through the apartment of the patient for some time, it could be detected in the urine.

[The inhalation of iodine has been greatly extolled by Sir Charles Scudamore; but we are not aware that his statements have been confirmed by other practitioners. We have not employed it ourselves to any extent in this disease, nor have we any accurate notes of the cases in which we employed it, but our impression is not favourable to it. Sir C. Scudamore's formula is as follows:

[31. R.—Iodini, gr. viij.
Potass. Iodid., gr. iij.
Alcohol, fʒss.
Aq. distil., fʒvss.

M.

One to six fluid drachms of this solution, to which are added from twenty-five to forty drops of a saturated solution of conium, are used for each inhalation, which is continued from thirty to forty minutes.]

It is not unlikely that, by very judicious management, the inhalation of various agents may sometimes conduce to a healthier and healing action in the interior of ulcerated lungs. But we must chiefly look to the improved state of the constitution for this healthy action, and for what is of more immediate moment—a cessation of that disposition to deposit more tuberculous matter in other parts, which too commonly prevails during the softening and the evacuation of tubercles.

In very many cases, alas! no means will stay the progress of consumptive disease, and the utmost that we can do is to give temporary relief to the more distressing symptoms; to the cough, sometimes by a leech or two over the windpipe, but more commonly by various narcotic remedies, such as conium, hyoseyamus, hydrocyanic acid, and particularly opiates, of which the compound camphor tincture, and Squire's solution of bimeconate of morphia in small doses, we have found the best; to pains in the side, by a mustard poultice, a turpentine fermentation, and if these fail, by a few leeches or a blister; to the dyspnœa, by æther and ammonia,

[32. R.—Spir. Æther. Sulph. comp., fʒiij.
Morph. Sulp., gr. j.
Spr. Ammon. Aromat., fʒj.
Mist. Amygdal., fʒv.

M.

Sig.—A tablespoonful when the dyspnœa is urgent.]

or paregoric, or tincture of lobelia, or, according to Sir J. Clark, by extract of stramonium, half a grain in the day; to the hectic heats, by sponging with tepid vinegar; to the sweats and to excessive expectoration, by acid and tonic mixtures; [the muriated tincture of iron, given in doses of twenty drops three times a day, is one of the very best preparations that can be employed against the colliquative perspirations;] to the diarrhœa, by astringents, preceded by a mercurial aperient, and accompanied by a suitable diet. In not a very small number of cases, we may considerably prolong life by watchfulness and judicious measures. Consumption may run its course in a few weeks: but it may exist in a limited and chronic form for many years, and such cases may reward us for our attention and judicious treatment, if not by permanent recovery, at least by temporary restoration of a moderate share of health and strength, compatibly with the enjoyment of life, and with the fulfilment of important duties to society.

PREVENTION OF TUBERCULOUS DISEASE.—The small chance of doing good which the healing art possesses in tuberculous disease is a great reason why our attention should be directed to measures of prevention from which much benefit may reasonably be expected; and it is on this department of practice that our improved knowledge of the pathology may be brought to bear.

The prevention or speedy removal of those inflammations and congestions which contribute to develop phthisical lesions, and of that state of strumous cachexia, or imperfect nutrition, from which they especially arise, constitute the indications for prevention which pathology suggests. To fulfil these indications is to remove or counteract the several causes which we have specified as producing or increasing consumptive disease and the means of affecting this, comprehend many remedial and hygienic details. It is only necessary here to advert to some of the more prominent.

The earliest and at the same time the least doubtful cause of phthisis is hereditary predisposition; and when this has been fully acquired, either this or some other form of scrofulous disease generally ensues sooner or later. But it is very probable, as Sir J. Clark has suggested, that the formation of this predisposition could be in great degree prevented by attention to the health and alliances of successive generations. "If," says he, "a more healthy and natural mode of living were adopted by persons in that rank of life which gives them the power of choice, and if more consideration were bestowed on matrimonial alliances, the disease which is so often entailed on their offspring might not only be prevented, but even the predisposition to it extinguished in their families, in the course of a few generations."

The propriety of avoiding intermarriage with those families which have shown proofs of consumption is obvious, as nothing is more likely to increase the tendency. The health of mothers during utero-gestation and suckling should also be carefully guarded: and the children of consumptive families must be reared from birth to maturity with the fullest possible regard to their physical condition, and every precaution against causes of disease and derangement of the general health. Warm clothing, well ventilated rooms, a healthy residence, plain nutritious food, but of due quantity and quality, regular and frequent but varied exercise in the open air, as far as the season will permit—that on horseback is the best; daily use of the cold bath, or free sponging, followed by friction; strict attention to the state of the excretions, and their regulation, if necessary, by diet and mild remedies, constitute the chief general means to be employed to fortify the constitutions of those in whom there is reason to suspect a disposition to phthisis. Frequent change of air, particularly from inland to coast and the converse, is generally beneficial, as far as that can be practised without incurring exposure to an unhealthy or too cold an atmosphere. Occasional sea voyages are sometimes of marked benefit in generally strengthening the constitution. A residence for some years in a warm climate is indicated for those whose brothers or sisters have become consumptive in this country about a particular age; but on their return, even although the critical period be passed, unusual care will be necessary for some

time. So, on the other hand, those who become enervated and languid during the heat of summer, should resort to a mountainous district or an airy coast during that period. The great object is to prevent the general strength from being lowered, or the functions deranged, by any influence whatsoever, and this is generally better effected by hygienic than by medicinal means, but we may and often must bring to our aid tonics and alteratives of various kinds, as well as the different remedies that are required to improve the secretions. It is impossible to enter into any details, for very different remedies may be best suited to different individuals; but if there be any which are so more commonly than others, these are combinations of iodine and of iron, and courses of saline or saline chalybeate mineral waters. With the view to strengthen the lungs, and to render the pulmonary system less apt to suffer from cold or heat, the regular practice of freely sponging the chest and whole trunk with vinegar and water, or salt and water, followed by vigorous friction, deserves especially to be recommended. It not only improves the tone of the respiratory apparatus, but diminishes the liability to bronchial affections from exposure to cold: these affections are the most common causes of the development of tubercles.

SECTION VIII.

MALIGNANT GROWTHS IN THE LUNGS.

WE need say little on the subject of encephaloid, scirrhus, and melanose disease of the lungs; for their occurrence is too rare to be of much practical importance, and they are not known to be influenced by medicine. They may occur in a circumscribed form, or pervading a considerable extent of the pulmonary tissue; and they would then produce physical signs like those of consolidation from hepatization or tuberculization of similar extent, and could be distinguished from these only by the history and general symptoms, and by the absence of the constitutional indications of tubercles. They commonly cause death, either by their encroachment on the function of the lungs, or from being simultaneously deposited in other organs, such as the mesentery, the liver, the ovaries, &c. But when they occupy the lung chiefly, both encephaloid and melanose deposits tend in time to soften and form ulcerous cavities as in the case of tubercle. We have seen such cavities more than once in both these forms of disease.

[A. CANCER OF THE LUNGS.

All precise knowledge on this interesting subject is of recent date, having been acquired within a few years. Cancer of the

lungs is far from being an affection of such uncommon occurrence as is generally supposed, and from its liability to be confounded with other diseases of the lungs, more especially tubercular solidification, it becomes a subject of great interest in a practical point of view.

The medical writers of the last century described this affection. Morgagni mentions several cases, (*De Causis et Sedibus Morborum*, t. vii. p. 641.) In Van Swieten's Commentaries a remarkable instance is given. (See commentary on the 797th Aphorism.) Under the name of cancerous phthisis, three cases of the disease are related by Bayle. MM. Begin, Velpeau, (*Rev. Med. Mars*, 1835,) Andral, Heyfelder, (*Archives Gén. te. serie*, t. iii. 1837,) have published interesting examples which fell under their own observation. The most valuable contributions, however, to the history of cancer of the lungs, have been made by Drs. Stokes, (*Dublin Journal*, May, 1842,) Taylor, (*Lancet*, March, 1842,) Hughes, (*Guy's Hospital Reports*, No. XII., Oct., 1841,) and Van Kleffens, (*Gronigen*, 1841.) From these materials we propose to give a sketch of the pathology and practical relations of the disease.

Dr. Louis has endeavoured to ascertain the frequency of this disease, and from the results of this investigation, which he has communicated to Dr. Valleix, (*Guide du Médecin Prat.*, t. ii., p. 372,) it appears that cancer of the lung comes after that of the uterus, stomach and liver. It is much less frequent than that of the two first organs. It is singular that in the cases observed by Dr. Louis that four times out of five, in instances of cancer co-existing in two or more organs, the lesion commenced in the lung.

ANATOMICAL CHARACTERS.—Of the three species of cancer now recognized by pathologists—Encephaloid, Scirrhus and Colloid—the two former only have been satisfactorily detected in the lung. Encephaloid is of much more common occurrence than scirrhus. Dr. Stokes enumerates the following anatomical forms as having fallen under his observation.

1. Isolated and generally well-defined encephaloid tubercles of a rounded form, the intervening tissue healthy, and the tumours equally distributed through both lungs.
2. Isolated masses of irregular form; sometimes coinciding with a mass of complete cancerous degeneration.
3. Tubercles of various species of cancer co-existing, such as scirrhus, the encephaloid and the black spongiform cancer.
4. Simple degeneration of the whole or part of a lung into the homogeneous encephaloid matter.
5. Encephaloid tumours of the posterior mediastinum compressing the lung.
6. The same condition combined with cancerous degeneration and cancerous tubercles of the lung itself.
7. Cancerous tumour of the anterior mediastinum.
8. Tumours of white fluid

cancerous matter perfectly encysted, and surrounding the trachea and œsophagus, combined with a white cancerous infiltration of a portion of the lung and cancerous coagula of the bronchial tubes. 9. Cancerous degeneration of the whole lung, with deep-seated and superficial ulcerous action, extensively separating the lung from the pulmonary pleura.

In the first of these forms—tuberous cancer—the pulmonary tissue around and between the nodular morbid masses, is in a singularly healthy state. Encysted cancer in the lungs is as rare as it is in other organs. Ulcerated cancer is exceedingly uncommon in the lungs, the two cases of Drs. Stokes and Taylor being the only ones on record. In the curious instance described by Dr. Stokes, the whole organ was converted into a mass, having less consistence than common in encephaloid disease; a large portion of the lung was burrowed by anfractuous excavations, communicating on the one hand with the bronchial tubes, and on the other terminating in fistulæ, running in various directions to the surface of the lung, where they terminated in superficial cavities (containing air and a whitish purulent fluid,) bounded at opposite points by the posterior surface of the pulmonary pleura, and by the degenerated pulmonary substance. The left lung is said to have been healthy, except that it contained “a few small hydatids.”

Cancer occurs in either lung only, or in both simultaneously. Of nineteen cases collected by Van Kleffen's, six were examples of cancer of the right lung, seven of the left, and six of both lungs. The right lung is probably more prone to the disease than the left. In a case, which we had the opportunity of seeing, both lungs were affected, the right, however, more than the left.

CAUSES.—The causes of cancer in the lungs, like those of cancer in other organs, are exceedingly obscure. Of twenty-seven cases, collected by Van Kleffens, in twenty-two, cancer existed in two or more different organs. In M. Heyfelder's case there was a scirrhus tumour of the right epididymis. In the only case which has fallen under our immediate observation, it was consecutive to an encephaloid tumour involving the thigh; the patient, a female, continued in excellent health for ten months after the removal of the limb, when the chest symptoms appeared, and she died in about a month. Females are more liable than males to the disease. It occurs in all ages from twenty to seventy; but appears to be most common in individuals between twenty and thirty years of age.

SYMPTOMS.—Cough is a constant symptom; it is sometimes dry, though generally accompanied with expectoration. The character of the sputa varies; they are sometimes mucous and bloody; sometimes mucous only, or purulent; more or less hæmoptysis commonly

occurs. Dr. Hughes lays great stress on the circumstance of the sputa "occasionally consisting of blood, so thoroughly incorporated with serous fluid as to resemble *red* currant jelly;" while Dr. Stokes compares the expectorated matter to *black* currant jelly. The breath is sometimes exceedingly fœtid. Dyspnœa, persistent or occurring in paroxysms, exists in almost every case. Still in cases of disseminated masses through the lung with a healthy state of the intervening tissue, it might be absent, and in Dr. Taylor's, this actually occurred. In the great majority of cases there is pain, which in some is described as severe and darting, in others as associated with pain in the shoulder of the affected side. In M. Heyfelder's case, the sensation was assimilated to electric darts passing from the false ribs and sternum to the spine. Dr. Stokes enumerates among the symptoms 'important as indicative of this disease, pain of a continued kind,' and elsewhere speaks of his inclining to the diagnosis of cancer in a case under his observation, in consequence of the patient's suffering under 'a violent attack of pain in the side, the pulse remaining natural.'

In the case which fell under our notice, there were pain in the side, intense dyspnœa, and slight hæmoptysis. There are some other symptoms which frequently exist besides the symptoms just described; they are stated as follows by Dr. Walshe: 1. Enlargement and extreme congestion of the jugular, axillary, mammary and superior epigastric veins; 2. A notable difference in point of fulness between the two radial pulses; 3. Œdema of the affected side, corresponding arm and side of the face; 4. Fulness of the neck; 5. Prominence of the eyeballs, which, combined with the condition of the neck and face, gives the patient the appearance to a certain extent of a strangled person; 6. Dysphagia; 7. The existence of tumours in other parts of the body. All these appearances (except the last) clearly depend upon venous obstruction, and will be present or absent according as such obstruction does or does not exist: in Dr. Taylor's case they were absent. The growth of tumours in other parts of the body has been of great service in diagnosis in many cases. 'One of the most interesting circumstances in this case,' says Dr. Stokes, in commenting on a narrative by Heyfelder, 'was the growth of the external tumour during the last period of the patient's illness;' a similar phenomenon was observed in the case published by Dr. Graves, in which, towards the close of the disease, three tumours appeared, and increased with great rapidity.

These conditions are constantly present in greater or less number, and when they are so associated with the physical signs, they leave no doubt of the existence of a tumour.

The *physical signs* of this disease are tolerably distinctive, the affection being now generally successfully diagnosed. In examining this part of the subject, we shall take Dr. Walshe's recent work as our guide.

There is an important distinction to be established between different cases of cancer, derived from the condition of the walls of the chest. This distinction was first seized by Dr. Stokes, and depends upon the existence or absence of dilatation of the affected side, while this in its turn furnishes some clue to the form in which the cancerous matter is deposited. Dilatation, in truth, never occurs when the cancerous substance is infiltrated through the pulmonary tissue: but may be absent or present in cases of the tuberos form according as the masses accumulated are of limited or of considerable bulk. We have thus one class of cases of 'infiltrated cancer of the lung, alone or combined with tuberos cancer, but not to such extent as to cause dilatation of the side;' and a second of cases of 'tuberos cancer of the lung or pleura, with dilatation of the side.' Of the first class Dr. Walshe enumerates the signs as follows:—

Inspection.—Retraction of the affected side; diminished motions of expansion and of elevation; diminished costal motions; intercostal spaces deeper than natural.

Application of the hand.—Vocal and tussive vibration diminished in intensity.

Mensuration.—Semicircular measurement diminished; deficient increase of width during inspiration.

Percussion.—Sound intensely dull, and of short duration; resistance of walls marked; special character of sound tubular in some cases about the edges of the infra-clavicular and also the mammary regions; the limits of the dull sound natural beyond the middle line in some cases.

So far the signs apply to infiltrated cancer previous to, or after the occurrence of softening; the remaining signs differ according as this change has or has not set in.

Before softening of the Cancerous Matter.

Auscultation.—Respiration of diffused blowing type strongly marked, or with progress of disease (which leads to obstruction or obliteration of the bronchi) weak or almost suppressed, retaining as long as it exists its blowing or bronchial character; respiration exaggerated on the healthy side; bronchophony; bronchial cough; heart's sounds transmitted with increased intensity.

After softening of the Cancerous Matter.

Percussion.—Sound may become somewhat clearer, and the resistance of the walls diminish.

Auscultation.—Cavernous respiration; mucous, cavernulous, or cavernous rhonchus.

Situation of surrounding parts.—Mediastinum, more rarely the heart, detruded to the opposite side, corresponding division of the diaphragm, with its subjacent viscera, may be depressed.

We have next to consider the signs of 'tuberos cancer of the lung or pleura with dilatation of the side.'

Inspection.—Affected side expanded, or affected with bulging inferiorly; intercostal spaces widened, flat or even convex; motions, both general and costal, abolished completely; fluctuation never visible in intercostal spaces.

Application of the hand.—Surface unnaturally smooth and even; vocal and tussive vibration abolished; neither simple fluctuation nor peripheric fluctuation to be detected; pulsatile vibration sometimes present.

Mensuration.—Increase of semicircular measurement of the side; width of side unaltered by respiration; antero-posterior diameter increased; vertical measurement increased; distance between the nipple and median line greater than on the opposite side.

Percussion.—Sound completely, and most extensively dull, and of short duration; resistance of walls extreme; limits of the dull sound not altered by changing the position of the patient.

Auscultation.—Respiration of the diffused or tubular blowing type, intensely developed in some cases; rhonchi either absent or those of coexisting bronchitis; bronchophony, sometimes so intense as to amount almost to pectoriloquy; bronchial cough; heart's sounds transmitted with unnatural intensity, double additional pulsation with blowing murmurs sometimes heard also; exaggerated respiration on the healthy side.

Situation of surrounding parts.—Heart and mediastinum detruded to the opposite side; corresponding division of the diaphragm, depressed with its subjacent viscera, sometimes to a very great amount.

DIAGNOSIS.—Infiltrated cancer of the lung, without tumour to such extent as to dilate the side, can only by possibility be confounded with the pneumonic or tuberculous consolidation and pleuritic effusion. From these maladies it distinctly differs in the following particulars:—

1. *From pneumonic consolidation* it would be distinguished by—*a.* The retraction of the side (a phenomenon never encountered in a state of hepatization, so complete as to give rise to the extensive dulness and blowing respiration met with in cancerous infiltration); *b.* The total absence of crepitant rhonchus before softening, and the large mucous rhonchus present after softening,—a rhonchus not to be confounded with that attributed by some observers to the suppurative stage of pneumonia. *c.* The extension of the dull sound under percussion beyond the median line; *d.* The absence in many cases of fever: *e.* The absence of the characteristic rusty sputa of pneumonia.

2. *From tuberculous consolidation* by—*a.* The signs of extensive consolidation being unattended with rhonchus of any kind; *b.* The absence of disease of the other lung frequently observed in cancer, seldom or never in phthisis, where one organ is very extensively affected (Taylor). After softening of cancerous matter, the diagnosis (provided the case had not been seen before that occurrence) must rest upon the signs of obstructive pressure coexisting with those of consolidation and softening.

3. *From pleuritic effusion* by—*a.* The absence of signs of expansion, and the depressed state of the intercostal spaces: in pleuritic effusion of sufficient abundance to cause the intense and extensive dulness of cancer, the chest would be more or less dilated, and the intercostal spaces rendered prominent; *b.* The

intensity of the blowing respiration, and the great extent of surface over which it is heard.

The class of cases of tuberos cancer with dilatation of the side can manifestly be confounded only with those of very extensive pleuritic effusion. Cancerous accumulation of this amount will be distinguished by—*a.* The invariable absence of simple fluctuation in the pleura, and in all probability, even in cases of the most diffuent encephaloid, of peripheric fluctuation; *b.* The intensely marked resistance of the walls under percussion,—such as to render it actually almost painful to use the finger as a pleximeter; *c.* The intensity of the blowing respiration, and the great extent of surface in which it is audible; *d.* The total absence of ægophony, which *may* be present in cases of even very abundant pleuritic effusion; *e.* The intense bronchophony commonly discovered; *f.* The unnatural distinctness of transmission of the heart's sounds; *g.* Occasionally the existence of pulsation, palpable and audible, in the cancerous lung. Add to these marks of distinction the evidences of pressure on the œsophagus, vena cava superior, &c., above enumerated, and the points of difference will be found sufficient, in the great majority of cases, to preclude the apprehension of error.

In some cases the amount of dilatation of the side is so great as in itself to make its dependence on fluid accumulation a matter of doubt; Dr. Walshe never witnessed such enormous enlargement from pleuritic effusion as existed in the instance of a boy affected with encephaloid cancer of the right pleura, whom he saw under the care of Dr. Louis in the winter of 1834.

TREATMENT.—With regard to the treatment of this affection, authors have laudably abstained from making any suggestions.]

B. MELANOSIS OF THE LUNG.

We have met with several cases of melanosis, or black tubercle, affecting the lung, both exclusively, and with the same production in other parts of the system. We have seen it combined with encephaloid disease. The black matter may occur infiltrated in a natural structure, or in distinct tumours or deposits of an irregular cellular organization. We are much inclined to adopt the opinion of Andral, that the black matter is nothing but a modification of the colouring matter of the blood, in which carbon is in excess, or even in a free state. We have seen the deposits exhibit in different parts various shades of colour, from the dark cruor red of hæmorrhagic engorgement to the deep jet black of perfect melanosis. The intermediate colours were of a bistre or sepia brown. The organized texture of melanose tubercles and tumours presents considerable variety, sometimes approaching to

the most perfect products of acute inflammation, being soft and cellular or membranous; and sometimes having almost the totally unorganized structure of scrofulous tubercle. Probably it is only this latter form that undergoes the changes of softening and ulceration ascribed to melanosis by Laennec; and under these circumstances, such changes are to be referred to the same causes as those which operate in the kindred changes of tubercle. The presence and modification of the colouring matter of the blood seem, therefore, to be the essential pathological conditions of this disease, as an altered or deficient vitality of the fibrinous matter is of tuberculous affection. [The researches of M. Breschet confirm satisfactorily the opinion that melanosis in the lungs is due to a peculiar modification of the blood.]

It is necessary to avoid confounding with melanosis the accumulations of the black pulmonary matter, which take place to a great extent in the lungs of old people, especially among the inhabitants of large towns. These are probably, as Dr. Pearson supposed, derived from the soot inhaled with the air; which, we presume, finds access to the texture of the lungs chiefly through abrasions, softening, or other such lesions of the bronchial membrane, which, in a slight degree, often result from a common cold or cough. Whether from this source, or, as others have supposed, from an altered state of the colouring matter of the blood itself, we think it is plain enough, that when once deposited in any corners out of the immediate sweep of the circulation, such as in the angles of the lobules, near old lesions, around large vessels, and in the bronchial glands, there it must lie, accumulating until death, or until it is carried off by the destruction of the tissue by some pulmonary disease. For it consists entirely of carbon; and this being totally insoluble in any animal fluid, is insusceptible of absorption, which scarcely acts on insoluble solid matter. For the same reason the carbonaceous matter of tattooed skins, and the insoluble oxide or chloride of silver in persons coloured blue from the too long internal use of nitrate of silver, are permanent, and can only be removed with the skin itself. It does not appear that this carbonaceous deposit in general interferes materially with the function of the lungs; but there are some curious cases on record, in which it has taken place so rapidly and extensively as to cause chronic inflammation and consolidation of a perfectly black colour, which tend to ulceration and the formation of cavities, as in other cases of chronic consolidations. Such cases are described by Drs. Gregory, W. Thomson, and others, as occurring particularly in coal mines, and in persons labouring under bronchial disease whilst continually employed by the light of smoky lamps.

SYMPTOMS.—The general symptoms of melanotic consolidation

of the lungs are those of obstructed breathing or circulation, dyspnoea, lividity, and dropsy; more commonly than those of consumption and emaciation, which belong rather to tuberculous disease. This is explained by their more rapid development, and their not so readily leading to softening and ulcerative destruction of the organ. When this process does occur, the expectorated matter may afford means of distinction. We have seen, in the case of encephaloid disease, streaky red and white purilaginous liquid sputa, and in melanosis, a considerable quantity of black matter, mixed with a muco-purulent compound. But such cases are not common, and the expectoration is more usually that of the bronchitis or pneumonia that may accompany the disease.

[TREATMENT.—In the actual state of science there is no treatment which can be opposed to these organic changes.]

SECTION IX.

ATROPHY OF THE LUNG.

WE have already adverted to atrophy of the lung as a concomitant of flaccid dilatation of the air-cells. But the same condition not unfrequently presents itself where there is no distinct evidence of enlargement of the cells; as in the lungs of aged persons, and of those who have died after a prolonged and emaciating illness. In such cases, the textures of the whole lungs are found much thinner, softer, and paler than usual, and when collapsed, they are shrunk into a very small compass. The cavity of the chest seems to be also diminished by the diaphragm occupying a higher position than usual. There are other cases in which partial atrophy of the lung can be traced in connection with tubercle, obliteration of the bronchial tubes, and as a sequel of pleuropneumonia; but, in these cases, there is generally also dilatation of either the neighbouring tubes or cells. It is very reasonable to suppose with Andral and Stokes that, when from a permanent obstruction, a part of the lungs does not receive its supply of air and blood like other parts whose functions are not exercised, it loses its substance; and it is still more interesting to conceive that the same result may affect more generally the lungs of those whose sphere of respiration is contracted by their being bed-ridden, or otherwise long limited in the exercise of the function.—Such individuals, should they recover the power of being active, are short-breathed without any other disease; and although weakness of the heart and muscles of respiration may partly cause this, we must suppose that the wasting of the lung through disuse is also concerned in it.

SECTION X.

HYPERTROPHY OF THE LUNG

Has been already noticed in connection with chronic pneumonia and emphysema. But we also meet with the lungs in a denser, heavier state in some other diseases, particularly those of the heart. This has been described by Dr. Clendinning, and, from much observation, we can bear testimony to the fact that, after the long continuance of organic disease of the heart, the substance of the lungs, even when not congested, is much more dense and heavy than usual, although the vesicular texture is everywhere filled with air. The lesion of the heart with which this state of the lung is most commonly associated, is hypertrophy of the right ventricle, with difficult transmission of blood through the heart; and we can readily conceive how the increased impulsion of blood produced by the one, and the long existing congestion resulting from the other cardiac lesion, may occasion an increased growth of the solid textures of the lung. The indifferent sound on percussion which the chest often yields in such cases, may result from this change; and the permanent shortness of breath is, perhaps, also in part due to the same cause.

The treatment belongs to the subject of hypertrophy of the heart, and the lesions which it induces.

CHAPTER VI.

DISEASES OF THE PLEURA.

SECTION I.

PLEURISY.

PLEURISY, pleuritis, *πλευριτις* (*Hippocrates*), are names applied to inflammation of the pleura, the serous membrane covering the lungs and lining the thoracic cavity. The leading characters of this disease are, sharp pain of the side, dry cough, dyspnœa, fever, diminished resonance of the side, with ægophony followed by enlargement of the affected side and abolition of all sound of respiration and voice. But there is so great an uncertainty in the general symptoms, and variety in the physical signs, that a satisfactory knowledge of the disease can be obtained only through a study of its pathology: a short account of this will therefore simplify the history of the disease, and render more intelligible and available the description of its symptoms and signs.

A. ACUTE PLEURISY.

PATHOLOGICAL HISTORY.—The first known stage of inflammation of a serous membrane is an enlargement of the vessels in the subserous cellular texture: it is these chiefly that form the striated patches or points of redness that are seen after death in the earliest stage of pleurisy, and their distension can be felt through the serous membrane, which seems slightly uneven on passing the finger over it. Perhaps at this period there is a diminution of the serous exhalation at the inflamed spot, as we know such to be the first effect of inflammation of mucous membranes, and probably increases the friction between the surfaces. Soon, however, the flow of serum is increased, and with it, if the inflammation continues, an albuminous matter (coagulable lymph) is exuded. This exemplifies the most simple form of inflammation. The vessels have no compound structure or secretion to complicate or modify their action; and we find their increased development attended by an exaggeration of those secreting functions which they fulfil in health. These functions are twofold, viz., that of liquid exhalation and that of solid nutrition: the fluid exhaled is serum; the material of nutrition is the albuminous or fibrinous part of the

blood. In their natural proportion, these functions preserve the membrane in a healthy state, one merely lubricating its surface with a slightly albuminous fluid, the other nourishing and sustaining the solid matter of the membrane. But when these functions are increased in activity by acute inflammation, there is an overflow of their products, the liquid effusion is more or less rapid and copious, and the excess of the nutritive secretion now appears on the exterior of the membrane in various forms, and, either by itself or mingled with the liquid effusion, constitutes all the different products which are recognized as the results of inflammatory action. In its smallest proportion, it is held in solution by the effused fluid, which, on being drawn from the body, or after death, gelatinizes from this fibrinous matter which it contains: where very abundant, it forms films or layers of lymph on the surface of the membrane; and this lymph is generally more abundant and disposed to speedy organization, when the inflammatory orgasm is strong, and the blood rich in nutrient matter.

Following still the pathological history of pleurisy, we find in the lymph the product of adhesions; but whether or not these adhesions take place, depends on the quantity of liquid effusion between the pleura. This effusion, to a certain degree, gravitates to the lowest part of the chest, and in those parts tends to keep the membranes separate, [gravitating effusion;] and if the upper parts of the pleura be inflamed, they adhere the more readily, unless the liquid effusion be very abundant. But if the pleura be inflamed only in their lower portions, a moderate quantity of liquid is sufficient to keep them separate, [laminar effusion]; and if the lymph then become organized, it forms not an adhesion but a false membrane coating the lung, which may have further effects in modifying the remains or the products of the previous inflammation.

[The character of the effused fluid varies greatly. It generally consists of turbid serum, with fibro-albuminous flakes. After some time it becomes clearer, and contains false membranes, which seem to result, in part at least, from the coagulation of the solid materials of the effusion. It sometimes, though rarely, resembles the thickened white of an egg; and occasionally has the same appearance as the caseous pus of a congestive abscess; at other times it has the opaque, creamy, greenish-yellow aspect of the pus of a common abscess, from which it does not in reality differ, genuine pus-globules being found, when it is examined, under the microscope. It is sometimes colored red; and Andral has seen masses of coagulated blood in it. In general it is not fœtid, nor does it become so, unless a communication is established with the lung.

The quantity of the fluid may vary from an ounce to several quarts. In some extreme cases the cavity of the pleura is so much distended that the heart, mediastinum, liver and diaphragm are

pushed aside, the lung very much compressed, the ribs widely separated, the intercostal spaces projecting, and the thorax dilated, as in a forced inspiration. In such cases there is considerable prominence of the supra-clavicular region. Sometimes the liquid occupies the entire pleural cavity, or a large portion of it; at other times it is neatly circumscribed as if it were an encysted abscess. Intimate adhesion may exist between the two laminae of the pleura at one point, whilst at another they may be covered with rugous projections, which produce friction-sounds, and other portions again may be widely separated by the effused fluid.

The false membranes offer every variety of form and character. At an early period of their formation, they resemble very closely the various stages of coagulating blood. Some are quite soft, transparent, and gelatiniform; others are solid, tenacious, and are torn with difficulty; whilst others again are opaque, and of white, yellow, or green aspect, and have a fibrinous character. These adhesions are sometimes quite thin, have a polished surface, and are of considerable extent, and permit the two serous laminae to slide on one another to some extent; others are thick, rugous and short, and bind the lung closely down to the thoracic parietes. They sometimes form fibrinous bands or columns, in which the effused fluid is contained. They sometimes acquire great solidity, which commonly happens, according to Laennec, in pleuritis accompanied with hæmorrhage (hæmathorax, pleurorrhagia,) in which case they form an almost solid envelope, constituted by three concentric layers, more or less fibro-cartilaginous in appearance. In these rare cases the adhesions are semi-transparent, and of a bluish tinge.

Ulceration of the costal pleura at the level of the liquid, consecutive to the effusion, sometimes happens, accompanied by, in some rare cases, perforation of the lung. In these cases an abundant expectoration of the liquid contained in the pleural cavity may take place. It may be asked whether the perforation occurred previously to the pleurisy, and whether the latter was not a consequence of the former. This supposition is hardly tenable when we remember that none of the organic lesions which give rise to perforation exist, and that the ulceration of the pleura is situated as well on the costal pleura, as on the organ itself. It may yet be asked whether this ulceration is caused by the violence of the inflammation, or by the presence of the fluid acting as an irritant. The answer is difficult; but the seat of the lesion being constantly at the level of the liquid, would seem to prove that the second suggestion is the correct one.

The condition of the lung varies with the nature and extent of the effusion. When this is considerable, the lung is pushed upwards and backwards, and will be found very much compressed, lying along the vertebral column. In some cases its tissue is

flaccid, dense, non-crepitant, of a coriaceous feel, smooth on being cut, has a non-granular fracture, and is impenetrable to the finger—in a word—carnefied. In others it is, on being cut into, fleshy, hard, penetrable to the finger, and on being pressed, gives issue to a small quantity of blood. In the first case pressure has been exercised on the organ whilst it was uninflamed, and permeable to air; in the other, it is most probable that the effusion was consecutive to, or concomitant with the inflammation.]

Before we consider these various results of the modifying influences of time, of the degree and kind of inflammation, and of previous disease, on the pathological history of pleuritic cases, we shall take a view of the symptoms and signs of acute pleurisy.

SYMPTOMS.—These have been long considered as well marked by the sharp cutting pain in the side, restraining every common inspiration, and often making the act of coughing or deep breathing almost intolerable; the short breath which consequently results, the short dry cough, the general inflammatory fever, which, with its antecedent rigour, sometimes precedes the pain, but more commonly is developed with or after it, with hard quick pulse, heat of skin, flushed cheeks, and scanty, high-coloured urine.

But it is now well known that there may exist extensive pleurisy and its consequences without this array of symptoms; nothing is more variable than the degree and combination in which they may occur. Pain of some kind is most frequently present; it is generally acute, circumscribed, and referred to below the breast or lower margin of the pectoral muscle; but sometimes it is lower down or shooting, or more diffused and less severe, and not seldom there is very little or no pain at all, but rather some soreness or tenderness on pressure between the lower ribs of the affected side. When the pleura covering the diaphragm is inflamed, the pain is generally acute, referred to the margin of the ribs, and causes an unusual degree of distress and dyspnœa. This form of pleurisy is by no means commonly accompanied, as formerly supposed, by the *risus sardonius* or delirium. The acute pain seldom lasts more than the first day or two, after which it may abate or entirely cease, although the inflammation continues, and the dyspnœa may increase with the accumulating effusion. [The invasion of pleurisy does not differ from that of other acute febrile maladies. In many cases there are one or more chills, preceded by feelings of malaise, anorexia, a great susceptibility to cold, with some debility. Sometimes its debut is sudden, and the disorder is severe from the commencement. According to Dr. Chomel, occasionally a remarkable degree of health and well-being is enjoyed just before the appearance of the disease. Louis has recorded several cases where violent pain in the side occurs, without careful physical exploration detecting any signs of pleurisy,

and the physician is tempted to regard it as a pleurodynia, until its real nature is developed. Soon after the initial chill, the pain in the side appears. This symptom is very rarely wanting; in forty-six cases collected by Valleix it was present in forty. Its seat is generally immediately below the nipple. Thus, in thirty-four instances in which its site was accurately noted, it was limited to one or other breast or to both, in twenty-seven; once it was felt in the inferior and posterior part of both sides of the chest; and once it occupied the whole of one side of the chest. The right side is a little more frequently its seat than the left. In twenty-five cases, fifteen times the pain was in the right side, and ten times on the left. The pain is generally acute, pungent, cutting or darting. It is augmented by the motions of the chest, by firm pressure percussion, cough and a strong inspiration. When the patient debilitated, or feeble, or when the pleurisy is consecutive to some adynamic disorder, the pain is generally absent. In young children it is frequently inappreciable. It declines as the physical signs are developed, and generally disappears from the third to the sixth day. In some rare instances it continues for ten days or two weeks, in which case its intensity is much diminished.] The same remark is in some degree applicable to the fever, which is greatly diminished in four or five days, assuming then a less inflammatory type. Sometimes it is very moderate, or of a remittent character; and this often happens when the effusion is most abundant. The degree of dyspnœa also varies much, being chiefly determined, first by the amount of pain, nervous sensibility, or catarrhal complication, and afterwards by the rapidity rather than the mere quantity of the effusion. [Generally the inspirations are short and interrupted, as if suddenly arrested.] The cough is a very uncertain symptom, being in some instances most distressing, in others altogether absent. [Cough is but rarely absent from the commencement, although but indirectly connected with the affection of the pleura. It is not usually frequent, but occasionally it becomes very troublesome. It is generally small, dry and convulsive. Expectoration is very often absent. In thirty-three cases where attention was paid to this symptom, it was wanting in twenty. When it is present, it is mucous, catarrhal, and rarely bloody.]

The decumbiture in pleurisy has been particularly studied. It having been observed that in some instances patients lie on the affected side, this preference was explained by the increase in the difficulty of respiration from the pressure of the side by the bed, and consequently, the prevention of the free dilatation of the ribs of the sound side. The fact is that pleuritic patients lie as much on one as the other, and in about one-half of the cases, they lie on the back, it being as painful to them to lie on one side as the

other. In some cases where both sides of the chest are affected, or where the effusion has been very rapid, patients prefer sitting up, or being propped up in bed. In some instances, patients who have lain on one side in the commencement of the disease, suddenly change their position and lie on the back; others, after remaining in this posture, take a semi-recumbent one, on account of the dyspnœa resulting from the effusion. Those individuals who were unable to lie on the affected side owing to the pain, assume this position from preference when it has abated, and the effusion is abundant. Thus we see that this symptom is very variable, and that any great value should not be attached to it.

The general symptoms accompanying inflammation of the pleura, fever, heat of skin, frequent pulse, cephalalgia, are very variable, but are always much less intense than in pneumonia. [In pleurisy the severity of the fever is in proportion to the violence of the pain in the side, and the rapidity of the progress of the disorder.] In fact, so uncertain are all the general symptoms, that there are cases of what is called *latent* pleurisy, in which there may be scarcely a suspicion of the presence of disease of the chest, when pleuritic inflammation and its concomitant copious effusion have existed for many days or weeks. This is especially apt to occur in the course of fevers, or during convalescence from them, and in persons of weak or injured constitution; but it is occasionally met with in the healthy and robust. [Dr. Walshe states (*Cyc. of Prat. Surgery*, Pt. ix., p. 96,) that one of the most extensive effusions he ever met with, (there was complete dulness above the clavicle with extreme displacement of the heart, &c.,) he discovered in a woman, who was so completely free from thoracic suffering, that the chest had not been examined. Such cases are now familiar to the profession, and furnish some of the most valuable illustrations of the importance of physical exploration.]

The above-described symptoms may present themselves without pleurisy. Sharp pains of a nervous character not unfrequently closely imitate that of pleurisy, especially in hysterical females; and if they happen to be attended with feverish excitement, the resemblance is more complete. In fact, the greater number of symptoms commonly supposed to be distinctive of pleurisy, depend on a morbid sensibility of the pleura, which is by no means a necessary accompaniment of its inflammation; and the symptom of oppressed breathing, proceeding from the pressure of the effusion, may be marked only when this effusion has accumulated very rapidly, or when the other lung has been prevented by prior disease from supplementary exertion.

PHYSICAL SIGNS.—On the other hand, the physical signs in the greater number of cases are very unequivocal, and although they

by no means mark the degree or the intensity of the inflammation, they seldom fail to announce its presence, and they pretty accurately measure its most serious concomitant, the liquid effusion. We shall first enumerate these signs in the order in which they commonly occur, and afterwards consider the nature and value of each:—

1. Diminished motion and sound of respiration from pain;
2. Sound of friction accompanying the motions of respiration;
3. Dulness on percussion in the most dependent parts of the chest from the effusion;
4. Diminished motion and sounds of respiration from the same cause;
5. Ægophony;
6. Cessation of vocal vibration felt by the hand;
7. Cessation of ægophony and all sound of the voice;
8. Enlargement of the side;
9. Displacement of the heart, liver, mediastinum and intercostal spaces;
10. Increased motions and sound of respiration on the sound side.

1. The respiratory movements are so far within the control of the will, that they are instinctively restrained in parts affected with pain; and it is obvious that the sound of respiration will be diminished in proportion. This has been noticed by M. Andral as an early sign of pleurisy; but it is evidently a very equivocal one, since it depends on the presence of pain, which is not constant, and which may exist quite independently of inflammation.

2. At the first onset of pleurisy, a rubbing or creaking sound accompanying the movements of the chest is sometimes heard. This may be owing to a slight roughness or defective lubrication of the pulmonary and costal pleuræ at certain points, and, when combined with the general symptoms, may be considered a pretty exact sign; but it is very transient, and is seldom heard. It may be produced also by interlobular emphysema, in which case it lasts much longer. We are disposed to think that this sound is rarely produced by pleurisy, unless the lung be at the same time pressed against the chest by a tumour or by effusion, or partially distended by emphysema, or tuberculous or other deposits. The friction sound is commonly heard about the middle parts of the chest; it generally ceases as soon as the sound of percussion becomes more extensively dull; but in dry pleurisy, and in the cases of partial pressure before mentioned, it may continue for a long time.

[The first sign detected by auscultation is a slight, superficial, *grazing* sound, which is sometimes heard, and arises from the collision of the dry surfaces. So soon as plastic exudation occurs, the *grazing* sound is converted into one of *rubbing* or *grating*, coexistent with both murmurs, though commonly more marked in inspiration; it is interrupted and jerking; and is most frequently heard at the postero-inferior angle of the scapula. In some cases, friction phenomena are audible in pleurisy after deep inspiration,

when perfectly imperceptible during ordinary breathing. The natural inclination of patients suffering from this disease to restrain the motions of the chest as much as possible, tends to deceive the observer as to the non-existence of friction sounds. When pleural friction sounds are strongly marked, a distinct sensation, more easily imagined than described, is conveyed to the hand, when laid over the seat of production. A slight dulness on percussion may be detected opposite the morbid deposition, if this be abundant.

Whilst pleurisy is a very common disease, friction sounds are far from frequent. Dr. Walshe has given the following as the chief reasons of this comparative rarity :—

1. Liquid effusion generally occurs with great rapidity ; the time during which friction signs are audible has therefore frequently passed by when patients apply for medical aid.

2. Friction signs may exist, but escape attention from their slight degree of development ;—

3. Or from auscultation not being practised immediately over their seat of production ;—

4. Or from too long a period being allowed to elapse between successive examinations of the chest.

5. In cases of absorption of pleuritic effusion, the development of redux friction sound will be prevented if there be general and regular adhesion between the two pleural surfaces ; because locomotion of the lung is thus prevented.

3. In by far the greater number of cases of pleurisy, there is an effusion of serum, soon after the commencement of the inflammation ; and the accumulation of this liquid in the chest is the cause of the signs by which pleurisy can be best distinguished. This fluid will accumulate first in the lowest parts of the chest, floating to a certain degree the lung upon it. Hence these parts will sound more or less dull on percussion, whilst the higher parts retain their usual resonance : change of posture, by changing the place of the liquid, will in some degree alter the situation of these sounds. As, however, the external vesicular structure yields more readily to pressure than the tubular parts within, the accumulating fluid soon mounts up in the form of a thin layer, between the lung and the ribs, to a considerable height in the chest. This thin layer slightly impairs the sound on percussion, and this more distinctly if the percussion be gentle and abrupt, as by filipping on a finger tightly applied, and comparing the sound with that of corresponding parts of the opposite side. This sign, as well as those to be next described, is liable to modifications from adhesions previously existing between the pulmonary and costal pleuræ: these we shall notice afterwards. As the effusion increases, the dulness becomes more complete and general, the infraclavian and scapular regions being generally the last to exhibit it. It often

happens, however, that when even these are dull, there is some resonance in the axilla, transmitted through the fluid from the opposite lung. Sometimes, at a particular stage of the effusion, a tracheal or tubular sound is for a day or two heard on percussion below the clavicles and in the axilla, arising from the larger tubes which are not yet compressed.

[When the effused liquid is in moderate quantity, it is found equally spread over the entire pulmonary surface, (laminar effusion.) This disposition of the fluid will continue so long as the aspiration of the lung exercises a more effectual influence upon the position of the fluid than its own gravity. With the continuance of effusion the force of gravity becomes predominant, and the fluid accumulates at the most depending part of the chest, (gravitating effusion). In laminar effusion, so long as the stratum of fluid is thin, and is equally spread over the entire surface, the clearness of the sound on percussion is diminished, but it is not completely dull; the diminished sonorousness is proportionally equal in all parts of the surface, and there is, therefore, no precise limitation between a dull and a clear sounding part, nor will any alteration in the position of the patient alter the situation or other characters of the dull sound. When the liquid has, however, collected in sufficient quantity to overcome by its gravity the other physical force acting upon it, there will be a change in the signs,—the upper portion of the chest will recover its sonoriety, and a diminution in the extent of dulness actually announces an increase of the disease. There is an increase in the dulness of the lower portion of the chest, and it is now limited superiorly by a well-defined line corresponding to the upper border of the effusion; its limits may be changed by causing the patient to assume different positions, the fluid collecting in the most dependant parts of the chest, the lung floating on its surface. The mobility of the dulness is sometimes wanting, owing to adhesions and other causes. An impression of resistance is now distinctly felt by the percussing finger over the seat of the effusion.]

4. The same accumulation of liquid must diminish the extent of the motions of respiration in proportion to its bulk, which has taken the place of the most expansible part of the lung. The sound of respiration will for the same reason be weakened, and its duration shortened in the affected side.

[Whilst the effusion is laminar, the motions of the affected side continue impeded as before, though sometimes, when the pain subsides simultaneously with the effusion, they recover their freedom. The inspiratory and expiratory murmurs lose further in point of duration, without undergoing any notable change of character. Friction sounds cease to be heard. In gravitating effusion there is a complete absence of respiration at the base of the chest; where a comparatively thin stratum only exists, the dura-

tion and intensity of the respiratory murmur are much diminished, and it is sometimes blowing or bronchial, which, at the upper part of the lung, which is condensed but not surrounded with fluid, is strongly marked.]

5. About the same time at which the dulness on percussion and diminution of the respiratory murmur reach the middle regions of the chest, there is a remarkable modification of the vocal resonance. It is heard much more distinctly than is usual in those regions; and it is superficial, as if produced in the spot, separately from the oral voice, and changed to a small bleating, trembling note, which so much resembles the voice of a goat, that Laennec has well termed it *ægophony* ($\alpha\iota\zeta$, a goat, and $\phi\omega\nu\eta$, voice). This modification of the voice is heard most distinctly in the space between the third and sixth ribs, which corresponds to the middle-sized bronchial tubes: but near the spine it is generally mixed with a louder and more uniform resonance, which is common bronchophony, from the larger tubes at the root of the lung. Two circumstances are remarkable in *ægophony*: first, that the voice is more audible at the very spot where the lung is pushed away by the liquid, in consequence of the liquid, by compressing the porous tissue of the lung, enabling it to transmit better the sound of the voice from its interior. The second point is, that the voice is altered in character: this may be supposed to be caused by the nature of the matter which it has to pass through, a thin layer of liquid, which, being thrown by it into irregular vibrations, trembles and dances, now checking the sound, now transmitting it with increased force, so that the voice comes through tremulous and wiry. The high tones of the voice are best transmitted in this way, for the bass tones do not enter the small tubes, but if strong, pervade the whole tissue with a diffused fremitus. Hence *ægophony* is best heard in women, children, and others who have high voices. In persons with a bass voice it is more commonly limited to the lower angle of the scapula or near the spine, and from being seated in larger tubes, takes more the character of buzzing bronchophony. As the liquid increases, the *ægophony* becomes weaker, more distinct, and loses much of its flutter or tremor, having rather the sound of a very slender deep-seated voice, or a silvery echo of the original. This is owing to the lung being pushed so far away from the walls of the chest, and its tubes so much compressed; and as these conditions increase, the sound ceases altogether. It is not easy to determine what quantity of the effusion is enough to do this; but we are inclined to think that much sound of the voice is not transmitted when the layer of serum exceeds an inch in thickness, except over large tubes.— [Although as a rule, *ægophony* diminishes with the increase of effusion, until it finally disappears, yet occasionally it remains in spite of very abundant accumulation. Andral has published a case (Clin. Med. t. ii. Obs. xxi.), where displacement of the

diaphragm and heart gave evidence of the abundance of the fluid.] If the ægophony remain stationary for several days, it is a proof that the effusion is moderate, and does not increase rapidly, which is a favourable sign: but it is often very transient, and many cases of pleuritic effusion are discovered after they have passed the degree which causes ægophony. Old adhesions will, however, modify this, as well as the other physical signs. When ægophony is most distinct, it is often coupled with bronchial respiration, especially between the scapulæ, where also there is a good deal of common bronchophony mixed with it. M. Reynaud has lately confirmed the original opinion of Laennec, that ægophony is a kind of bronchial voice modified by its transmission through a layer of liquid. He observed in a pleuritic case, that the ægophony heard at the lower angle of the scapula when the patient was sitting, became changed to simple or louder bronchophony when the patient stooped much forward or lay prostrate, this change of posture permitting the liquid to gravitate to the anterior part of the chest, and floating the lung into contact with the parietes. Ægophony and bronchophony are different enough when their characters are well marked; but they often present mixed and doubtful varieties, that do not admit of any such easy distinction. As far as description will go, we would represent the true character of ægophony to be a certain tremulousness in the voice when it is superficial, and an echo-like slenderness when it is deep-seated; whilst bronchophony may present many other varieties.

[In laminar effusion there is morbid resonance of the voice unequally diffused, and in many cases the voice has a peculiar character which approaches to ægophony. The value of ægophony, as a sign of pleuritic effusion, has been greatly exaggerated by Laennec and his followers. It is frequently absent, being replaced or not by bronchophony. Ægophony undoubtedly occurs occasionally in pneumonia, and individuals with a shrill treble voice have in health a peculiar resonance, closely resembling it; hence it is more valuable as a sign in persons having a bass voice.]

6. An early and very characteristic effect of the accumulation of liquid in the pleural sac, is its intercepting the diffused vibration of the voice, which is usually felt by the hand applied to the chest. A layer of liquid muffles and destroys this vibration; and it may do this even when ægophony is audible at the same spot, the vibrations of the latter being too fine to be felt by the hand. This affords a distinction between a liquid effusion and a consolidation of the lung, for the latter transmits the vocal vibrations with unusual force from the tubes. This diagnostic sign we owe to M. Reynaud; and it is the more valuable because it is easily obtained even by a person who does not practise auscultation. It must not, however, be always considered as quite conclusive, for

there are some exceptions to it, both positive and negative. For example, in case of partial adhesions of the lung to the chest, even more vibration than usual may be felt at the adhering parts where the lungs and its tubes are pressed into close contact with the walls of the chest: it may happen, on the other hand, in consolidation of the lung, that liquid or other obstruction in the bronchial tubes may prevent the voice from being transmitted through them.

7. As the liquid effusion increases, the *ægophony* and all sound of the voice cease throughout the affected side, except within two or three inches of the spine, and in spots where the lung may have been adherent, which frequently happens at the upper parts of the chest. The sound of respiration is also abolished in most parts, but never in the interscapular region, and rarely under the clavicle and in the axilla: it is, however, much weaker in these parts than on the sound side, and may probably be only transmitted from that side.

8. Enlargement of the affected side is another sign to be noticed. The effusion must be pretty copious to render this enlargement perceptible; but a difference between the two sides of the chest may sometimes be seen on inspection of the chest in different periods of respiration when the quantity of liquid is not very great. The affected side is first seen to be larger at the end of expiration, when it does not diminish equally with the other side, especially at its lower portions. So, on encircling the chest with a piece of tape, fixing it at the sternum and at the spine, it will be observed to tighten and slacken with inspiration and expiration more obviously on the sound than on the diseased side, which remains more fixed in a state of partial distension. As the effusion increases, the difference is perceptible through the whole respiratory act, and the eye can easily detect the want of symmetry, whether the inspection be made in front, behind, or from above, looking down on the patient's shoulders. To be more exact, however, the chest should be measured with a tape or ribbon passed horizontally around the chest, and made to meet at the centre of the lower end of the sternum; then taking it off by the point where it crosses the spinous processes of the vertebral column, the length of the two sides may be compared. In making this comparison, it must be recollected that the right side in the healthy state is from a quarter to half an inch larger than the left. Laennec remarked that the enlargement of the side is sometimes discoverable by the eye as well as by measurement, two or three days after the first attack of pleurisy: but it does not generally proceed afterwards in proportion to the effusion until this becomes excessive, and has displaced the adjoining parts to a great extent.

9. A very important class of signs arises from the displacement

of certain of the walls and organs bounding the effusion. Laennec remarked that the intercostal spaces on the affected side do not present their usual depressions, and are sometimes, especially in chronic cases, even prominent beyond the surface of the ribs. This had been noticed by surgical writers in empyema. It is scarcely perceptible, however, in acute pleurisy, unless the subject be thin. In such cases we have seen the intercostal spaces not only prominent, but presenting also an evident fluctuation. In looking for this sign, the patient should be placed obliquely with regard to the light; and it may be more readily seen by surveying the chest from a little distance, than by a closer inspection.

But we may generally learn more from the displacement of the organs adjoining the effusion, especially the heart and the liver. Laennec barely noticed these displacements. To Drs. Stokes and Townsend we chiefly owe their application to the diagnosis of liquid effusions in the chest. The displacement of the heart by an effusion in the left pleura, is the most valuable and easily recognized of these. In this case the pulsations of the heart are felt and heard most distinctly under or to the right of the sternum, or in the epigastrium, instead of, as usual, between the cartilages of the fourth and sixth left ribs. On the other hand, a very abundant effusion on the right side will push the heart so far to the left, that it may be felt beating below the left axilla. But in this case the more remarkable displacement is that of the liver, which by feeling and percussion will often be found far below the margin of the ribs. Sometimes it forms a distinct tumour in the abdomen; and we have known more than one case of latent pleurisy, in which this tumour was long supposed to be the chief disease, the patient not complaining at all of the chest. Dr. Stokes has published some interesting observations with the view to prove that the displacement of the diaphragm and intercostal muscles in great measure depends on paralysis of their muscular fibres, the result of the inflammations of the pleura which covers them.

[Whilst Dr. Walshe does not contest such loss of tone in some cases, he cannot coincide with that eminent observer in believing it a *sine quâ non* of intercostal protrusion. He has satisfied himself, both before and since his acquaintance with Dr. Stokes' observations, of the existence of intercostal bulging in pulmonary emphysema, an affection in which the serous inflammation and muscular paralysis, alleged to be essential to the development of such bulging, have never existed.]

The displacement of the mediastinum is to be discovered only by percussion; situated as this is naturally in the mesial plane, it divides the two cavities of the pleura at a line down the middle of the sternum, which bone sounds well on percussion from the margins of both lungs which lie under it. But a copious effusion will push the mediastinum towards the opposite side, and,

by occupying the whole space behind the sternum, will give this bone a dull sound on percussion, and this may even extend half an inch or an inch beyond it. All these displacements may also be produced by an accumulation of air in the pleural sac, but the tympanic sound on percussion would at once distinguish this case.

10. In all cases of physical examination, the two sides must be examined with the view to comparison; and in case of pleuritic effusion it will be found that the sound side will give not only the negative proofs of the absence of disease in it, which may well be compared with the positive signs of disease on the opposite side, but it will even show an exaggeration of the signs of healthy action, in consequence of its work being really increased. Thus, whilst the diseased side is almost fixed, the healthy side will be seen to move more fully and quickly than usual, and the sound of respiration will be increased in a remarkable degree, so as to resemble the loud respiration of children; hence it is called *puerile*.

[*Peripheric Fluctuation* may be heard in gravitating effusion, especially if it be extremely fluid, and the thoracic parietes thin. If a quick sharp fillip be given in an intercostal space, perpendicular to the surface, and a finger of the other hand be at the same time firmly applied to the surface in the same space, at a short distance from the point percussed, a sensation of fluctuation will be transmitted to the latter.]

We have before noticed that the physical signs of pleurisy are liable to be much modified by old adhesions, which bind the lung to the walls of the chest. When the adhesions are loose, they only form bands or cells distended with fluid; and keeping the lung at a moderate distance from the walls of the chest, they may render the continuance of ægophony much longer than it would be without them. When an adhesion is so close and strong that the accumulating fluid cannot separate it, the lung is there compressed against it; or if there are several adhering points, the attachments to these are preserved by so many pillars of compressed lung at these adhering parts; if they be at the upper or middle regions of the chest, instead of a total abolition of the voice and respiration, there may be loud bronchophony and bronchial respiration, transmitted from the large tubes by the adhering dense column of lung. Sometimes the adhesion is to the diaphragm or mediastinum; and it may then prevent or modify the displacement of these parts by the fluid. Not uncommonly the adhesions are more extensive and close, especially to the upper parts of the chest, and then the lung is pressed by the effusion from below against the whole of the upper walls of the chest. In this condition it may still admit air: and be quite resonant on percussion; but as much of its vesicular structure is compressed, the sound

of respiration there will be tubular or bronchial, and a noisy bronchophony will be transmitted by it to the whole upper region of that side. We have often heard the voice and respiration quite tracheal from this cause. The displacement of the heart and liver, the prominence of the intercostal spaces, and the dulness on percussion of the whole lower portion of the sternum, together with the immobility and enlargement of the lower part of the affected side, will generally distinguish the true nature of these cases. Much more rarely the lung adheres closely to the whole of the lower part of the chest, and the effusion occupies the upper. In such cases there may be pulmonary resonance in the lower parts, with obscure sound of respiration. The upper may be dull in the situation of the effusion; but sometimes, from the top of the sternum to the middle of the clavicle and below it, there is a remarkable amphoric, or tracheal resonance, with some respiration of the same character, yielded by the large tubes through the effused fluid. The character and production of this sound may be illustrated by filliping on a finger pressed against the trachea when the mouth is open. The windpipe passes under the sternum, and divides into the two great bronchi, which spread between one and two inches below the clavicles. Here in health the porous lung lies over these tubes, and intercepts their resonance on percussion; but if this be perfectly condensed by liquid effusion, or perfectly consolidated by hepatization, the hollow note of the tubes will be produced on percussion, just as it is over the windpipe, where no lung intervenes. [Sometimes from the earliest period there will be a notable diminution in the clearness of the affected side at its most inferior portion, when percussed, accompanied with increased resistance; and these signs augment in intensity from above downwards in proportion as the disease advances.

The following tabular view of the physical signs, in the several stages of acute pleurisy, will, after what has been said, be understood.

a. *Dry Period.*

Inspection.—Diminished motions of expansion and elevation, jerking rhythm of these motions; partial motions also slightly lessened in amount.

Percussion.—Clearness of sound not perceptibly diminished.

Auscultation.—Intermittent weak respiration; occasionally, but rarely, grazing variety of friction sound.

b. *Period of Plastic Exudation.*

Inspection.—Signs the same as during the dry period.

Application of the hand.—Rubbing vibration occasionally to be felt.

Percussion.—Clearness and duration of sound somewhat diminished; if notably so, and the sensation of resistance very slightly but distinctly increased, the plastic matter is abundant; deep respiration will restore, in a great degree, the natural clearness of sound.

Auscultation.—Intermittent weak respiration; rubbing or even grating variety of friction sound.

c. *Period of Effusion.*

c. 1. *Of Laminar Effusion.*

Inspection.—Signs usually as in the previous periods, but sometimes the partial and general motions become freer, and cease to be jerking in consequence of decrease of pain.

Application of the hand.—Diminution of vocal and tussive vibration; rubbing vibration, if before perceptible, ceases to be felt.

Percussion.—Sound diminished in clearness and in duration; sense of resistance increased; these changes exist to an equal amount all over the chest, and are not influenced by any change of posture of the patient.

Auscultation.—Deep-seated persistent weak respiration, with harsh or slight bronchial character; friction sound ceases commonly to be audible; vocal resonance louder than natural, and generally having some ægophonic character,—this unnatural resonance being diffused, though commonly most marked towards the angle of the scapula.

c. 2. *Of Gravitating Effusion.*

Inspection.—Motions of expansion and elevation, and costal motions much diminished, especially at the lower parts of the chest.

Application of the hand.—Vocal and tussive vibration abolished at the inferior parts of the chest; rubbing vibration not perceptible.

Mensuration.—Defective expansion of the chest in inspiration.

Percussion.—The upper part of the chest is found to have recovered in some degree its natural sound; the sound of the lower is completely dull and proportionally short, the sense of resistance here extremely marked; the limits of the dull and clearer sounding parts are distinguished by a tolerably well-defined line; the limits of the dull sound commonly change with the position of the patient; deep inspiration has no influence on the limits or degree of the dull sound.

Auscultation.—Respiratory murmurs suppressed where effusion most abundant; weak where less so; in some comparatively rare cases, however, the respiration is distinctly audible, and of the diffused blowing type in the parts directly corresponding to the effusion, above the effusion they are exaggerated, harsh, or bronchial; friction sound almost always inaudible, sometimes, however, may be slightly detected towards the upper edge of the effusion, where also ægophony is heard, especially towards the angle of the scapula, ægophony may be absent or replaced by bronchophony.

c. 3. *Effusion with Dilatation and Detrusion.*

Inspection.—Affected side expanded, intercostal spaces widened, flat, or even convex; motions of expansion almost completely abolished; lower part of chest slowly dragged upwards, a motion which seems to take place later than on the other side; costal motions abolished; fluctuation visible in rare cases of considerable bulging of the intercostal spaces.

Application of the hand.—Surface felt to be unnaturally smooth and even; vocal and tussive vibration not to be detected; simple fluctuation producible in cases of bulging of the intercostal spaces; peripheric fluctuation.

Mensuration.—Increase of semicircular measurement of the side; deficient enlargement of side during inspiration; antero-posterior diameter increased; vertical measurement also increased; distance between the nipple and the median line greater than on the opposite side.

Percussion.—Sound completely dull, and of short duration where the fluid exists; resistance extremely marked; the limits of the dull sound not altered by changing the position of the patient.

Auscultation.—Respiratory murmurs totally suppressed except close to the spine and under the clavicle, here harsh, bronchial, or even slightly blowing, sometimes more extensively audible of the latter type, friction sound inaudible; ægophony or other vocal resonance ceases commonly to be perceptible.

Situation of surrounding parts.—Heart and mediastinum detruded to the opposite side; the corresponding division of the diaphragm depressed with the subjacent abdominal viscera.]

TERMINATION OF THE DISEASE.—The general symptoms seldom maintain their acute character for many days. The stitch in the side ceases, or is felt only in a long breath, or in coughing; sometimes, but not always, accompanied with soreness. The cough, if there be any, generally continues and becomes bronchitic. The pulse sometimes loses its hardness, and is reduced in frequency; in other cases, particularly when the effusion is very copious, it remains as quick as ever, although it may be weaker. The difficulty of breathing is, perhaps, less apparent, but the frequency is often not diminished, whilst the effusion is unabated, although the patient is scarcely sensible of it. In other cases again, in the course of a few days, the breathing returns nearly to the natural state, although one side of the chest is full of fluid. In almost all cases, lying on the healthy side embarrasses the breathing, both by restraining its movements and by causing the fluid to press against the heart and the sound lung. For the same reason, pressure on the abdomen may cause little uneasiness on the diseased side; but on the sound side, by impeding the descent of the diaphragm, it produces a feeling of dyspnœa, even when none may be otherwise present. Not uncommonly after the few first days of the disease, when the acute symptoms have in great measure subsided, the patient complains of nothing but weakness, and calls loudly for an improved diet. It is especially in such cases that we must be in great degree guided by the physical signs: if these indicate that the effusion is undiminished, or even increasing, we may be sure that the inflammation is not subdued, but only latent. But if, from an improved resonance on percussion, and returning movement and sound of respiration, first in the upper parts of the chest, as well as a diminution in the volume of the affected side, we find that the liquid effusion is on the decrease, we may judge that the inflammation is subdued, and that its products will gradually be removed. The reabsorption of the fluid sometimes takes place in the course of two or three weeks; and in that case ægophony [redux] returns when the layer of fluid is thin enough to permit the vocal resonance to pass through it, but more commonly the fluid is not dispersed for a much longer time. Laennec remarks that an effusion which has been formed in the course of a few days is sometimes not entirely removed at the end of six months: and we can add our testimony to the truth of this obser-

vation. In such cases the return of ægophony is very uncertain : in fact the signs are rarely watched during so long a period, and the patient may cease to be the subject of medical treatment before the effusion is sufficiently reduced to give transmission to the voice. In very moderate cases the liquid is absorbed before the lymph or albuminous matter is removed ; and when the pleural surfaces covered with this come together, a sound of rustling or rubbing is sometimes heard with the movements of respiration ; but this soon ceases, as the lymph is converted into adherent bands of false membrane. Now, if these false membranes are formed after the liquid has been removed, and the lung has recovered its full extent of expansibility, they are adapted to its free motions, and do not to any material extent interfere with them. Hence in dead bodies we often find adhesions which are lengthened in the lower parts of the chest, where, from the action of the diaphragm, the lungs descend as the ribs rise, whilst in the upper parts, the adhesions are short, because the lungs there follow more exactly the movements of the walls of the chest.

But in more severe or obstinate cases, which are not uncommon, the inflammation continues after the liquid has been abundantly poured out, and not only increases and perpetuates this liquid effusion, but also throws out albuminous matter in various conditions, which, by its present qualities or future changes, may produce a variety of prejudicial effects, all tending more or less to interfere with the perfect restoration of the organs to a healthy state. These, and the signs and symptoms which they produce, may be better considered under the head of chronic pleurisy ; for although inflammation in which they originate may often be acute at the first, yet the course and character of these changes are quite of a chronic description.

[During the absorption of pleuritic effusion, the physical signs disappear in the inverse order of their appearance. The walls of the chest gradually lose their prominence, the detrued viscera are restored to their places, and no evidence remains in the conformation of the thorax of the previous existence of pleurisy. The dulness on percussion decreases as well as the resistance felt by the finger ; phonic fremitus is re-established ; peripheric fluctuation ceases to be felt ; and the motions of the chest regain their freedom. The respiration becomes, gradually, again audible ; at first it is attended with a change in its quality, but it soon reacquires its natural duration and intensity ; it first appears in the upper parts of the chest—under the clavicle and about the shoulders.

d. *Period of Absorption.*d. 1. *Without retraction of the Chest.*

Inspection.—The appearances of enlargement and bulging gradually disappear, and with them the obstructed state of the general and partial motions; fluctuation ceases to be visible.

Application of the hand.—Natural intercostal depressions again felt, increased by emaciation; rubbing vibration sometimes reappears, as also vocal and tussive vibration.

Mensuration.—The semicircular and vertical measurements fall to the natural standard; the distance between the nipple and median line decreases gradually to the natural amount.

Percussion.—Sound gradually recovers its natural clearness and duration, first at the upper then at the lower parts; at the latter it may long retain some degree of dulness; the sensation of resistance alters in the same way; the clearness of sound may sometimes be increased by a full respiration.

Auscultation.—Respiratory murmurs gradually restored, but remain for a variable time weak and slightly harsh; friction sounds sometimes reappear and continue audible for an indefinite period; ægophony or bronchophony (redux) reappear.

Situation of surrounding parts.—Heart, mediastinum, vault of the diaphragm, and subjacent abdominal viscera, restored to their natural position.

B. CHRONIC PLEURISY.

GENERAL SYMPTOMS.—There is less reason for distinguishing formally between acute and chronic inflammation of the pleura, because the transition of the one to the other is really not defined; and the symptoms of the recent disease sometimes have so little of an acute character, whilst that of a long duration occasionally manifests such an intensity of irritation, that the terms acute and chronic are less applicable to pleuritic affections than to inflammations of most other organs. We can see some reason for this in the fact, that the pleura, being a short sac, is liable to have its acute inflammation converted into chronic by the retention of its product; and chronic pleurisy is liable to be excited into an acute state by the distending or irritating influence of the effusion. Still differences are very apparent in many cases, in the prevalence of high inflammatory fever in some, and in there being no fever, or one of a hectic kind, in others; in the sthenic condition of the circulation in some, and its weak depressed state in others, whatever be the degree of pain or nervous irritation accompanying them. Thus it may happen that an acute inflammation with all its prominent symptoms has been apparently subdued; but the effusion remaining undiminished, the disease goes on in a latent form, until, from some imprudence on the part of the patient, who supposes himself cured, an attack of dyspnoea, or a stitch in the side, again lays him on his bed; and although these symptoms may generally be mitigated, they then leave those more peculiar to chronic disease. Of these a remittent or hectic fever, with permanently quick pulse; gradual emaciation; shortness of breath,

particularly on exertion ; inability to lie on the healthy side,—may be mentioned as the most common : occasionally there is cough, and there may be purulent expectoration from a concomitant chronic bronchitis, and various degrees of pain in the affected side ; but these symptoms are very uncertain. A chronic form of pleurisy is sometimes developed gradually without being preceded by a distinct acute attack ; but it is probable that many of these cases are at first acute in a latent form, the patient having been supposed to suffer merely from a cold, or a slight feverish attack, during the acute stage of the disease, and the local symptoms not attracting attention until they have become more developed in the chronic form.

PATHOLOGY.—In tracing the signs and complications of the more chronic forms of pleurisy, we shall be enabled to exhibit them more concisely and intelligibly through a rational view of their pathology, as we have studied it in the signs and anatomical effects.

Besides serum and coagulable lymph in their simplest forms, which may be speedily removed and organized, inflammation, particularly the more chronic kind, may generate the following products, which are less readily removed, and which tend more or less to interfere with the restoration of the organs to a healthy state.

1. Healthy and highly organizable lymph, when deposited in a thick layer, must in some degree restrain the expansion of the lung, and thereby retard the absorption of the fluid. This lymph may be diminished by absorption ; and the membranes formed of it may ultimately adapt themselves to the full expansion of the lung ; but there will be less chance of this in proportion as the liquid effused is copious, and its removal slow.

2. In cases similar to that just mentioned, but with a lymph less organizable, the product of a less active inflammation, or in which there is much of the colouring matter of the blood (but not in this case only, as Laennec supposed), its organization is more tardy, and the membrane resulting is of a more rigid and less yielding nature ; consequently the lung is more permanently confined in its compressed state. The membranes which are formed on the pleura in these cases are sometimes quite cartilaginous in density, and of considerable thickness ; and occasionally they are found in process of time, partially ossified. If these acquire their density before the liquid is removed, it is clear that they must for ever bind down the lung : but we have seen cases in which there have been signs of further contraction after the absorption of the liquid, which may be ascribed to the tendency which some newly-formed tissues have to contract for some time after their production. This is exemplified in the contraction of

the cicatrices of burns of the skin, and of the false membranes lining cavities of the lung; and in other cases, where false membranes have been slowly formed, and tend to assume a fibrous or fibro-cartilaginous rather than a serous or cellular structure.

3. But the inflamed pleura may effuse lymph of still lower vitality, susceptible of but imperfect organization, and wholly incapable of throwing out more of an organizable character: hence, when the pleura is coated with it, if the inflammation continue, the overflow of the nutritive secretion will be in the form of a curdy matter, or of mere loose shreds of solid albumen.

4. The solid matter may be thrown out in a disintegrated state, utterly insusceptible of organization, and diffused through the fluid in flakes or particles forming a mixture more or less resembling pus, which is the fluid of empyema. Although in many instances this is the result of a more chronic form of pleurisy than that which forms lymph, and owes its persistence and tendency to increase to the want of vitality in its solid matter, yet we do meet with cases of empyema which arise from very acute forms of inflammation. In these instances, the fluid is more strictly purulent, the solid matter being in the form of globules, like those of pus; and seems to be the result of what may be called a suppurating diathesis; in consequence of which, all the albuminous products of inflammation tend to assume a purulent character. In such a case we have seen pus within a fibrinous clot in the heart;* and it is difficult to avoid the supposition that it is something in the condition of the blood that determines this less usual product from the acute inflammation of a serous membrane. It is well known that the continued access of air will cause the inflamed pleura, as well as other internal textures, to secrete pus instead of lymph; hence, whenever pleurisy is excited by the perforation of the lung, the liquid poured out is more or less purulent.

5. Lastly, as the solid accretions on the inflamed pleura, we may find the various morbid productions called tuberculous, scirrhus, encephaloid, and melanotic; these being commonly the result of some constitutional taint developed by the local inflammation; but in the case of the first and last, probably sometimes the product of peculiar modifications of the inflammation itself.

It is not to be supposed that the products of pleurisy in every case belong exclusively to one of the kinds now described, or that they are so simple as to be rigidly divisible by any such classification. We rarely examine a case of protracted pleurisy

* [The common mistake has been committed here of mistaking *softened fibrin* for pus. The liquid or pulpy matter in the centre of fibrinous clots is totally distinct from pus, both in its chemical and microscopical characters. See Gerber's *Gen. Anat.*, p. 28, note by Mr. Gulliver; and Williams' *Prin. of Med.*, Ed. by Dr. Clymer, p. 235.]

after death, without finding traces of several forms of the products of inflammation; and a comparison of many discovers that these pass by insensible gradations into one another; so that, although we may meet with some that are clearly referable to one class of products, there are others of a mixed or intermediate character. If we reflect on the consequences of all these products of prolonged inflammation of the pleura, we must perceive that they all tend to keep down the lung in that compressed state to which it was reduced by the first effusion; and they do this by the rigid false membranes which are formed when the solid effusion is susceptible of organization; and by the persistence of the liquid effusion when the solid matter is destitute of organization, and acts as an extraneous irritant. We must suppose, too, that the absorbing properties of the pleura must be altered by the long continuance of disease; and that various lesions are propagated to the adjoining tissues, which, however they may have escaped the immediate effects of inflammation in its acute form, can scarcely fail to be affected by the slow and less limited influence of chronic inflammation. Hence the parenchyma of the lung, the bronchi, the pericardium, the bones and cartilages of the chest, occasionally become the seat of various changes: thus, the lung becomes at first consolidated, and afterwards atrophied; the tubes secrete pus, and become dilated; the pericardium forms adhesions to the heart, and becomes thickened; and in cases of empyema, the ribs, vertebræ, and their cartilages, may become carious.—Nor must we forget the unfavourable operation of the disease on other functions, the obstruction to the circulation by pressure on the pulmonary and adjoining vessels, the abridgment of the function of the lungs themselves, and the irritating or depressing influence occasionally extended from the seat of lesion to the various organs of the abdomen. In fact, besides the injury done to the respiratory organs, an imperfectly cured pleurisy may, in an insidious manner, oppress the whole system, and bring it into an anomalous cachectic state, in which morbid conditions of various kinds may be produced or brought into activity. Thus we have met with several instances in which tuberculous disease was first developed after pleuritic attacks, and in two instances we have found the tubercles confined to the uncompressed lung, indicating that their development was posterior to the compression of the other lung, in which their deposition was mechanically prevented.

For practical purposes it will be convenient to divide the preceding results of pleurisy into two classes:—1. Those in which absorption ultimately predominates over effusion, and the liquid is gradually removed; and 2. Those in which the effusion predominates, and the liquid can only be removed through a perforation of the pleura.

SIGNS OF ABSORPTION OF THE EFFUSION.—In the first of these, as the absorption of the fluid proceeds, what is it that supplies its place? The lung, as we have seen, may be either so bound down by rigid false membranes, or so condensed and obliterated by long-continued pressure and inflammation, that it is not susceptible of its former expansion to effect this purpose. In the great majority of cases, as the liquid is absorbed, the walls of the chest are contracted or collapsed, so that the diseased side, which at the height of the effusion measured perhaps an inch or two more than the healthy side, now gradually becomes considerably smaller, sometimes to the extent of two or three inches. The contraction is first perceptible in the upper part of the chest, and with the depression and more fixed condition of the shoulder,* contrasts remarkably, on inspection, with the full development and active motions of the sound side. On examining the contracted side more narrowly, we see, in detail, that the ribs are lower at the sides and closer together, the scapula more prominent and nearer to the spine; and sometimes the sternum, and occasionally even the spinal column also, are curved concave towards this side. [To these characters Dr. Woillez has added inclination of the ribs downwards, absence of the natural lateral curve of these bones, as if they had undergone pressure from without inwards, and irregularity of the contracted surface. This phenomenon will occur in cases where the contraction mainly affects the transverse diameter, but, according to Dr. Walshe, the curvature will, on the contrary, be greater than natural, when the antero-posterior diameter has been chiefly involved in the retrocession. The same authority thinks that permanent displacement of the heart is one of the most effectual causes of diminution of the antero-posterior diameter.] In all this we see the results of the atmospheric pressure, together with unantagonized muscular efforts, acting on the walls of the chest. [Several of the normal measurements of the chest are affected by this contraction—the distances between the nipple and the median line of the sternum, between the nipple and the antero-superior spine of the ileum; and between the twelfth rib and that spine. Dr. Walshe in one case found the distance from the nipple to the middle line an inch and a quarter less on the affected than on the sound side; in another case there was a deficiency of three quarters of an inch between the nipple and the iliac spine, and of half an inch between the twelfth rib and that spine in other instances. Though in some cases the nipple is visibly lower than its fellow, the superficial measurements between the nipples and the sterno-clavicular articulations do not differ in any appreci-

[* The shoulder is not always depressed, but, on the contrary, may be raised considerably above the natural level. In this case the patient appears to lean to the healthy side.]

able amount, or may be actually less in the diseased than in the healthy side.] The same pressure tends to fill the cavity from the abdomen: thus the diaphragm is pressed permanently upwards, carrying with it the mass of the liver on the right side, and the resonant stomach on the left; and on watching the abdomen, it is not seen to swell on that side, as on the other, at each inspiration. In some cases, too, the same pressure is exerted within the chest from the sound side, causing displacements the very reverse of those which have been occasioned by the pressure of the previous effusion. We have seen many cases in which the healthy lung had displaced the mediastinum towards the contracted side, not only under the whole sternum, but even under the cartilages of the ribs to the extent of an inch beyond it; so that these parts sounded well on percussion, and the intercostal spaces there showed movements of respiration which scarcely affected any other part of that side. Dr. Stokes has recorded a case in which, after the absorption of an effusion on the right side, the heart was drawn over to that side, so that its pulsations were felt to the right and not to the left of the sternum. We have met with three examples of this kind, in which the heart became permanently displaced to the right. We have also seen, after the removal of pleuritic effusion on the left side, the heart drawn upwards to the left, so that its pulsations were distinct from the fifth to the third rib, near the axilla. Dr. Stokes describes a case in which, after an acute effusion on the left side, which displaced the heart to the right of the sternum after the removal of the effusion, the heart remained loose, falling from one side of the sternum to the other, according to the position of the body.

We proceed to describe the signs obtained by auscultation of a side contracting after chronic pleurisy. In many cases where the effusion has been copious and of long standing, the sounds of respiration and percussion continue permanently imperfect, although the liquid be completely removed; and in almost every case they are more or less impaired for months after the attack; in fact they correspond pretty well with the appearance and diminished motion of the affected side, and are to be referred to the same causes. The improvement is generally to be found first in the upper part of the chest, and near the spine. [Friction sounds varying in type, are sometimes audible in the posterior regions of the chest. Dr. Walshe has found a distinct *leather-creak* in the supra spinata fossa, (an exceeding rare situation for this class of sounds,) gradually dwindling into a slight *rubbing* sound at the angle of the scapula, while, on the anterior surface, scarcely more than a *grazing* sound could be detected. The duration is variable, disappearing in some cases in a few days, and in others again, remaining for months after retraction is established.] With the return of a weak respiratory murmur, and slight

resonance on percussion, some degree of vocal resonance may also accompany the removal of the liquid in the upper parts of the chest amounting to loud bronchophony, often accompanied by a remarkable *buzz*, in other parts being merely the diffused vocal fremitus, according to the size of the bronchial tubes and the degree and permanency of their compression. This is one of the instances in which some physical signs may deceive us, unless attention be paid to all, and to the general history of the case; for if, for the first time, we see a patient with the above signs, and he happen to have bronchitis, we may be led to believe that the resonance of the voice and the dulness are caused by consolidation from recent inflammation of the lung, or from tubercle: but this error may be avoided by attending to the history of the case, and the signs of contraction that characterize it. The dulness on percussion in the contracted chest is less owing to the absence of air than to the compressed, drawn-in condition of the walls, which are no longer free to vibrate; and although there be air in considerable quantity in the lung underneath, this air gives no spring to counterbalance the atmospheric pressure, which is continually acting as a dead weight on the contracted side. Sometimes more sound may be obtained by pressing the fingers strongly on the side, and then striking on them; this pressure brings the walls beyond the unequal atmospheric weight, so that they may then vibrate more freely, as we have formerly explained.

We find, then, that in these cases of pleurisy, the condition of the side of the chest was, at the period of the copious effusion, the reverse of what it becomes when that effusion is removed; then it was dilated, and the adjoining parts pushed from it; now it is contracted, and the adjoining parts drawn into it. Is there not, then, an intermediate stage, in which neither of these conditions is presented, and the side has the usual shape and dimensions? Our experience leads to the conclusion that there is not; but that the transition from one condition to the other is not generally uniform, but partial. The common case is that the contraction begins in the upper part of the chest before the dilatations and displacements have ceased in the lower; and it seldom happens that there is not, during the diminution of a pleuritic effusion, an irregularity in the shape of the chest, a comparative bulging of the lower portion, which may serve to distinguish it from consolidation of the lung.

In the cases hitherto considered, the effusion has been supposed to be general and to fill the cavity of one side of the chest; and the contraction after its removal, although irregular, to be also general. In case of partial effusions, limited by rigid adhesions to transverse portions of the chest, it is plain that the thoracic walls cannot contract enough in those parts to obliterate them. In the few cases of this kind which we have seen, there had been

partial contraction; but the space occupied by the effusion was chiefly filled either with air, or by the adjoining viscera pushed in, or with a semi-solid curdy fluid, probably the inspissated remains of the effusion.

[The following table exhibits the signs of absorption,

d. 2. *With Retraction of the Chest.*

Inspection.—Retraction, or more commonly depression; proclivity of the shoulder, of the ribs, and of the nipple; in rare exceptional cases elevation of the shoulder; scapula tilted outwards at its inferior angle; lateral curvature of the dorsal spine, with the concavity towards the diseased side; distortion of the ribs; intercostal spaces unnaturally narrow; diminished motions of expansion and of elevation, especially of the former, while the latter is effected in the same manner as during the period of effusion with dilatation; motions of ribs on each other much impaired.

Application of the hand.—Surface felt to be irregular and uneven; rubbing vibration sometimes, but rarely, felt.

Mensuration.—Semi-circular measurement diminished; deficient increase of width during inspiration; antero-posterior diameter diminished; as likewise the vertical measurement; distance between the nipple and the middle line diminished; distance between the clavicle and the nipple increased; that between the nipple and the iliac spine, and between the nipple and the twelfth rib, decreased.

Percussion.—Sound dull and of short duration, with marked resistance under the finger at the lower parts; superiorly it is clearer, in the inferior regions it has a wooden character, and at the antero-superior, often a tubular one.

Auscultation.—Respiratory murmurs suppressed at base, at upper parts weak and harsh, or bronchial; this partial restoration may not occur for many months after the commencement of contraction; friction sounds commonly audible, of rubbing, grating, or creaking type; bronchophony and bronchial cough, especially posteriorly.

Situation of surrounding parts.—The vault of the diaphragm and the subjacent viscera are sometimes drawn above their natural level; mediastinum and heart commonly, but by no means always, restored to their natural positions.]

It might be supposed that individuals, whose lungs are reduced, by contraction of the chest after pleurisy, to little more than half their natural size, would be reduced to a very frail state of health and a low scale of bodily strength; yet it is curious enough, that some such individuals have continued to enjoy good health, and to be actively engaged in the pursuits of life. Laennec mentions the case of a distinguished surgeon of Paris, who, although he had one side contracted, in a very marked degree, from an attack of pleurisy in his youth, yet enjoyed excellent health, and was in the habit of lecturing twice a day without inconvenience. We have met with a few instances of the same kind, but they were in young subjects in whom the walls and organs of the chest are capable of more extensive adaptation than in after life, and in no such case have we found the contraction excessive, nor the respiratory murmur nearly abolished. In other cases (and they are, we believe, the most common) extensive contraction of the chest causes such an habitual shortness of breath and tendency to palpitation,

as to incapacitate the subject from active exertion, so that even slight bronchial attacks, or febrile excitement, cause severe and distressing dyspnœa. We have further had occasion to observe, that before the system becomes accommodated to the abridgment of respiration which this lesion produces, and even afterwards, under unfavourable circumstances, there is an enfeebled or cachectic state of the whole frame, in which various trains of disorder may arise; and unless care be taken to counteract them by remedies and circumstances most favourable to the general health, scrofulous or dropsical disorders may be engendered, and develop new mischief in the respiratory organs or elsewhere. Although, therefore, we may look on contraction of the chest as a mode of curative termination of pleurisy, it is one of the least favourable kind, and liable to many detracting circumstances.

EMPHYEMA.—The other class of cases in which effusion preponderates over absorption, and the liquid can only be removed through a perforation of the pleura, comes next to be considered. This character is to be traced in some instances to the condition of the membrane, which, either from its continued inflammation, or from change of its structure, secretes more than it can absorb: sometimes the accumulative tendency of the effusion may arise from some obstruction in the circulation, dependent on disease of the heart or great vessels, on tuberculous or other consolidation of the lungs, or even on the partial pressure of the effusion itself. But the more common cause of increasing effusion is in the nature of the matter effused, which, when of a purulent character, is not readily absorbed, and constitutes the *Empyema* of authors.

[This term, which etymologically (*εμπυημα*, from *εν*, in, and *πυον*, pus,) means any internal collection of pus, was restricted by the older writers to purulent accumulation in the chest, a condition which would be more correctly expressed by the term *Pyothorax*. In practice, however, the word *empyema* is now generally employed in a wider sense, and is applied to every fluid pleuritic collection, whether purulent, puriform, albumino-serous, or otherwise, which manifestly runs a chronic course, and continues stationary, or increases in spite of remedial measures.—(Walshe, *Cyc. Prat. Surg.*, Pt. ix., p. 94.)]

SYMPTOMS.—The symptoms and signs of empyema are generally those already described as indicating extensive liquid effusion, but they may be modified by the length of time that effusion continues; thus, although the feeling of dyspnœa, and perhaps the fever, may have abated, even with the effusion on the increase, yet the general disorder of the system, and the signs of enlargement of the side, and displacement of its usual boundaries, com-

monly become more marked. [The decumbiture varies, as a general rule, with the duration of the disease. Patients with empyema lie, for a time, almost without exception, on the affected side, or on its outer and posterior edge,—that is, on the back and side conjointly, with the head bent towards the shoulder of the affected side; in this manner the viscera are better protected from the pressure of the accumulated fluid. In the more chronic cases, decumbiture on the back, or on the sound side, is borne.] It is by no means constantly observed that the effusion of pus is peculiarly marked by the occurrence of rigors, hectic fever, or more constitutional disturbance than that which attends the effusion of mere serum and lymph; but when such symptoms do occur, there is a probability in favour of the effusion being truly purulent. [It is a matter of common belief that when there is hectic, it is a proof that the pleuritic fluid is purulent. Dr. Walshe considers this as decidedly an error; for he has repeatedly observed cases of the kind in which the contents of the pleura were discovered after death to be purely sero-albuminous. Œdema of the integuments of the affected half of the thorax, sometimes involving the entire side of the body, commonly attends advanced empyema: the face, too, is puffy, and has a semi-transparent aspect; the lips are tumid and livid-coloured.] The long-continued pressure, perhaps joined, as Dr. Stokes has suggested, with the paralyzing influence of prolonged inflammation, causes the muscular portions of the walls to yield to an increased extent; hence the intercostal spaces become more prominent, and the diaphragm further pressed into the abdomen, carrying with it the abdominal viscera. Thus on the right side the liver may be pressed down to the umbilicus and ilium, causing a protuberance there, which has not unfrequently been mistaken for the chief disease. On the left side, the stomach is not generally so much displaced, but the diaphragm is pushed down more behind, carrying with it the spleen and the colon, the pressure on which sometimes seems to cause flatulent distension of the abdomen. In a case of this kind which we have recently witnessed, the enlargement of the chest was entirely behind, the left infra-mammary region not being at all full, and giving the resonance of the stomach, although the heart was displaced to the right of the sternum.

When the effusion is purulent, there is not uncommonly associated with it an ulcerative process, which may permit the matter to escape through the lungs, the walls of the chest, or the diaphragm, and which, in cases of long continuance, often involves other parts besides that through which the matter is evacuated. Thus after death we often find small excavations in the layer of semi-organized lymph coating the walls of the chest, and in some instances, this ulceration perforates the pleura and a layer of intercostal muscles, without proceeding further. In other cases the

ribs, vertebræ, or sternum, become partially carious from the same cause. When this ulcerative process proceeds so far as to cause the matter to point externally, a soft fluctuating swelling is felt at some part of the chest; and it may generally be known to communicate with the interior of the chest by its becoming tense during expiration, and softer during inspiration. Not uncommonly the matter burrows under and between the muscles and integuments of the chest, and points at several places, and at a distance from the perforation of the pleura. We have seen abscesses connected with empyema point in three instances under the pectoral muscle, once in the right hypochondriac region, and once close to the spine: that in the hypochondriac region had been mistaken for an abscess of the liver; in this case it was found after death that there were perforations of both intercostal muscles and diaphragm; and between the layers of the latter, the matter passed to the margin of the ribs, and there spread under the integuments, communicating with the other perforation between the ribs. The superficial abscesses are sometimes accompanied by much local pain and tenderness; but in some cases these are scarcely complained of. These abscesses are generally slow in opening spontaneously: they generally first spread between the muscles and integuments, causing a puffy state of the parts. When the opening does take place, there is a discharge of matter, more or less copious; and this recurs from time to time, especially during any strong efforts of expiration, as in coughing. Sometimes air is drawn at the orifice during strong inspirations, and the next jets of matter issue with greater force, occasionally mixed with bubbles of air. After the air has gained access to the empyema, the pus, which was at first inodorous, generally in a few days becomes fœtid, exhaling the odour of sulphuretted hydrogen: and with this change in the discharge, there is increased constitutional disturbance, sometimes manifesting itself in form of irritative fever, with bounding pulse and heat of skin, alternated with colliquative sweats; sometimes producing typhoid symptoms, and a state of general depression.

When the matter of empyema is discharged by ulceration through the lungs or bronchi, there is a violent fit of coughing almost like vomiting, ending in the expectoration of large quantities of matter. These efforts sometimes threaten suffocation: but the discharge is followed by considerable abatement of the symptoms. Laennec considered this a more common event than perforation of the walls of the chest: our own experience would indicate the contrary; but there are on record many cases of both results. The ulceration through the substance of the lung or air-tubes is described by Dr. Townsend to be accompanied by the formation of a gangrenous eschar, which is detached, and the fistulous passage is lined with a false membrane, which prevents the

matter from spreading through the lung, and conducts it to the air-tubes.

The evacuation of the matter by fistulous openings may go on continually, or recur from time to time, with more or less temporary relief, for weeks, months, or even years; the patient in some instances recovering, in others sinking from the continued effects of the disease. In the former case, the discharge soon becomes less, and entirely loses its fetid character; the wound heals, and the chest gradually becomes contracted in the manner before described, there being a partial return of respiration in some portions of the chest.

[CAUSES.—Pleurisy is one of the most frequent of all the phlegmasiæ, occupying the fifth rank in acute affections and coming next after pneumonia, typhoid fever, bronchitis and the anginæ. It constituted one-twentieth of the whole number of patients admitted into the service of Dr. Chomel, at the Hôtel Dieu, in 1838–39. If the number of cases in which the pleura presented traces of false membranes were also counted, this proportion would be materially increased, for there are few autopsies at which we do not find some evidence of pleurisy, either recent or old.

Pleurisy exists at all ages, but under one year of age, simple pleurisy is comparatively rare; it is more common between one and five years, and again diminishes until fifteen, when it becomes again frequent. In old age it is comparatively rare. Secondary pleurisy is very common in young children. Pleurisy is much more common in males than females, at all ages; of thirty-six cases taken at hazard by Valleix, there were thirty-one males and five females. Acute articular rheumatism, according to Bouillaud and Chomel, predisposes to pleurisy. It is more frequent in winter and spring than at any other season.]

We are not aware that any circumstances predispose to pleurisy further than those which render the body liable to other inflammations, such as a relaxed or debilitated state of the system after fevers or other severe disorders, the puerperal state, &c.

Of the *exciting* causes of pleurisy, cold is by far the most common, especially exposure to cold winds; hence it is observed to prevail especially in the month of March. It may, however, be excited by external injuries, such as wounds and contusions of the chest, fractured ribs, &c.: in these cases the disease is not uncommonly latent, and becomes chronic. It is an occasional complication of continued and exanthematous fevers, particularly in some epidemics, constituting one of their dangerous complications. Less frequently it is excited by gout or rheumatism; and on the sudden removal of a cutaneous eruption, or healing of an old ulcer or other habitual drain. It sometimes occurs from the

extension of inflammation from the lung, the peritoneum, or the walls of the chest. From the latter cause, it not unfrequently forms the closing scene in cancer of the breast. It is occasionally associated with erysipelas, diffuse inflammation of the cellular tissue, inflammation of the veins, and puerperal fever; in such cases it is usually latent, and accompanied by the typhoid symptoms common in those formidable diseases. It is not uncommonly excited by tubercles in the lung, both in their solid state, and after they have been softened. In the latter case, when the pleura is perforated, there is generally, also, the admission of air into the pleura, producing the complex lesion, pleuritic pneumothorax, to be afterwards noticed.

[COMPLICATIONS.—The most common complications of acute pleurisy are pneumonia and pericarditis. The former, very frequent, coexists with the disease, but not necessarily so, as has been asserted. Double pleurisy is always complicated with tubercles.]

DIAGNOSIS.—In its very earliest stage, at the first attack of pain, pleurisy may be mistaken for pleurodyne and nervous pains of the chest and upper part of the abdomen; and as there are rarely any distinctive physical signs at this period, we must seek for the character of pleurisy in the general symptoms of fever, heat of skin, and sharp hard pulse, and sometimes in the short dry cough which accompanies it. In a short time, however, the physical signs become the most characteristic marks of the disease. It is unnecessary here to repeat the description, and it only remains to point out the signs which distinguish pleurisy from some other lesions which most resemble it.

Consolidation of the lung differs from pleurisy in its not causing any displacement of the contents or walls of the thorax, and generally, also, in its increasing the vocal resonance of the affected side, whether heard, or felt by the hand; and by its leaving some sound of respiration, which is generally of a bronchial character.

Partial pleurisies confined by adhesions are less easily distinguished, because, where the lung is adherent, there may be as much bronchophony and respiration as in cases of consolidation; but on examination, these will be found to be more circumscribed than in the latter case, all sound being absent in other parts, which further present the signs of enlargement or displacement of the heart, liver, or mediastinum, with fulness of the intercostal spaces, generally more remarkably than usual. A similar irregularity in the shape of the chest will serve to distinguish pleurisy in the progress of cure by contraction of the chest, from the case of a consolidated lung.

The diagnosis of intra-thoracic tumours was described under their head.

Chronic pleurisy is liable to be confounded with tuberculous phthisis, for their general symptoms are often very similar; and in truth they sometimes coexist, or run into one another. But their physical signs sufficiently separate the two kinds of lesion; there never being in phthisis that general dulness and absence of respiration, with enlargement of the side and displacement of parts, which occur in empyema. [Nor is the resistance felt by the percussing fingers so marked, as that caused by liquid effusion. The progress of the signs depending on tubercular accumulation, is in phthisis from above downwards,—in empyema from below upwards.] The expectoration in chronic pleurisy is sometimes purulent without any communication with the pleura, or disease in the substance of the lung; it is in fact the product of a bronchitis which generally accompanies the last stages of most diseases of the chest.

From simple bronchitis, dilated air-cells and tubes, and other chronic affections of the chest, the distinction of pleurisy through its physical signs is sufficiently evident.

Its diagnosis from hydrothorax will be afterwards pointed out.

[Chronic pleurisy may be confounded with *cancerous solidification*. The differential diagnosis has already been pointed out, (p. 404, 405).

The dilatation of the side and the dull sound produced by *enlargement of the liver* may be mistaken for empyema. It may be distinguished from empyema, according to Dr. Stokes, by the following characters: 1. Absence of intercostal paralysis or protrusion. This statement should be modified, for, in some cases of enlargement of the liver, the subjacent intercostal spaces are manifestly more prominent than those of the other side. 2. The clearness, on percussion, of the upper and middle portions of the chest. 3. The loudness of respiration in the postero-inferior regions, which is much greater than could be anticipated from the amount of dulness. 4. The absence of lateral displacement of the heart, and the existence, in many cases at least, of the vertical displacement upwards. This is principally seen when the left lobe of the liver is engaged. 5. The fact of the interlobular fissure being parallel with the mesian line; for in displacement of the liver, the pressure being exercised on the right lobe, the interlobular fissure is directed towards the left side, and forms a considerable angle with the mesian line. 6. In cases of hepatic tumour without pleuritis, the dulness of the postero-inferior portion of the side disappears on the patient taking a deep inspiration, returns upon expiration, and remains fixed during ordinary breathing. Dr. S. has never witnessed this phenomenon in any case of empyema; he believes, however, that

the test is not applicable when the lower portion of the pleura has been obliterated by adhesions. When the liver has been, previously to the enlargement, or at its commencement, bound down by adhesions, so that the increase in size is principally confined to the superior portion of the organ, great difficulty will be experienced in establishing a diagnosis, particularly, as is often the case, when false membranes have been thrown out at the base of the lung. The history of the case must be our chief guide.

Enlargement of the spleen sometimes causes protrusion of the corresponding size. Enlargement of this organ generally occurs in continued fever, or is consecutive to intermittent fever; in both of which affections effusion into the pleura is exceedingly rare. So that an inquiry into the circumstances of the case will prevent error. The form of the part emitting the dull sound on percussion will further localize the enlargement of the spleen, and the condition of the respiratory murmurs, posteriorly especially, proves the freedom of the pleura from effusion.

The distinction of an external abscess communicating with the pleura from a mere parietal collection of pus, is to be established by the history of the case, and the presence of the physical signs of empyema.]

PROGNOSIS.—Simple acute pleurisy, although a serious disease, and full of danger when neglected, generally yields to remedies promptly employed before the effusion is copious. But if active measures have been delayed or insufficiently used, or if the effusion be purulent, or if there be other diseases in the chest, such as organic lesions of the heart, liver, or kidneys, or tuberculous or other deposits in the lungs, pleurisy often becomes an intractable and even fatal disease. It does not commonly prove fatal in its acute stage from the quantity of the effusion, except when the disease attacks both pleuræ at once, or in cases in which empyema, or some previously existing disease in the other lung, prevents its free expansion to supply the defect of that which is compressed. The very rapid accumulation of the effused fluid is generally an unfavourable sign; for experience has proved that in such a case its dispersion is more difficult.

[According to Dr. Louis, pleurisy in an individual enjoying perfect health at the time of the attack, almost always terminates favourably. Of upwards of one hundred and fifty patients seized with the disease under these circumstances, he did not lose one. But when it is a secondary affection, it is much more serious, and though in general its gravity is proportioned to the severity of the primary disorder, it may prove fatal, when developed in the course of an insignificant malady—as simple bronchitis. Pregnancy is a serious complication of inflammation of the pleura; death often occurring after abortion has been produced. When double—and

in such instances it is nearly always secondary—it is very serious.]

When the acute symptoms have subsided, and the extreme oppression resulting from the first effusion has abated, the probable issue of the case will depend much on the condition of the general health and strength. If this continue pretty good, there is reason to hope that the effusion will be gradually removed; and this hope becomes more sure as soon as the sounds of percussion and respiration are heard returning to any part, however small, in which they had been previously absent. But if the weakness of the body increase, and some of the functions be more or less disordered, the urine scanty and high-coloured, the legs or surface œdematous, or the expectoration purulent, with night sweats and increasing emaciation, there is much reason to fear an unfavourable issue, either from the nature of the effusion or the want of power to effect its absorption before it fatally oppresses the vital functions.

In case of empyema, where the purulent matter makes its way into the bronchi, or through the walls of the chest, although its discharge may give considerable relief for the time, yet the improvement may be but temporary; and here also the ultimate result will much depend on the general health and strength, as indicated by the rational symptoms, as well as on the condition of the lungs and other organs. Where these circumstances are favourable, a permanent cure may follow; or the spontaneous discharge continuing to a greater or smaller extent, a tolerable share of health may continue for months and even years. But not uncommonly, before the matter finds its way externally, it has produced serious mischief in other parts, and by totally destroying the irritability of the intercostal muscles, by causing caries of the ribs, sternum, or spine, extensive fistulous abscesses in the walls of the chest and abdomen, or tuberculous deposits in the lungs, and at the same time injuring the constitution generally, it leaves the body in a condition most unfavourable to the restoration of health. These circumstances suggest the propriety of anticipating the process of nature, by artificially evacuating the matter before these serious consequences ensue.

TREATMENT.—The leading indications in the treatment of pleurisy are, 1. To subdue the inflammation; 2. To promote the removal of its more injurious product; 3. In chronic cases to improve the state of the general health, and to counteract the injurious effects of the persisting disease.

The most desirable object is to destroy the inflammation at its very onset, before the signs show that the effusion is considerable. For this purpose, the most effectual remedy in severe cases is a full general bleeding, carried, if possible, to such an amount as

to remove all pain on full inspiration; or, if there be little or no pain, until all hardness of the pulse ceases. This should be followed by free leeching or cupping of the affected side. We think leeches generally preferable; but they should not be applied sparingly, and they should be immediately followed by a large warm poultice covered with flannel, or by a succession of warm dry napkins. These depletory measures must be repeated if within a few hours the pain return, or the pulse resume its hardness. Of internal remedies, those are the most useful, in the first instance, which assist the blood-letting in producing an impression on the circulation, especially brisk purgatives containing mercury and antimony, which act fully on all the secretions. Calomel and James's powder, followed by an active draught consisting of salts and senna, generally answer best. Tartarized antimony is less effectual in this than in other inflammations of the chest: it may do harm if it excite vomiting; but in doses short of that effect it may prove useful.

It commonly happens that such measures take off the edge of the disease without destroying it entirely, or, at least, without removing its products, which must be a work of time; and although the pain, dyspnœa, and cough be much relieved, they are not removed, and the physical signs show that the effusion has taken place to a greater or less extent. Under these circumstances, the proper means are those which promise to fulfil both indications, to reduce the remaining inflammation, and to promote the absorption of the matter already effused. The most powerful of these is mercury, which may be combined with ipecacuanha and opium, to lull the pain and to prevent the calomel from passing off too freely by the bowels.

[33. R.—Hydrarg. Chlor. mit., gr. viij.
 Pulv. Ipecac. gr. iij.
 Opii, gr. ij.
 M.—Div. in pil. viij.
 Sig.—One every three hours.]

These remedies should be given in pills every three or four hours; and to them may be added digitalis or colchicum in a saline mixture, with an excess of alkali, to keep down the action of the heart and arteries, to determine to the kidneys and skin, and to lower the inflammatory condition of the blood. The beneficial influence of mercury is sometimes apparent when it does not affect the gums, especially in young subjects; its operation being only manifest on the hepatic and alvine secretion, which is green, dark, or high-coloured, from different conditions of the bilious matter in it: but in most cases the gums exhibit the effect of mercury before these secretions are produced.

Venesection can seldom be repeated with much advantage after the first few days, unless on the occasion of a fresh access of pain,

or other symptoms which denote the renewal of acute inflammation. Occasional leechings continue to be useful ; but, after the inflammatory fever has been reduced, the most effectual external remedies are blisters, which should be used large, and not left on too long ; from six to eight hours is generally time enough to make them vesicate without inflaming the tissues too deeply, or irritating the system by the absorption of their serous discharge. Where the effusion is abundant, a succession of blisters will be necessary ; or they may be varied by a suppurating counter-irritant, such as the tartar-emetic ointment or solution.

The diet must be of the most spare kind in the early stage of acute pleurisy ; and the patient should remain as quiet as possible in bed. But when the inflammation is subdued, sitting up, and, if the strength will permit it, using a little exercise about the room, will be beneficial in promoting the absorption of the fluid.

In limited varieties of pleurisy, such as those of a mild or partial kind, those excited by tubercles, and in those which occur in combination with typhoid or asthenic symptoms, the antiphlogistic measures above described must be reduced to suit the nature of the case, and the amount of the general strength. Circumscribed pleurisies may sometimes be removed by cupping or leeching only ; and in conditions of the system depressed by febrile or other morbid poisons, or reduced as in phthisis, blisters or sinapisms may be the only antiphlogistic means which can be borne. In continued fever, besides these external means and the usual salines, mercury in combination with opium is, according to our experience, the most appropriate remedy.

If, in severe cases, from insufficiency or delay of treatment, or in spite of it, the signs of effusion continue beyond two or three weeks, little or not at all diminished, with more or less constitutional disturbance, it is to be apprehended that the disease will take a chronic form, in which the character of the treatment must be to a certain extent changed. If the strength continue to diminish, the pulse be weak, and the fever (if present) of a remittent or hectic kind, a more nutritious and tonic plan must be cautiously pursued to the extent that the patient can bear ; the heat of skin, pulse, cough, and condition of the breathing being referred to as tests of the suitability of the change. But external counter-irritation should still be continued, especially by blisters, which may perhaps be useful not only in reducing internal inflammation and in promoting the removal of the effusion, but also, as Dr. Stokes supposes, in restoring energy to the inactive external muscles of respiration, as they sometimes do to the muscles of a paralyzed limb. [The effect of blisters in this stage of the disorder is manifest ; they should not be applied, however, while fever exists, as they tend, in spite of all precautions, to increase it, and thus induce a condition adverse to absorption.—

Blisters should be frequently repeated—for a fortnight at least—made of large size, their place of application varied, and not kept on longer than merely to produce vesication. The blistered surface should be rapidly healed. The *magistral blister*—a singularly prompt means of procuring vesication, much used in France, and of easy preparation—may be advantageously employed in these cases.

Take of powder of cantharides and wheat flower, of each equal parts, and of vinegar sufficient quantity to make a soft paste.]

The secretions must be kept free by medicines of a milder class than those used in the acute stage; and except with this object, we have not found much benefit from mercury in the advanced asthenic stages of simple pleurisy. In fact, when the effusion is purulent, the constitutional effect of mercury seems to be injurious. In these stages we have seen the most salutary effects result from the employment of the hydriodate of potass, which seems to act both as an alterative and as a diuretic. Dr. Stokes highly recommends iodine, both internally and externally, in the form of a pint of Lugol's mineral water daily, and from a quarter to half an ounce of the ointment rubbed into the side.

[34. R.—Iodinii, gr. ss.
Sod. Chlor. gr. xii.
Aq. Destil. Oj.

M.

Lugol makes the mineral water of three strengths—gr. $\frac{1}{2}$, $\frac{2}{3}$, and gr. j. of iodine to the pint of water.

35. R.—Iodinii, $\overline{3}$ ss.
Potass. Iodid., $\overline{3}$ j.
Adipis, $\overline{3}$ ij.

M.—Ft. Unguent.]

We prefer the hydriodate simply, in the dose of two or three grains, three or four times a day; and in the more asthenic cases, the iodide of iron in rather smaller doses. As there is apt to be in both these medicines some free iodine, which we believe to be the chief cause of the unpleasant symptoms which they are sometimes said to produce, it is well to direct the patient to eat a bit of bread or biscuit after each dose: the starch of this, combining with the free iodine, removes its injurious property; and with this simple precaution, we have administered both these remedies in numerous instances, for a great length of time, without ever inducing the gastric irritation and nervous symptoms, which are commonly ascribed to iodine, and which we have seen produced even by Lugol's diluted solution. These medicines seem especially calculated to promote absorption; and, combined with blisters, we have found none so efficacious in hastening the removal of a pleuritic effusion.

Various other medicines are occasionally useful. As diuretics, Laennec recommended acetate and nitrate of potash in very large

doses, such as from $\bar{3}$ ss to $\bar{3}$ ij of the former, and $\bar{3}$ ss to $\bar{3}$ iv of the latter, occasionally combining with them hydrochlorate of ammonia and squills. [The hydrochlorate of ammonia is much employed in Germany in the treatment of pleurisy. Sir George Lefevre gives the following formula for its administration :

36. R.—Ammon. Hydrochlor. $\bar{3}$ j.
Ext. Glycyrrhыз. $\bar{3}$ ij.
Ant. et Potass. tart. gr. j.
Aq. Destil. f $\bar{3}$ vij.

M.

Sig.—A large tablespoonful every two hours.]

Where a dropsical diathesis prevails, we have occasionally found the tartrate of iron a good diuretic. But in some such cases, a coagulable state of the urine sometimes indicates a state of the kidneys in which diuretics prove injurious. Under such circumstances, powerful purgatives and diaphoretics alternated are sometimes useful in reducing the effusion. But such remedies can seldom be used for any length of time without causing serious weakness and disorder, and are, we apprehend, more hazardous than the simple operation of mechanically drawing off the fluid.

Gentle exercise and friction are commonly serviceable in promoting the expansion of the chest and lungs, and the absorption of the fluid. In the more chronic cases, it is of the utmost importance to promote the general health by free exposure to a pure, mild, and suitable air; and in cases disposed to scrofula, this will be best found at the sea-side.

[Three objects should be steadily kept in view in the treatment of chronic pleurisy: 1. The prevention or diminution of febrile action. 2. The promotion of absorption. 3. The support of the general health. When the effusion is not of long standing, and the constitution is not impaired, and there is continued febrile action, with or without local pain, antiphlogistic measures should be enforced; but the greatest caution should be observed, for a degree of depression may follow the moderate loss of blood from the vein which will not easily be recovered from. Local bleeding is therefore preferable to general, and six or eight leeches may be applied to the affected side two or three times a week for a fortnight. Absorption is to be promoted by the use of diuretics and iodine, and in cases of extreme dyspnœa, by the cautious use of purgatives; for if the lungs are tuberculated, and active purgatives are administered, the patient's death will probably be hastened. Of the efficacy of blisters in this emergency, we have already spoken. The patient's strength must be supported by succulent diet, mild tonics, and change of air.]

TREATMENT OF EMPYEMA.—The removal of the fluid effused by pleurisy through an artificial opening in the chest (*paracentesis thoracis*), the utility of this operation, and its mode of performance,

have long been, and are still, subjects of much question among both medical and surgical writers. We must refer to other works for the different opinions on these points: we shall endeavour to state in the simplest terms the general results of our reading, observations and reflection on the subject.

There are two kinds of cases in which it becomes proper to give exit to the liquid accumulated in the pleural sac. One includes the examples of the recent disease, in which the effusion takes place so quickly and abundantly as to endanger life by the pressure which it causes on the lungs and blood-vessels. A sudden effusion may have this effect, where its quantity is not sufficient to compress the lung totally, or to displace the viscera to a great extent, especially if the lungs be previously disabled, as by emphysema, catarrh, &c.; there is, however, always some enlargement of the side, which, with dulness and absence of respiration and vocal vibration, will sufficiently indicate the nature of the case. Here the liquid is generally serum, with more or less lymph, and it commonly deposits a further clot of gelatinous fibrin after it has been drawn from the chest: the same liquid is, however, sometimes yielded by pleurisies of long standing. The other class comprehends those cases in which the pleurisy has existed for a long time; and the effusion, instead of showing a disposition to disperse under the influence of remedies, either increases or remains stationary; and whether it cause a dangerous degree of dyspnoea or not, its longer continuance must do mischief by perpetuating the compressed state of the lung, as well as by the various other structural and functional affections which we have before alluded to. The cases of true empyema are generally included in this number, and are considered the more legitimate subjects for operation, because there is less chance of purulent matter being removed by absorption; but we must add that the operation has not been so often successful in these cases as where the effusion is not purulent.

Now the object of the operation is to remove the fluid, which either from its quantity oppresses the functions, or by its quality extends and perpetuates the structural lesions of the chest and its organs. With this view, an outlet is given to it, any number of times, until its quantity is so far diminished and its quality improved, that it shall not prevent the re-expansion of the lung as far as that is possible; the contraction of the chest filling up the deficiency as the remaining fluid is afterwards gradually absorbed. It is easy to perceive that after the distension is relieved by the flow through the opening, the remaining fluid cannot be drawn out of the chest without something to occupy its place; and, unless proper precautions be taken, that something will be air, drawn by inspiration, not into the lung, but through the orifice into the cavity of the chest. Air thus introduced often seems to have the

effect of causing an unfavourable change in the nature of the remaining liquid, rendering that which was serous decidedly purulent, and giving to pus a fetid character. Further, when air gets access, it tends to do mischief, whether the orifice remain open or be closed: in the former case, the air passing in and out prevents the lung from expanding, and constantly irritates the serous membrane, which is not fitted for contact with it; and if it be closed, the air admitted tends to engender more air by the decomposition which it causes in the remaining fluid, so that the pleura soon becomes as much distended as before the operation. Hence, although the operation generally gives temporary relief, it has often been followed by symptoms of irritation, or of increased oppression, which have ultimately led to a fatal result. It is true that in some cases the cause of failure is irremediable disease in the walls or viscera of the chest, or perhaps in the constitution, which may be either the cause or the effect of a long continuance of the pleuritic effusion: but even in these cases, the operation may prove the means, either of great temporary relief, and considerable prolongation of life, or of just the contrary, according as it is, or is not, performed with due reference to sound physiological and pathological principles. The operation has, we admit, sometimes succeeded where these principles do not appear to have been much attended to; but this has been for the most part in young subjects, where the reparatory powers are active, and sufficient to countervail very unfavourable circumstances; and we are confident that it would succeed in many more instances, were it resorted to at the time in the way pointed out by our improved knowledge of the subject. One great error has been to delay the operation too long, until some of the bad consequences of the disease, such as obliteration of the tissue of the lung or deposits in it, surfaces secreting inorganizable matter, and incapable of adhesion, ulceration and even sloughing of the soft parts, caries of the bones, morbid deposits in other parts, and depression of the vital powers generally, prevent the possibility of recovery. Another great error we consider to have been in the neglect of all means to promote the re-expansion of the lung, which is the only natural mode of supplying the place of the fluid drawn off, and is an obvious step towards a restoration of the healthy condition of the parts.

[No very accurate estimate of the utility of paracentesis in empyema can yet be made, for there are no existing data from which precise inferences of the success of the measure can be drawn. In the recorded cases no pains have been taken to ascertain the condition of the other organs, and to determine the presence or absence of pulmonary tuberculization. The probable result of the operation will be determined by the state of the functions in general. It is much more successful in young persons than in those of mature age. When paracentesis is performed at an advanced

period of the disease, it is rarely successful. Puncture of the chest is commonly postponed until the constitution has become seriously compromised. Dr. Walshe says, that "there can be no question that the fitting time for operation has come, when a tendency, insuperable by medical means, exists either to increase or to non-absorption of the fluid," (*loc. cit.* p. 113). The whole history of the case, and the existing local and constitutional states must be thoroughly considered, to enable the physician to seize the propitious moment for surgical interference.]

The operation of paracentesis thoracis has been in use since the time of Hippocrates, and has been held in different degrees of estimation by the very numerous authors who have described it in its various modifications, but a great preponderance of opinion is in favour of its utility and safety when properly performed. It is very remarkable that many of the more important precautions in the operation were attended to by Hippocrates and his followers more than by the greater number of writers down to the present century; and we find from the "aphorisms," that the operation was considered to be the only means of cure, and when these precautions were attended to, and the fluid white and of good quality, the patients recovered. The chief of these precautions were, not to delay the operation after the existence of the empyema is known, and to draw off the liquid gradually, at successive periods, closing the wound in the interval. We must refer to works on surgery for details of the different modes of operating; and we would remark that from the time of Hippocrates to that of Laennec, although many new plans were proposed, little improvement had been made, and the credit of the operation had rather declined than otherwise; but the greater precision conferred by the latter author on the diagnosis and pathology of effusions in the chest, has furnished the means of rendering this operation more successful than it has hitherto been. Formerly the signs of the very existence of empyema and hydrothorax were so uncertain, that many patients have been tapped when there was no effusion: in many, the existence of empyema was not suspected until it had proved fatal, or produced changes which prevented recovery; and in many instances the almost hopeless lesion of tuberculous perforation of the lung and pneumothorax has been joined with liquid effusion, and its incurable character has thrown additional discredit on the operation. But now we have sure means not only of detecting the presence of liquid in the chest, but in a great measure also of discovering the complicated lesions, and of distinguishing the cases which give the operation the best chance of success. The same means also enable us to simplify the operation; for whereas formerly it was expedient to make a long incision with a knife or lancet through the integuments, and then cautiously to divide the intercostal

muscles and pleura with a bistoury, for fear of wounding the lungs or heart, now the surgeon, guided by the physical signs and the exploring needle, may without fear plunge a trocar at once into the chest, thus much diminishing the pain of the operation, and the risk of hæmorrhage.

Before describing the mode of operation which we would recommend, it is necessary to advert to some disputed points in regard to it. One respects the place for making the puncture. In case of the matter forming an abscess in the walls of the chest, there is no choice: this must be opened; but in the absence of such pointing, it is of importance to determine what is called the *place of election*. The majority of the older surgeons preferred the inferior parts of the chest, under the notion that the fluid would ponderate there. But as the fluid occupies the whole pleural sac, and by change of posture may be made to ponderate in any direction, this notion is of no weight in opposition to the risk of wounding the diaphragm and abdominal viscera in these regions. Accidents of this kind have repeatedly occurred. Laennec gives an instance in which a trocar passed between the fifth and sixth ribs on the right side, perforated the diaphragm and entered the abdomen; the diaphragm having been pushed up by an enlarged liver. In other cases, the liver, the kidney, and the lung have been wounded, the latter in consequence of its adhering to the diaphragm. On the other hand, the objection against puncturing the upper parts of the chest is chiefly on account of the greater frequency of adhesions of the lung there. The middle portions of the chest are therefore generally considered the most eligible, between the third and seventh ribs: and as the intercostal spaces are widest, and there is less thickness of the walls at the side, this part is generally selected as the place of puncture. [In selecting the spot for the performance of paracentesis, the presence or absence of adhesions, with their precise limits if existing, must be ascertained; their site should be carefully avoided. The common habit of surgeons has been to operate at the most dependent and prominent spot of the antero-lateral portions of the chest—that is between the third and fourth false ribs on the left side, and between the fourth and fifth on the right. Laennec recommended the space between the fifth and sixth ribs, a little in front of the digitations of the serratus magnus muscle, as the fittest place for puncture. It must be remembered, however, that in enlargement of the liver, this organ not unfrequently reaches as high as the fifth rib, and therefore it would be safer on the right side to puncture the fourth intercostal space, unless the upper surface of this viscus is evidently below the fifth. Nature commonly perforates the chest in empyema by ulceration in or above the fourth or fifth intercostal spaces. M. Cruveilhier

also inclines, on the ground of this fact, to the performance of the operation between the fourth and fifth true ribs.]

Another debated point is, whether as much of the liquid as possible shall be evacuated at once, the aperture left open, and a canula inserted, or a little only at a time and the orifice closed. In regard to the quantity to be drawn off, we are fully persuaded, by the study of recorded cases, and by personal observation, as well as by reflection on the pathology of the case, that the Hippocratic method of evacuating the fluid *gradually at successive times, closing the orifice in the intervals*, is the best; both because it gives the lungs time to expand, and the vessels to adapt themselves to the diminished pressure, and also because it affords the best means of preventing the admission of air through the orifice. For the same reasons we decidedly disapprove of the practice of leaving the orifice open, and particularly of leaving a canula in it. In proportion as the air has free access to the pleural sac, it will irritate it, perpetuate its inflammation, and prevent the lung from expanding, even in cases where it does not cause decomposition of the remaining fluid. But in many instances the fœtor, which in the course of two or three days is perceived in the air and discharge which proceed from the orifice, becomes evidence of the latter mischievous effect of the introduction of air; and not a few patients have obviously sunk under the pernicious influence of the putrid matter thus generated. This result has ensued in some cases even where air has been admitted only in a very small quantity; and we therefore hold it to be highly desirable to prevent the entrance of any air. We are surprised that Dr. Townsend, who otherwise advocates the plan of the gradual discharges of the fluid, and the closure of the orifice, expresses a doubt whether the admission of air be really hurtful, and supports the doubt by the experiments of Nysten and Speiss, who found that air introduced into the healthy pleura was invariably removed by absorption in the course of a few days. These are obviously not parallel cases, and it is highly improbable that air admitted to a serous cavity whose absorbing properties are manifestly impaired, the membrane being covered with products highly disposed to decomposition, will be absorbed without further mischief.

[The practice of those who empty the sac at once, as completely as possible, has been the most successful. The late Baron Larrey, whose operations for paracentesis were eminently successful, insists forcibly on the importance of thoroughly emptying the pleural sac at once, and ascribes the frequent failure of the operation to the pursuance of an opposite conduct. Cruveilhier (Bul. de l'Acad. de Médecine, t. i. p. 165,) pronounces himself emphatically against repeated openings and gradual evacuations. Heyfelder, whose practice has been particularly successful, removes the whole of the fluid at once; and the medical journals contain

numerous cases of recovery in which this plan has been pursued. There is besides another strong objection to partial evacuation—little or no relief is afforded, until the whole or the greater part of the fluid is removed, and in cases where the entire accumulation has not been evacuated, patients have become completely despondent, on finding themselves in as much misery as before the operation. When the whole of the fluid is evacuated at once, a condition of perfect ease, comparatively, will almost instantaneously follow.]

To prevent the admission of air, it has been lately proposed to puncture the chest under water, the patient being in a warm bath; and this expedient is well worthy of attention, particularly in cases where, from the long continuance of the disease, and consequent loss of expansibility of the lung, and elasticity of the walls of the chest, the method to be described afterwards may be insufficient. Several writers have recommended liquid injections with the view both to expel the air and to facilitate the discharge of the matter. The ancients in some cases injected oil and wine to promote the healing of the cavity; and it has repeatedly been tried, and sometimes with good results, to attain this by aromatic and tonic vegetable infusions. Sir P. Crampton used with success an injection of a weak solution of chloride of lime. However useful these injections may be for these purposes, they must in some degree prevent, rather than favour, the re-expansion of the lung. To attain this point, as well as to increase the discharge of the liquid, it has been attempted to suck the latter through the orifice, by means of different kinds of syringes. Laennec proposed using a cupping-glass with an exhausting syringe after the puncture: this contrivance would probably draw off the fluid and promote the expansion of the lung very effectually; but unless the operation be conducted with great care and gentleness, there may be danger of rupturing the lung by the forcible entry of the air into it, or it would be almost impossible in the mode proposed by Laennec to prevent air from entering through the puncture on removal of the cupping-glass. Still we think that the expedient might be useful and safe by means of a little management, by which the canula should be slipped out, and the integuments drawn over the puncture, so as to make it valvular before the cupping-glass is removed, when the orifice might be further secured by means of a compress confined by strips of adhesive plaster.

But we apprehend that the exclusion of air as well as the expansion of the lung, as far as that can be safely attempted, may be effected by applying manual pressure to the walls containing the effusion, and by closing the orifice before that pressure is removed. The following is the manner in which we recommend the operation generally to be conducted.

The spot for the introduction of the trocar must be determined with due reference to the physical signs; carefully avoiding every

part where or near which there is sound of respiration, voice, or not perfect dulness on percussion. A projection and fluctuation of an intercostal space give greater eligibility to a spot; and these circumstances present themselves most frequently at the inferior lateral parts of the chest from the third to the seventh rib, where also the soft walls of the chest are as thin as anywhere. In all cases it is a proper precaution to pass a grooved needle first, as recommended by the late Dr. Thomas Davies; for this at once determines the presence of the liquid, its quality, and the thickness of the walls which contain it at that spot. Of course it is proper to avoid the immediate vicinity of the heart or of any of the known arteries or nerves. The upper margin of the fifth or sixth rib most commonly presents a favourable spot, but whether more or less at the side must be determined by the position of the heart and other circumstances. The patient should be lying on his back, inclining to the affected side, and not more raised than is necessary for the state of his breathing. The skin should be drawn aside, so that the puncture through it may not, after the trocar is withdrawn, correspond with that of the costal pleura, but form a valvular orifice. The trocar should not be pushed in further than is necessary to clear the parietes; but the canula may be pushed in further after the stilette is withdrawn, and its sides should have several holes in them. As soon as the stilette is withdrawn, steady pressure should be applied by a bandage or by the hands of assistants, to depress the shoulder and ribs, and to push up the diaphragm on the affected side, to promote the flow of liquid and to prevent the introduction of air through the orifice during any sudden or forcible act of inspiration. For the same reason, during a fit of coughing, if there appear any tendency to intermission in the stream of liquid, the orifice should be closed by the finger. The pressure should be steadily increased as the liquid flows; and if the stream should stop, a probe may be passed through the canula to clear it of clots of lymph or any other obstructing matter; but if still no more flows, a compress, or if the liquid is purulent, a large poultice should be placed on the orifice; and then, but not till then, the pressure on the walls of the chest may be discontinued. The result will be, that the walls of the chest, expanding by their own elasticity on the removal of the pressure, will draw air into the compressed lung, which, being thus inflated, will begin to resume its part in the function of respiration and circulation, and will thus promote the absorption of the rest of the fluid, and improve the condition of the whole system. Even if the fluid should accumulate again, the temporary expansion of the lung will have served to restore its natural properties, so that when another quantity of fluid is again withdrawn, its tissue will be better prepared for a restoration of its function.

Performed in the manner as directed, the operation is almost free from risk, and will seldom fail to give relief. If the liquid be purulent, it will generally be necessary to repeat the operation several times; but if it be serous, one tapping, which will partially expand the lung, will often be sufficient to give a turn to the disease, its complete removal being effected by nature aided by appropriate remedies.

When the fluid is purulent, we should strongly recommend the injection of warm water with the view to displace it; but instead of doing this, as it is usually practised, with a single tube, it should be done through a double-tubed canula, the tube for injection being cautiously carried two or three inches into the chest, whilst the evacuating tube is merely long enough to pass through the walls. If warm water previously boiled be then thrown in through the long tube by Read's syringe, it will drive the matter through the short tube; and in this way the greater bulk of the secretion will be displaced by water, which is very likely to be absorbed. If, after repeated evacuations, there be no apparent disposition to the expansion of the lung or contraction of the chest, and matter continues to be secreted, it may be useful to use medicated injections, such as a very weak solution of nitrate of silver, or chloride of soda. The pleural sac may be treated as an abscess, and if the discharge be unhealthy, it is quite proper to correct it and to promote the healing of the diseased parts by such means as are known to promote granulation and desiccation of suppurating wounds. When the discharge is fœtid, it is more decidedly necessary to correct it by injections of chlorinated solutions, mixtures of creasote, or other antiseptic liquids. The same practice may be advantageously pursued when the matter has pointed and opened spontaneously, leaving a fistula which may remain open for months and even years. Dr. Townsend mentions the remarkable case of Dr. Wendelstadt, who had been tapped thirteen years before, since which time the wound had remained open and discharged daily to an amount varying from half a drachm to four ounces. The diseased side was much contracted, and did not move in breathing, yet he could blow the flute, walk fast, and actively perform his professional duties.

SECTION II.

PLEURODYNIA.

THE affection usually called Pleurodynia is generally considered to be of a rheumatic character, either in the intercostal muscles, or in the fibrous fasciæ lining the chest. If it occur singly, it may be of little consequence; but if connected with constitutional

rheumatic disease in other parts, whether attended by much fever or not, it is not to be lightly thought of, for it may readily be converted into a pleural or pericardial inflammation. [At first sight this affection may be regarded as of but small importance, and of little gravity, more particularly as the patient states that he has never previously suffered from any rheumatismal symptoms, and that his family has been equally exempt. However, in spite of the apparent benignity, rheumatismal pains of the chest merit all our attention. If they persist for any time, they are almost invariably followed by pleurisy, with effusion in the side corresponding with the pain. Sometimes the effusion forms, by degrees almost insensibly, without any evident precursory symptoms, and without the knowledge either of the patient, and often of the physician. It very often happens that the medical attendant having ausculted a patient at the commencement of pleurodynic symptoms without finding any thing anormal, and not thinking to repeat his exploration, is surprised to find some time subsequently his patient suffering from dyspnoea, with impeded respiration, and, on examining him again, to discover a considerable pleuritic effusion. This should lead to frequent examination of the chest of patients thus affected, in order to be averted of the consecutive lesions that may follow. The production of serous effusions in the pleura from rheumatism of the thorax, bears a strong analogy to the serous effusions in the synovial membranes and the articulations, in consequence of articular rheumatism, as in the knee and elbow, for example. These two kinds of effusion are governed, by all appearances, by the same law. Let not, therefore, pleurodynic pains be neglected, especially when they last any time; treat them on the contrary with care, promptly, and with energy, according to the state of the case.]

SYMPTOMS.—It not unfrequently happens in sensitive frames, particularly those of females, that an acute pain suddenly seizes some part of the chest, causing shortness of breath and perhaps cough, very like the stitch of pleurisy: but there is no heat of skin, and the pulse, although often quickened, is not hard. The respiratory motions and sounds may be diminished by the restraining influence of the pain; but the other physical signs of pleurisy are wanting. There is no friction sound, or dulness on percussion; but there is sometimes a continued dull rumbling sound produced by the vibrating contraction of the muscles, which is kept up by the sensation of pain. [When the nature of the pain, the constitution of the subject, the absence or presence of cough fail to guide us, the progress of the case should be watched for a while before a decided opinion on its nature is hazarded. The combination of pleurodynia with slight bronchitis is one of exceedingly difficult detection.]

The subjoined is a tabular view of the physical signs of pleurodynia :

Inspection.—Movements of expansion and of elevation diminished, as also the partial motions ; jerking rhythm of the general motions.

Percussion.—Clearness of sound not perceptibly altered.

Auscultation.—Respiratory murmurs of intermittent weak type and jerking rhythm.]

These affections appear to be neuralgic, and are often connected with a condition of the system the very opposite of inflammatory, such as that which comes on after considerable losses of blood, or when the blood is in an impoverished state, as in chlorotic females. Sometimes they occur in connection with the periodic plethora of irregular menstruation, and are relieved when the catamenia flows. In such cases blood-letting relieves the pain, but often at the expense of the natural function.

There are other kinds of pain in the chest which may be called nervous, such as those associated with indigestion and a disordered stomach : they are generally referred to the sternum, and in the case of gastrodynia, are so severe as to cause great apparent dyspnoea. Pains are also felt in the chest and shoulders, from a congested state of the liver.

TREATMENT.—The treatment of nervous pains of the chest must be directed more to the condition of the system inducing them, than to the part which seems to be most affected ; for it may be at one time the chest, at another the abdomen, or a limb that is the seat of these pains. [Cut cups,] sinapisms, hot fomentations and stimulants, or anodyne liniments or plasters, will generally relieve the pain. Where the nervous irritation seems to arise from an undue depression or depraved state of the vascular functions, as in chlorosis, the careful administration of tonics, especially steel medicines, with due attention to the state of the excretions, will be most beneficial. When the pain seems to be the result of misdirected rather than of excessive nervous influence, as in amenorrhœa without chlorosis, those remedies are indicated which tend to draw blood and nervous irritation towards the uterus, such as small doses of aloes, the hip-bath, and for a more continued effect, wearing flannel over the hips and thighs, and riding on horseback. If blood is to be drawn at all for temporary relief, it should be by leeches to the inside of the thighs. The application of three or four every night for four or five successive days, sometimes brings on the natural relief when all other means have failed. If there be much tenderness at any part of the spine, all the symptoms may sometimes be relieved by leeches applied to that part.

Nervous pains unconnected with menstruation may be treated with narcotics both externally and internally. Pleurodynia of a

rheumatic kind will require the treatment commonly useful in the form of rheumatism, with which it happens to be associated. It is not necessary here to enter into further details on these subjects.

SECTION III.

PNEUMOTHORAX.

PNEUMOTHORAX (from *πνευμα*, air, and *θώραξ*, the chest) implies the presence of air in the cavity of the chest. The discovery of this disease, or rather of this effect of other pulmonary lesions, is of modern date, though it for a long time received no distinctive name till the term pneumothorax was proposed by M. Itard, and subsequently adopted by writers on pulmonary diseases.

CAUSES.—Pneumothorax may be produced in three different ways:—

1. It may be the consequence of a partial pleurisy. We have mentioned, that after a pleuritic effusion has long compressed the lung, and the compression has been perpetuated by a rigid false membrane formed over it, the absorption of the liquid leaves a void, which the collapse or contraction of the walls of the chest is in some cases insufficient to obliterate, and this void is sometimes filled with air secreted by the membranes. We have seen two instances of partial pneumothorax produced in this way. They each occupied about half of the pleural sac; in one case the upper, in the other the lower half; and the lung in both cases was strongly bound down by fibro-cartilaginous membrane, and condensed in the part contiguous to the empty space. There was also some contraction of the chest in both cases. This kind of pneumothorax is very rare.

2. Another kind of pneumothorax is that which may be called idiopathic, and arises from an effusion or secretion of air into the sac of the pleura without perforation. This is also of very rare occurrence. It is said to occur sometimes towards the termination of fatal diseases, in the same manner as tympanitis occasionally occupies the peritoneal sac under similar circumstances. We have never met with such a case in which the signs of pneumothorax were observed during life; but we have several times seen a little air in the pleural sac when it is opened after death, without any discoverable perforation of the pleura. It is possible that a little air may have been exhaled from the animal fluids after death, and then increased by exosmosis through the lung: the facility with which gases pervade dead membranes countenances such a notion. Pneumothorax is also said by Drs.

Hudson, Graves, and others, to have occurred in a few instances at the commencement of pneumonia, and to have soon afterwards disappeared: but as the chief sign in these cases was a remarkable resonance on percussion, we suspect that these were examples of the production of tracheal or amphoric sound, from consolidation of the upper lobe of the lung, and not cases of pneumothorax.

3. By far the most common kind of pneumothorax is that caused by some unnatural communication between the pleural sac and the external air, and this may be by a perforation either of the external parietes or of the pulmonary pleura. The latter case is now recognized as the usual cause of pneumothorax, and constitutes the great bulk of the examples that are met with. The perforation depends on the progress of the ulceration, generally of tuberculous character, rarely of gangrenous abscess, through the pleura. The circumstance of ulceration reaching and perforating the pleura indicates a low state of the reparative powers, and a want of plasticity in the products of inflammation; for under ordinary circumstances, ulceration could not approach the pleura without causing it to inflame and throw out coagulable lymph, which, becoming organized, forms either a protecting thickness of membrane, or close adhesions to the costal pleura. We see this in most cases of chronic phthisis, where the upper lobes are generally adherent to the ribs. We have seen ulceration extend from a tuberculous cavern across the two layers of the pleura thickened and adherent, and completely through the walls of the chest, so that when the patient coughed, air bubbled out of two or three fistulous openings in the front of the chest, but there was no pneumothorax. On the other hand, we have met with more than one case in which the adhesive process seemed quite incapable of protecting the pleura, which was consequently perforated at several points, wherever in fact the ulceration of the lung reached it, and air freely passed into the pleural sac by all these holes. More commonly, however, there is only one perforation; and this is generally near the apex of the lung, in connection with some of the cavities which first form there.

[The causes of pneumothorax, and their relative frequency may be thus enumerated. The rupture of a tuberculous cavity into the pleura is the most frequent; then the production of air either by the pleura, or from the decomposition of pleuritic or sanguine accumulation; next gangrene of the lung, and the rupture of an apoplectic collection into the serous cavity. Well-marked pneumothorax has also in some few instances been produced by the rupture of several emphysematous vesicles. Instances are also recorded where pneumothorax followed the bursting of a pulmonic abscess, or of hydatids of the lung or liver; cancer of the lung; cancer of the stomach; abscess of the bronchial glands;

and rupture of the œsophagus. Of one hundred and forty-seven observations of pneumothorax, by M. Saussier, eighty-one were in consequence of rupture of vomicæ; twenty-eight followed chronic pleurisy; eight, gangrene of the lung; five, emphysema with rupture of the vesicles; three, hydatids of the lung; three, wound of the lung following contusion of the chest; and one, the remaining conditions. Pneumothorax consecutive to the perforation of a pneumonic abscess, occurs sometimes in children. We have already seen how frequent abscesses were in the pneumonia of children, and how superficial is their situation. Those perforations are in general of small diameter, varying in size from a pin's head or a crow's quill, to even a small lentil. Their orifice is generally round, and is formed sometimes by the borders of the pleura, which are as thin as a sheet of paper. In three recorded cases the orifice was single; in one, multiple. Their situation was generally in the inferior lobe. The perforation was in none of the cases, in any wise connected with tubercles.]

The completion of the perforation is in most instances sudden—a part thinned by ulceration, and imperfectly adherent, giving way during a fit of coughing, or some other unusually forcible act of respiration. We have met with an instance in which external violence produced the rupture.

[SITE.—The location of pneumothorax differs with the exciting cause. When it results from phthisis pulmonalis, it is more frequently on the left than the right side. In eight cases cited by Louis, seven were on the left side. Saussier, in a larger number of cases, found the ratio something less; fifty times on the left; twenty-five on the right; once on both sides; and in four the seat was not indicated.

ANATOMICAL CHARACTERS.—On making a small puncture into that portion of the chest which is resonant, air escapes with a whistling sound, and with sufficient force to extinguish a light held near. If the opening be made over the portion of the chest which is dull, a purulent or sero-purulent fluid flows out, at first without noise, but it soon becomes mingled with bubbles of air, and then escapes in a less continuous stream and with more or less noise. The gas contained in the pleura is sometimes inodorous, and sometimes very fœtid, having the odour of sulphuretted hydrogen or of garlic, &c. According to the chemists, it contains a large proportion of carbonic acid and nitrogen, whilst the quantity of oxygen is greatly diminished. Some analytical chemists have discovered a small portion of sulphuretted hydrogen. The quantity of liquor varies very much; sometimes it occupies nearly the whole cavity of the pleura, at other times there is little or none. It is serous, purulent, or sero-purulent, greenish-yellow,

or grayish, and sometimes, though rarely, white, like pus. In one case, Dr. Louis found it reddish, turbid, and similar, except in density, to that contained in tuberculous cavities. The pleura is lined with false membranes, ordinarily very thick, easily torn, moist, yellow, and of recent formation. These false membranes should be distinguished from those which existed anterior to the pneumothorax, and which, in tubercular cases, occupy the summits of the lung. These are white, dense, strong, close, and by their characters, disclose the age of their formation. Sometimes, though rarely, the new false membrane is thin and of a variable colour. In one case Laennec found it black, and attributed this to the contact of the sulphuretted hydrogen which was in the gas. Sometimes ulcerations are found in the pleura, and are by some attributed to the corroding influence of the fluid. Gangrenous eschars were found in one case by Laennec. The lung is compressed against the vertebral column, and its diminution in size corresponds with the degree of liquid and gaseous effusion. In some cases, owing to the resistance of the bands, it is less compressed. Its tissue is soft, non-crepitating, containing nearly always more or less tubercles, and carnefied in those portions where no other lesion existed but that produced by the compression. But the most important lesion, and the one most difficult to discover, is the perforation of the lung, the cause of all the symptoms. It is sometimes large and easily perceived, and sometimes the surface of the lung is perforated with a number of small holes. In Dr. Louis's cases there was but one perforation, but he observed a disposition which explains how multiple perforations may occur. He found in many cases on the surface of the organ, a large number of yellow and white spots which corresponded to as many softened tubercles, separated from the pleura by less than half a line in thickness, just about bursting into the cavity of the pleura. Sometimes the fistula is very narrow, and sometimes it is covered by false membranes, and is discovered with great difficulty. The best method to ascertain the fistula in such cases is to fill the cavity of the pleura with water, and blow through the trachea; the escape of air will reveal the seat of the perforation. If this method fails, the false membranes should be carefully removed, and then proceed as before. Pneumothorax in phthisis is almost always at the summit of the lungs. The opening of the fistula is sometimes oblique, sometimes direct, and the course of the fistula varies also. In the very great majority of cases the fistula, where the perforation is due to the rupture of a tubercular or gangrenous cavity, communicates with the bronchi, but sometimes (and Louis has cited instances) the tuberculous mass being very superficial, this communication does not exist, but the air escapes through the opened vesicles, as is the case in rupture of emphysematous cavities.

The lesions proper to the primitive disorder are also found in those who have died of pneumothorax.

Sometimes, however, (and Saussier gives twenty-nine cases of this kind, out of one hundred and forty-seven,) there are only the lesions due to pleurisy with or without consecutive perforation of the lung. In those cases where the consecutive perforation is ascertained, the pneumothorax is easily understood; but the explanation is much more difficult, in those cases where no perforation is discovered, and some doubt may be allowed to be entertained of the exactness of the anatomico-pathological examinations. Saussier cites an example where, after an attentive examination, no perforation was discovered, but the amphoric hissing was constant during life; and how can we conceive the existence of this sign without bronchial communication? Yet after death, on the opening of the chest, no gas escaped; this he explains from its having been re-absorbed. Was the diagnosis in this case incorrect? Andral published two cases of pneumothorax without communication, and subsequently discovered the causes of his error. With this example we should be very careful in admitting cases of pneumothorax without communication with the external air.]

SYMPTOMS.—The immediate effect of the perforation is to admit air more or less rapidly into the pleural sac, which, by equalizing the atmospheric pressure outside and inside of the lung, permits it to assume that state of collapse to which its natural elastic contractility would reduce it. Hence dyspnœa, sudden and severe in proportion to the extent to which the air enters and the lung becomes collapsed. But the access of air to a serous membrane totally unaccustomed to it, with perhaps the discharge of matter from the ulcerous opening, also occasions great irritation and consequent inflammation of the pleura. Hence a sudden, sharp pain, and dry cough, with spasms of the intercostal muscles, and a weak, quick, and sometimes irregular pulse. Soon the irritation becomes accompanied with inflammatory reaction, and then follow the symptoms of acute pleurisy with heat of skin and inflammatory pulse; and liquid effusion is added to the air in the pleural sac.

Although a perforation of the pleura will not fail to introduce air into its sac, the amount and effect of this introduction of air will vary considerably according to the size and other conditions of the ulcerated opening. If this be very small, or if, as it not unfrequently happens, it be so placed that the walls of the chest close it in expiration, by which it is rendered valvular, or if it be below the level of the liquid, the air introduced by each inspiration will not escape as freely in expiration, and the result will be the progressive accumulation of air in the pleura, and a consequently increasing compression of the lung and dyspnœa; and in

this way perforation of the lung has in some cases caused suffocation within a few hours of its occurrence; in others this catastrophe has been delayed by the egress of the air by accidental changes of position, by violent coughing, or by puncturing the chest. If the aperture be of larger size, and no impediment occur to the passage of air through it, it will interfere with respiration only so far as it suffers air to pass outside of, instead of into, the lung. But when the air passes thus freely, the pleura is more irritated by it, and there is a more copious secretion of liquid, which is generally more or less purulent and often fœtid. In either of these cases after the subsidence of the spasm, pain, and dyspnœa, first caused by the entry of the atmospheric air, there are no characteristic general symptoms which can serve to distinguish pneumothorax. The occurrence of perforation may sometimes be suspected from the sudden supervention of acute pain of the side and oppression, which the patient in some instances refers to something having given way during a fit of coughing. But such sudden attacks sometimes take place from pleurisy without perforation, and we have repeatedly known perforation happen without being followed by any remarkable increase of pain or distress.

The *physical signs* of pneumothorax are generally very remarkable and distinctive. The presence of air in the pleura will give to the walls of the chest a freedom of vibration, and therefore a degree of resonance on percussion, even greater than that which the air-filled structure of the lung confers upon them; so that percussion will give more of the drum-like note or tone which is obtained by striking on the region of the stomach or cæcum. This is more marked in proportion as the quantity of air is considerable. The same circumstance will also impair or destroy the sound of respiration; for the air not only removes to a greater distance the pulmonary structure in which this sound is produced, but also by its pressure diminishes that entrance of air into the cells on which the sound depends. There will be therefore this remarkable contrast of signs to distinguish pneumothorax—a clear or hollow sound on percussion, with little or no sound of vesicular respiration, whilst the healthy side gives a duller sound on percussion, but a much more distinct respiratory murmur.

There is, however, produced in air-filled cavities another class of sounds, which often gives decisive evidence of their existence. The character and cause of these sounds may be shown by a simple experiment. If the mouth of a caoutchouc bottle be held to the ear, and its outside struck, each stroke causes a short tinkling note, like the clink of a piece of metal or glass. This note is a kind of echo, produced by the reverberations or repeated reflections of the impulse from the walls of the cavity, and it is shrill and acute because the reflections are short and quick in so small

a space. The same kind of note may be heard in other hollow bodies, such as an empty cask; but it is there less shrill, because the space is larger. Any sound proceeding from, or communicated to, the interior of the cask, the caoutchouc bottle, or any cavity in the body with reflective walls, will be accompanied or followed by this sort of tinkling or ringing echo, which will be more prolonged and distinct in proportion as the walls are perfectly and uniformly reflecting. Sounds of this kind may often be heard on using the stethoscope over the stomach and large intestines, as their contents move and cause a sound within them. So too this tinkling echo may accompany the sounds proceeding from an air-filled cavity in the chest, and it becomes a distinctive sign of the existence of such a cavity.

In idiopathic pneumothorax, and in that partial kind resulting from the absorption of a pleuritic effusion confined by adhesions, although the cavity be present, there may be no sound produced in it, or transmitted to it, so as to cause the tinkling echo. Sometimes percussion on the external walls will do this; and we have heard the metallic tinkling accompany both the voice and the cough in a case of partial pneumothorax without liquid effusion or perforation of the pleura, the sound being transmitted to the cavity through the condensed tissue of the lung. But it is where the pleura is perforated and where liquid is present, that the phenomenon of metallic tinkling is commonly heard; not, as Laennec supposed, because these conditions are essential to its production, but because the motions of the liquid or of the air through the orifice make sounds within the cavity which serve to show its echoing properties. So metallic tinkling has often been heard after the operation for empyema, manifesting the presence of air in the pleura.

DIAGNOSIS.—Perforation of the pleura, with its consequence, pneumothorax and liquid effusion, is not a very uncommon accident in the course of phthisis; and its signs are so remarkable, that they can scarcely fail to be recognized even by those who are but moderately versed in auscultation. The tinkling echo may present several modifications, which it is useful to notice, as they serve to give a more accurate knowledge of the condition of the parts and of their tendencies. When the perforation is small, or obstructed by its position against the walls of the chest or below the level of the liquid, the tinkling is seldom heard except on coughing or taking a full breath, which reaches the cavity and may throw the liquid into bubbles. The voice may also sometimes reach the cavity through a consolidated portion of the lung, and then it will be accompanied by a tinkling. When the orifice is large and free, the air will pass in and out in ordinary breathing, and will produce in its vicinity a sound like that of blowing into

the mouth of a glass bottle: this kind of respiration is therefore called *amphoric*. In such cases there is seldom so much oppression of the breathing as in those where the air passes less freely and accumulates in the cavity. In listening for the tinkling phenomena it must be held in mind that they may be audible only in certain parts of the chest where the lung is not adherent, and where the liquid effusion does not reach. Generally, in the sitting posture they are heard best about the mammæ and the lower part of the scapula and axilla; but we have heard them in some cases in every part of the affected side, and in others only in one spot. In fact, there must be a certain degree of tension in the walls of the cavity to make them good reflecting surfaces, and if this be deficient at the spot of the cavity opposite to that on which the stethoscope is applied, the sound may be absorbed and not reflected.

The addition of the liquid to the air in the chest makes the diagnosis still more easy. By percussion we can find the exact level to which the liquid rises, and that this level moves with change of posture; this is much more distinctly perceptible than with simple liquid effusion. The motions of the liquid may further give very decisive evidence of its presence with air in the cavity. On change of posture and on coughing, the liquid will sometimes drop from the parts which have just been immersed; and the sound of this will exhibit the metallic ringing in so distinct a manner, that it resembles the note which a glass or porcelain vessel yields when struck. If the liquid be agitated more forcibly, as by the patient giving his trunk an abrupt jerking turn, or being violently shaken, it may be heard to splash most distinctly against the walls of the chest: this is the sign of *succussion* described by Hippocrates. It may be best heard by applying the ear to the chest at the time of the movement, and then the tinkling is heard to accompany it, and sometimes to follow it as the liquid drops from the sides, or the bubbles break on its surface. The splashing is not easily produced, unless there be a good deal of air in the pleural cavity with a moderate quantity of liquid. The proportions of these are, however, better ascertained by percussion.

[The diagnosis of pneumothorax does not produce great difficulties. The manner and circumstances under which the symptoms occur, and the means offered by physical exploration, enable us to ascertain the presence of this disease. A violent pain in the chest suddenly occurring, and quickly followed by suffocation, oppression, extreme anxiety, should lead us to suspect pneumothorax under the following circumstances;—if the subject is tuberculous; if there has been gangrene of the lungs; if he has received a violent blow on the chest, followed by pectoral symptoms. If, on examination, we find the chest tympanitic, with feeble respira-

tion over the same portion—the respiratory murmur seemingly produced at a distance from the walls—or suppressed respiration; no tussive and vocal resonance; dilatation of the chest; amphoric respiration; metallic tinkling; and, (if there be hydro-pneumothorax,) hippocratic succussion; we may decide positively on the presence of a gaseous or sero-gaseous effusion into the cavity of the chest.

Pulmonary emphysema presents some of the physical signs of pneumothorax—dilatation of the thoracic parietes, protrusion of the intercostal spaces, and diminution of the respiratory murmur with increased sonoriety over a portion of the chest. But in emphysema these symptoms do not occur suddenly, but are, on the contrary, slowly developed; sharp pain in the side has not existed; and the dyspnœa is paroxysmal, and not continuous as in pneumothorax; the respiratory murmur is feeble, but never suppressed, and is superficial, whilst in pneumothorax it is produced at a distance. When thoracic fluctuation can be produced, or metallic tinkling is heard, of course no doubt of the nature of the disease can exist.]

PROGNOSIS.—The prognosis of pneumothorax from perforation must be generally unfavourable, because, besides its own formidable character, in the vast majority of cases it arises from tuberculous disease of the lungs. Provided, however, the tuberculous disease be very limited, it does not seem unreasonable to think with Laennec that the case may not be entirely hopeless. Laennec mentions an instance in which pneumothorax lasted for six years. Dr. Houghton describes another in which the individual survived the perforation eighteen months, and probably would have lived longer if he had not imprudently exposed himself in his work as a bricklayer; for the signs of the cavity had disappeared, the side had contracted, and the general health had been much improved. In a case related by Dr. Stokes the patient lived for many months, during which he rode much on horseback, and could hear a splashing in his chest when he trotted or cantered. We have known two patients with pneumothorax leave the hospital with the impression that they were nearly well, having gained flesh, and lost the worst phthisical symptoms after the first severe consequences of the perforation had subsided. In such cases, which are to be considered exceptions to the general rule, the production of the new disease in the pleura seems to act favourably in retarding the tuberculous affection of the lungs; and if this be of limited extent, it is possible that it may be removed, the wound on the lung cicatrized, and the cavity of the pleura obliterated by contraction and adhesion.

TREATMENT.—The measures calculated to relieve the symptoms

of pneumothorax with perforation vary considerably according to the period of the lesion, and the condition of the system. In the first instance the perforation and access of air and matter to the pleural sac are often attended by considerable prostration of the system with rapid feeble pulse and faintness, together with the pain and cough, which are then the result of irritation rather than inflammation. Considerable doses of opium or morphia are necessary to allay this irritation; they may be advantageously combined with calomel and antimonials; and sinapisms or warm fomentations may be applied to the affected side. More active antiphlogistic measures cannot be used until the reaction takes place, which generally begins in a few hours, bringing with it heat of the skin, strength and hardness of the pulse, and great soreness as well as pain of the whole affected side; then blood-letting, chiefly local, must be used, with aperients and salines, according to the strength of the patient, and the degree of fever present. These may be followed by blistering or tartar-emetic counter-irritation in proportion to the continuance of the inflammatory symptoms. But it is not to be forgotten that perforation of the pleura and its consequence are almost always added to a previously existing disease, tuberculous phthisis: and the degree of advancement that this may have reached must much limit the propriety and efficacy of the measures for this accidental inflammation that has been excited. The same considerations are to be kept in view when, in consequence of the smallness of the perforation, or its valvular condition, air accumulates in the chest and becomes the cause of oppressive dyspnœa. The immediate indication in this case is, doubtless, to give exit to the air by puncturing the chest; and this has been done in several instances with great temporary relief. But before this operation is prescribed, it should be considered whether, as the relief from it will be but temporary, the condition of the patient be such as to make this likely to outweigh the pain and risks of the operation. These certainly are not great; but when added to the dubious view in which the friends of the patient may regard an operation which proves but imperfectly successful, they are sufficient to deter us in many cases from recommending it. The case is different when the accident occurs before the consumptive disease has advanced far, when there is much flesh and strength, and when the physical signs have shown that there is a large proportion of sound lung. The operation may be repeated if the air accumulate again. As it is impossible to avoid the continued introduction of air into the chest, the mode of performing the operation is a matter of much less consequence than in empyema. It is more desirable to puncture below the level of the liquid, to allow this as well as the air to escape.

CHAPTER VII.

[DISEASES OF THE BRONCHIAL GLANDS.]

SECTION I.

BRONCHIAL PHTHISIS.

THIS is almost exclusively a disease of childhood. It is frequent and serious, and has been accurately studied, only within a few years past.

ANATOMICAL CHARACTERS.—All the varieties of tubercle are found in the bronchial gland. Tubercular infiltration is the most common; next, miliary tubercles; then yellow granulations, and gray granulations; and lastly, tuberculous dust. Ordinarily the central portion of the gland is the first invaded; and the tuberculization extends gradually to the circumference; in other cases it is irregularly disposed, gray granulations being found in the centre of the organ, whilst the periphery is already converted into a tubercular mass; later, the entire gland degenerates, increases in size, and becomes as large as a filbert or a chestnut. Sometimes five or six of the external glands, surrounding the root of one or both lungs, only are enlarged; at other times these are much more numerous, and form large masses. The internal ganglia never exceed a small almond in size; they can be traced to the third and even fourth division of the bronchi. These glands are enveloped by a thin cyst, to which a layer of tuberculous matter closely adheres. When the degeneration is recent, and the tubercular matter is not softened, the wall of the cyst is single; later, there are two membranes, one internal, and the other external. In the course of time the tubercular matter softens, either from the centre or at the surface, the matter is eliminated by ulceration, and adhesion takes place between the walls of the cyst and some neighbouring organ, into which the contents of the cyst is evacuated. Sometimes the cyst is found only half-filled, without any of the matter having been discharged; in this case absorption has probably taken place. Sometimes a small portion of the tuberculous matter passes into the cretaceous state. The enlarged glands may compress, or adhere to the neighbouring organs. The former lesion produces curious physiological effects, and is interesting in

the symptomatology of the disease. The enlarged ganglia may compress and even obliterate the great vessels—as the vena cava superior—giving rise to hæmorrhage into the cavity of the arachnoid and œdema of the face—the aorta, the vena azygos, and the pulmonary arteries and veins, causing, indirectly, œdema and hæmorrhage. The trachea and bronchi may be compressed, and the latter almost obliterated. The internal glands often compress the tissue of the lung as well as the pneumogastric nerves and their branches, whose filaments are flattened and displaced and their tissue altered. Several instances of displacement of the œsophagus are mentioned.

The glands contract adhesions with the neighbouring organs; those with the bronchi are the most common, and take place by the medium of cellular tissue, which is at first loose, and subsequently becomes dense; the adhesion is finally quite intimate, so that you cannot separate the gland without a portion of its tissue remaining attached to the side of the bronchus; finally, a communication is established between the ganglia and the bronchi, either by the softening of the tubercular matter, or by absorption from pressure. The character of the perforations varies according as they are recent or ancient, and whether they communicate with a cyst filled with softened tubercular matter, or are in contact with a crude tubercle; in the latter case the edges of the perforation are sharp, rounded, and not injected; in the former, on the contrary, the wall of the bronchus, in connection with the cyst, is of a bright red, the edges of the perforation are ragged, and sometimes the debris of cartilaginous rings are found. The progress of the ulceration is evidently from without inwards, and cannot be mistaken for the effects of inflammation of the mucous membrane of the bronchi. The position of the cyst, in those cases where it communicates with the bronchi, varies; sometimes it is situated in the neighbourhood of a primary bronchus, and is but remotely connected with the lung; in this case a soft, fluctuating tumour, varying from a hazelnut to a pigeon's egg, is situated on the anterior or posterior face of one of the two primary bronchi; on cutting into it more or less whitish curdy fluid escapes; when emptied, it is evidently lined interiorly by a red, uneven, thick false membrane, different in colour and aspect from the mucous membrane of the bronchi, but continuous with it. In contact with the false membrane is a layer of whitish tissue, dense and tuberculous, sometimes softened and lamellated, which simulates a second false membrane. When the cyst is exterior to the lung, a communication appears to be established between the tissue of this organ and the ganglionic cavity; a section of the lung and cyst shows the parenchyma traversed by cavities separated by walls formed by the carnified pulmonary tissue. These cavities, which communicate largely with the bronchial cysts, are lined with a false membrane entirely identical.

They are generally the bronchial cysts which have penetrated the lung, depressing its tissue, and are not due to the destruction of the pulmonary tissue. Sometimes the bronchial cyst communicates with a tubercular cavern in the lung, and this communication takes place by means of cylindrical canals, lined by a membrane analogous to that of the ganglionic cavity. When the ganglion is deeply seated in the interior of the parenchyma, and communicates largely with the bronchi, or has produced ulceration of the neighbouring tissues, these cysts are often mistaken for caverns; their situation and structure, with the condition of the surrounding tissue, will, however, serve to distinguish them. The pulmonary vessels are sometimes, though rarely, perforated, and occasionally also the œsophagus.

There is a great tendency to union between the ganglionic and the pulmonary tubercles. In children, tubercular matter in the lung has a great tendency to be deposited on the surface, beneath the pleura. There may also occur a junction of a pulmonary cavern and an empty ganglionic cyst.

SYMPTOMS.—Bronchial phthisis is rarely uncomplicated, its general and local phenomena being frequently conjoined with those of phthisis. Or, it may not be well marked, no characteristic symptoms occurring, owing to the glands not being sufficiently enlarged to interfere with the neighbouring organs. Sometimes it is from the first the principal disease. When uncomplicated, the early symptoms resemble those of phthisis; there is cough, with undefined thoracic pains, accompanied by slight fever, and more or less profuse sweats; at other times the cough is paroxysmal without sibilus or vomiting, and in the interval there is acceleration of pulse and of the respiration, or more or less oppression, accompanied by a noisy sonorous rhonchus, which is heard at a distance and is intermittent, and a peculiar hollow cough. These are the first morbid phenomena. These symptoms, or others—as the swelling of the face, great irregularity in the rhonchi—are sometimes the first and only appreciable symptoms at an epoch, when we have assurance from other phenomena, of the tuberculization of other organs.

When the disease is fully developed, whether it is primitive or consecutive, it usually offers the following symptoms. The face, often natural, has at other times, the same appearance as that of a child labouring under disease of the heart—it is pale, with the cheeks and lips violet, and slightly œdematous, and this œdema appears and reappears several times in the course of the disease; the veins of the neck are dilated; the decumbiture is ordinarily indifferent; at other times the child sits down as usual during the paroxysm of dyspnœa, or when the oppression is considerable. Sometimes the respiration is natural, at other times it is accelerated and rises to 36 or even 60 in a minute, according to the

age of the child. In rare cases there is a noisy rhonchus, resembling tracheal rhonchus, which is heard at a distance. The cough, which usually constantly exists, offers no special character in some cases; in others it preserves that just mentioned. In some cases auscultation either does not indicate any thing, or merely pleural or pulmonic disease. In others, the physician discovers at the posterior part of one side of the chest considerable feebleness in the respiratory murmur; this feebleness yields sometimes after a deep inspiration. In most cases, however, you find in one or other interscapular space, rarely anteriorly, modifications in the respiration, remarkable for their great irregularity. Thus, one day there will be prolonged expiration: another day, interrupted or even cavernous respiration, with or without moist rhonchi, and then again prolonged expiration. At other times there is a large mucous rhonchus, the resonance of that in the trachea, or else sonorous or sibilant rhonchi, remarkable for their extent and persistence. Sometimes percussion gives no positive information; at other times there is permanent diminution in the sonorousness of the chest.

The malady continuing to increase, these symptoms persist singly, or combined; sometimes asthmatic paroxysms supervene, with an intermittent alteration of the voice. At the same time tuberculization of other organs appears or increases. The general symptoms which existed from the commencement augment, or they now appear; the strength fails; emaciation occurs or increases; fever persists, with evening exacerbations; the sweats augment or appear; in a word, all the train of symptoms of phthisis takes place, and the child dies in the last stage of marasmus.

Death is sometimes hastened by accidents,—as profuse hæmoptysis, a meningeal apoplexy, or perforation of the pleura with pneumothorax.

The progress of bronchial phthisis is generally chronic, though, occasionally, it is tolerably acute.

CAUSES.—The causes of bronchial phthisis are those which produce tuberculization in general. Measles and hooping-cough especially seem to determine the disease.

Children of all ages are equally liable to bronchial phthisis; it is perhaps rather more frequent in very young children, but very advanced tuberculization is more common from six to fifteen.

Girls are less subject to this lesion than boys up to eleven years of age, but as puberty approaches, the ratio between the sexes becomes about the same.

DIAGNOSIS.—The symptoms that we have enumerated depend, as has been said, principally on the enlarged bronchi pressing on the neighbouring organs and interfering with their functions. Where the glands have not acquired any size, and when the dis-

ease is about beginning, the diagnosis is difficult and obscure, and it is often only by exclusion that we can arrive at it.

If, in a child, three or four years old, there supervene cough, emaciation, fever, sweats, without the physical signs of tubercles in the lungs on attentive exploration, and without symptoms of cephalic or abdominal tubercles, the existence of bronchial phthisis may be suspected. This presumption becomes certain if the character of the cough changes, if it occurs in spells, without sibilus or vomiting, or becomes hollow, or if we hear a loud rhonchus in the trachea, or loud sibilant or sonorous rhonchi in the bronchi remarkably persistent, if paroxysms of asthma, or a great and intermitting alteration of the voice, or œdema of the face obviously depending on no other appreciable cause, occur. The physical signs should be carefully weighed. They are, as has been said, very fluctuating. The mobility of the auscultatory phenomena, compared with the fixedness of those derived from percussion, should serve as a base for our diagnosis. The portion of the chest where the alterations in the respiration are heard, should be borne in mind. The physical signs of bronchial phthisis are found generally at the superior part of the chest, and principally in the interscapular spaces, at the root of the lungs. Sometimes, though rarely, they may be detected anteriorly. If, then, in a child attacked with a chronic pulmonary complaint, the signs of tubercles in the interscapular space are ascertained, one should be led to believe, if their progress and intensity are variable, that there is bronchial tuberculization. The extreme ganglia in the groins, axillæ and neck, should be carefully examined, especially the latter, which sometimes form a string, which, descending to the clavicle, seem to be continuous with the tracheal ganglia.

Bronchial phthisis can be confounded with whooping-cough, phthisis pulmonalis, and tumours in the mediastinum.

The differential diagnosis between tuberculization of the bronchial glands and whooping-cough is very important. In both the urgent symptoms are paroxysmal, but one is susceptible of being cured, whilst the other is necessarily mortal. The subjoined synoptical table contains the prominent features of each disease.

Whooping Cough.

Often epidemic; attacking several children of a family together, and transmissible by contagion.

Has three distinct periods, in the second of which only is the cough paroxysmal.

Paroxysms of cough, with whistling inspiration, vomiting, and stringy expectoration.

Respiration natural in the intervals of the paroxysms.

Bronchial Phthisis.

Isolated, and non-contagious.

No distinct stages.

Paroxysms generally of short duration, without whistling inspiration; stringy expectoration; and vomiting.

Physical signs of ganglionic tuberculization; but, in certain cases, absence of these signs.

In the intervals of the paroxysms, respiration and pulse natural, when the disease is simple.

Voice natural.

Progress of the disorder acute.

Asthmatic paroxysms in some cases, alternating with the paroxysms of cough; continued febrile movement, with evening exacerbations; sweats; progressive emaciation, &c.

Sometimes the voice is changed.

Progress chronic.

The symptoms that we have detailed will serve to distinguish bronchial from pulmonary phthisis, or enable us to recognize the former when it complicates the latter. When both affections have the same intensity, the diagnosis is often impossible.

No other disease of infancy offers the same reunion of symptoms from compression; in adults the same symptoms occur where tumours are developed in the anterior mediastinum, or in the thoracic ganglia; and also from aneurism of the aorta; but these are unknown in infancy.

PROGNOSIS.—If the tuberculization were limited to the bronchial glands, the disease, though grave, would be less so than pulmonary phthisis—the secondary inflammations being absent, which are so frequent a cause of mortality in the latter disease. But the accidents resulting from the connection between the tuberculous ganglia and the neighbouring organs, render the prognosis serious. These are hæmorrhage into the lung and beneath the arachnoid; perforation of the lung and œsophagus; compression of the blood-vessels, nerves and bronchi, producing deficient hæmatosis, and serous effusions. The immediate danger depends on a number of circumstances—the intensity of the lesion; the condition of the lungs; the general state of the child; the violence of the fever; the appearance of secondary lesions in the lung and other organs; the age of the patient; sex, &c.

Certain symptoms indicate a speedy fatal termination—as persistent œdema of the face after the disease has existed for some time, hollow cough, loud tracheal rhonchus, asthma, great debility, aggravation of the general symptoms, and increase of the dyspnœa.

TREATMENT.—When the physician is satisfied of the existence of bronchial phthisis, he should immediately adopt such means as will arrest the further deposition of the tubercular matter, and procure the absorption of that which has been already deposited. To meet these indications the preparations of iodine should be immediately resorted to, unless decidedly contra-indicated. The iodide of iron is perhaps the best form in which the iodine can be administered, or we may employ Lugol's solution, or the iodide of potassium.

37. R.—Ferri iodid. gr. v.
Aq. destil. f $\bar{3}$ j.

M.

Sig.—A teaspoonful three times a day, in sugared water, gradually increased to two teaspoonfuls.

Or,

38. R.—Syr. Ferri iodid. f $\bar{3}$ j.

Sig.—Two drops three times a day in a wineglassful of sugared water, gradually increased.

Or,

39. R.—Iodinii, $\bar{3}$ j.
Potass. iodid. $\bar{3}$ ij.
Aq. destil. f $\bar{3}$ vij.

M.

Sig.—Three drops twice a day, gradually increased.

Ioduretted frictions should be used in the superior anterior portions of the chest, and in the interscapular region. The iodine may be employed in the form of solution, or of ointment.

40. R.—Iodinii, $\bar{3}$ ij.
Potass. iodid. $\bar{3}$ iv.
Aquæ destil. $\bar{3}$ v.

M.

Or,

41. R.—Iodinii, gr. xij.
Potass. Iodidi, $\bar{3}$ ss.
Adipis, $\bar{3}$ ij.

M.—Ft. unguent.

Sig.—Rub in a drachm two or three times a day.

Conjoined with this treatment tonics should be administered, with a mild, nourishing diet, salt bathing, and exercise. Warm clothing is all important, and flannel should be worn. The earliest signs of disorder of the stomach and bowels demand attention, and they must be removed by appropriate medicines and food.

The cough is a very urgent and distressing symptom in bronchial phthisis, and the attention of the medical attendant should be early directed towards it. Opiates succeed best in calming it, and of these the extract of conium or lactucarium has been highly recommended by Dr. Ley. Narcotic and antispasmodic liniments may also be advantageously applied to the chest, and antispasmodic enemata at the same time administered. During the paroxysm, any portion of the clothing which may compress the vessels of the neck, or embarrass the motions of the chest, should be immediately removed.

During the intervals of the paroxysms the child should not be teased or irritated, and means should be resorted to, to reduce, as much as possible, morbid excitability. The tincture of hyoscyamus in hop tea has been highly recommended for this purpose. An equable temperature should be constantly maintained, and every thing calculated to excite asthmatic paroxysms should be sedulously eschewed, as the inhalation of dust, smoke, &c.]

CHAPTER VIII.

DISEASES HAVING NO DETERMINATE SEAT.

SECTION I.

SPASMODIC ASTHMA.

THE air-tubes are throughout endowed with nervous and muscular fibres, the functions of which contribute to the due performance of the act of breathing. The amount of the assistance which they thus contribute in health is not well known, but a morbid defect or excess of their operation is the cause of a peculiar class of affections of the respiratory organs of a nervous or spasmodic character, including *Laryngismus Stridulus* (Spasm of the Glottis), which has been already described, *Spasmodic Asthma* and *Atonic* or *Paralytic Dyspnœa*, *Hooping-cough* and *Neuralgia* or *Morbid Sensibility of the Air-tubes*.

PATHOLOGY.—The term *asthma* is generally given to dyspnœa occurring in paroxysms. We have seen that attacks of bronchial congestion and bronchial flux may come on suddenly, last a longer or shorter period, and cease in such a manner as to merit the name of *asthma*; by which in fact, they are generally known in this country. In the greater number of cases of asthma, there is reason to suppose that one or other of these affections or some degree of inflammation is present, and, by increasing the irritation or the irritability of the bronchi, causes an undue contraction of their circular fibres. An increased vascularity of the bronchial membrane may heighten its sensibility, and augment the contraction of those fibres that are in relation to it; and the same effect may ensue from the irritation of an unusual quantity or quality of the secretion within these tubes. So on the other hand, the continuance of inflammation, the thickened and altered condition which it induces in the membranes, may tend to impair their sensibility, and injure in proportion the contractility of the air-tubes. In all these cases, the modification of the sensibility and contractility of the air-tubes is secondary to other lesions that are more essentially vascular.

But there are also cases of asthma of a purely nervous charac-

ter; and this is sufficiently pointed out in the temperament of the patient, the nature of the exciting causes, the very sudden attack and removal, and the irregular duration of the affection. Thus it commonly occurs in nervous or hysterical subjects. The attacks are excited by strong or peculiar odours (such as the smell of a stable or of ipecacuanha), close rooms, sudden changes or particular conditions of the atmosphere, irritations of the stomach, mental emotions, disordered menstruation, and the like.

[All cases of paroxysmal difficulty of breathing were for a long time designated under the name of asthma, whilst dyspnoea or orthopnoea was applied to instances of embarrassed respiration accompanying other maladies. The researches of Laennec, Louis and others, have recently shown, as we have seen, that a large majority of the cases of asthma are, in reality, cases of emphysema, and that essential spasmodic asthma is a very rare disease.]

SYMPTOMS.—These causes often suddenly bring on an attack, which, if severe, obliges the patient to assume a remarkable and very characteristic attitude. The body is bent forwards with the arms resting on the knees; the chest is contracted, with the feeling of a tight cord or heavy weight upon it; the face is suffused; accompanied with an expression of great anxiety and distress; the veins are turgid, and the perspiration copious, whilst all the muscles of respiration, ordinary and supplementary, are brought into full action in order to introduce air into the chest.

With what amount of success these efforts of respiration are made, may be known by applying the ear to the chest, where, in spite of the force of the motions, scarcely any sound of passing air is heard. The contractions of the muscles often give an external muscular sound; but within the chest there is only a very faint respiratory murmur, with occasional whistling or wheezing. The violent action of the muscles of inspiration seems to diminish rather than to increase the entrance of air; but when the efforts are less violent, especially towards the end of the paroxysm, now and then the air is heard to enter freely, as if the obstacle were suddenly removed, but at the next breath there is the same obscurity as before. At these temporary returns of the respiratory sound we must suppose that the spasm of the bronchial muscles is for the moment relaxed; and Laennec has pointed out a method of causing at will this relaxation, the consideration of which may be useful in enabling us to discover the nature of the disease. If we desire a patient who labours under the asthmatic spasm to restrain his efforts of breathing, and to hold his breath altogether for a few seconds, or, what amounts to the same thing, to count with his voice as many numbers as he can without taking breath, and then as quietly as possible to breathe again, the air will be heard to enter freely into every part of the lungs, but in a breath

or two after the spasm regains its hold, and the respiration becomes as obscure as ever.

Laennec used to say by way of explanation that the spasm was thus overcome by *surprise*; but this expression gives no distinct physiological reason for the phenomena. It does not seem to be explicable without assuming that there is a temporary relaxation of a tonic spasm of muscular fibres; and this relaxation we would ascribe to an increased degree of the same cause which usually induces the contraction of the same fibres. It is probable that the contraction of the circular fibres of the bronchi, excited by a certain degree of foulness of the air that is within them, is an essential part of natural expiration. Now the foulness of the air being increased by holding the breath long would stimulate these fibres to their utmost contraction, a contraction even beyond that of asthmatic spasm: their irritability is thereby for the moment exhausted, the spasm becomes consequently relaxed, and the air is heard to enter freely; but after a few moments' relaxation, the irritability is again restored, and, the exciting cause of the spasm remaining, the next breath may find the contraction as strong as ever.

The distinctive physical sign, then, of spasmodic asthma is imperfect sound of the respiratory murmur, *except after holding the breath*, when it becomes as loud as, or louder than usual. The bronchial spasm is often of long duration; but it is liable to temporary increase, causing more decided fits of asthma in which the symptoms before described are manifested in the highest degree, and on their subsidence, the patient is only short-breathed. When the bronchial spasm is considerable, especially in the paroxysms, the chest may sound ill on percussion, not with the absolutely dull sound produced when solid or liquid occupies the chest, but a short tight sound, like that which the chest yields on a forced expiration. This is caused by the contracted state of the lungs when under the influence of the bronchial spasm; the walls of the chest, therefore, being forced inwards by atmospheric pressure, are not so free to vibrate as usual, when this pressure is more nearly balanced on either side. A better sound may generally be obtained by striking on a finger or pleximeter pressed on the chest strongly enough to exceed the contraction of the lungs. This contraction when excessive sometimes causes the diaphragm to rise higher than usual in the chest, leaving a remarkable hollow in the epigastrium, and gives to the whole chest a tight and contracted appearance.

[In the few instances where we have listened to the breathing during an attack of pure spasmodic asthma, there was either entire absence, or decided feebleness of the respiratory murmur over a large portion of the lungs for a time, when the air would rush in

with a violent whirling whistling sound, and respiration would again suddenly cease.

A tabular view of the physical signs is here presented.

Inspection.—Increased motions of expansion and elevation and jerking rhythm of these motions; extent and frequency of the general motions increased, while the duration and intensity of the respiratory murmurs are much diminished; diminution of the costal motions.

Percussion.—Sound slightly diminished in clearness and duration.

Auscultation.—Intermittent, weak, or suppressed respiration; alternating with exaggerated respiration; the latter occasionally accompanied with the dry rhonchi of bronchitis; rhythm of respiratory murmurs jerking, sometimes incomplete, inspiration being deficient at the close.

Spasmodic asthma is sometimes strictly an intermittent affection, the paroxysms occurring at regular intervals. A striking example of this form of the disease fell under our notice, several years since. A young lady of a highly nervous temperament, entirely free at the time, and both previously and since, from any thoracic affection, and who had never before suffered from asthma, nor inherited it, was suddenly attacked, whilst labouring under great mental depression, with a severe paroxysm of spasmodic asthma, which returned every morning and evening for six successive days, and only yielded finally to large doses of the sulphate of quinine. She has never subsequently experienced an attack.]

COMPLICATIONS.—We have remarked that those who suffer much from spasmodic asthma are seldom free from a shortness of breathing in the intervals; and the frequent recurrence of the paroxysms generally increases this habitual dyspnoea. If we examine their chests, we find the same diminution of respiratory sound as during the paroxysm, but in a less marked degree; and the test of holding the breath proves that the spasm exists here also, having in a measure become habitual. The frequent recurrence or long continuance of these spasmodic contractions of the tubes must lead to permanent diminution of their calibre, and the other tissues become changed, and fix the tubes in this constricted size. We see the parallel of this in the irritable bladder, which, after long-continued attacks of spasm, at last becomes permanently contracted. Where the disease is purely spasmodic, this more lasting change might not ensue for a very long period; but with the spasm there is so commonly associated, either as cause or effect, congestion, irritation, or inflammation, that the phenomena and effects of these pathological conditions are very commonly combined with those of spasmodic asthma. Thus in asthmatic subjects, an attack of bronchitis, bronchial congestion, or bronchorrhœa, will be attended by spasmodic exacerbations; and a fit of nervous asthma which first comes on suddenly as a spasm, often terminates in a copious catarrhal secretion. The spasmodic constriction of the bronchial tubes, and the consequent violent yet ineffectual respiratory efforts,

produce a congested state of the pulmonary vessels and partial obstruction of the circulation, which disorder the action of the heart, and may not be relieved without a free watery discharge from the bronchial membrane. On the other hand, asthmatic paroxysms are frequently associated with organic diseases of the heart. The congestion which these determine in the membranes and structure of the lungs, increases their sensibility and irritability; and where the circular fibres are naturally disposed to spasm, this congestion readily excites it; and the spasm may not be entirely relaxed until the congestion is relieved by free secretion from the bronchial membrane. So also, irregular gout, or the sudden suppression of an habitual discharge or secretion, or of a cutaneous eruption, may determine an irritation and congestion of the bronchial surface, accompanied by an asthmatic spasm.

CAUSES.—In the preceding sketch of the history and pathology of the disease, we have adverted to some of the causes which occasionally excite asthmatic spasm. But when the disease is purely nervous, there must be a condition of the nervous system in general, or of the nerves of respiration in particular, which gives the bronchial muscles unusual irritability. The nature of this condition is involved in much obscurity; but it may be classed with that which gives rise to many spasmodic affections of other muscles, which are called nervous or hysterical, and which not unfrequently occur in the subjects of spasmodic asthma. Hence violent mental emotions, long-continued illness, especially such as in itself or by its treatment tends to depress the tone of the system, menstrual irregularities, and particular states of the atmosphere, are among the circumstances which may predispose to, and even produce, spasmodic asthma; the predisposition is in some instances distinctly hereditary. In a few instances, spasmodic asthma has been more satisfactorily traced to a local cause of irritation, such as a tumour pressing on the pulmonary plexus, or on the par vagum, in some part of their course. Probably the remarkable influence which the state of the stomach and digestive organs often exerts on asthmatic affections may be also referred to irritation reflected through these nerves. In some instances too a source of irritation has been found in a diseased state of the upper part of the spine, occasioning pressure on the medulla or on some of those spinal nerves which, communicating with the great sympathetic, are also in relation with the nerves of the lungs.

[Asthma is a disorder incident to both sexes, but is much more common in males than females. It occurs at all ages, but is generally regarded as most frequent in the middle periods of life; it is rare before puberty, though instances of it occasionally are met with. Contrary to the prevalent opinion, however, Dr. Chapman asserts that he has seen as many instances in children as in

adult age.* Dr. Watson mentions the case of a boy eight or nine years of age, who had had several well-marked attacks of pure asthma. It seldom appears for the first time in old age. Asthma is one of the maladies which are distinctly transmitted, the disposition to it descending from generation to generation, and pervading whole families. Dr. Chapman is persuaded that those of a phlegmatic and perhaps sanguine temperament, are as liable to it as the nervous. It is more frequently met with amongst the rich of sedentary and luxurious habits than the poor, except where the latter are exposed to some of the exciting causes.

Every variety of weather occasions an attack, and the condition which is favourable to one sufferer is detrimental to another. The close confined air of densely peopled cities is generally better borne than that of the country. Dr. Chapman mentions the case of a friend of his who cannot walk to the suburbs of the city in which he resides, without being incommoded. A day may be spent in the country with impunity, but the night induces an attack. Another case is related by Dr. Dunglison, of a friend in Baltimore who cannot sleep at a villa, whilst the day is spent there comfortably. Different localities in the same town and even in the same house which do not offer any perceptible difference in the atmospheric condition, affect asthmatic patients in the same manner. Called to visit a young lady from the south of the United States, who was labouring under a violent paroxysm of the disease, Dr. Chapman was told that she had derived immunity from it during a previous and recent residence in Paris, by selecting the middle story of an hotel in a particular portion of that city; and that, whenever she quitted the apartment, a paroxysm soon came on, from which she was as speedily relieved on returning to it. Curious to make the experiment, Dr. Chapman was seconded by the patient's own desire, owing to her anxiety to change her lodgings, where she had suffered severely, and in a very short time she went to another house in the vicinity, in which she entirely escaped the disease for several months. Being compelled, however, to leave it, she took up her residence at the distance of a few hundred yards, in a street no less thickly built; and here she had scarcely any exemption for weeks. On moving to a different quarter of the city, Dr. Chapman witnessed a complete verification of the statement she had made. As long as she occupied the chamber on the second floor, she was harassed almost nightly by renewals of attacks, which were prevented by sleeping in the room above. Even by dining below, her respiration was, on several occasions, seriously affected.

Dr. Watson refers to the case of a person, a resident of Newmarket, who could sleep in certain towns of England with perfect

[* Lect. on the more important diseases of the thoracic and abdominal viscera, p. 135-36.]

security, whilst in others he dared not go to bed. The lungs formed an infallible eudiometer. The same authority mentions another, who can sleep in one inn at Cambridge and not in another; he cannot sleep in certain streets in London, and when in Paris, if in the back part of Meurice's hotel looking on the courtyard, he is secure, and if in a front chamber, exposed to the garden of the Tuileries, he is certain of an attack of asthma; and the same in certain locations in London. Laennec speaks of a man whose attack was brought on by his light being extinguished, or if his chamber door was shut. Sleeping in a room with a rose-bush in bloom, or with pots of hyacinths, the smell of red beets, mellow apples, &c., have all been known to induce attacks, the emanations from a cigar manufactory, etc. etc. Two instances of the opposite effects of coal smoke are related by Dr. Graves. One was attacked violently with asthma from the smoking of a chimney during the night, and the only relief which the other obtained for habitual attacks was to obstruct the progress of the smoke up the chimney, and fill the room with smoke. The smoke of turf was inefficient. A change of weather is often indicated to an asthmatic patient by an attack.

The repercussion of cutaneous eruptions also frequently produces attacks of severe dyspnœa. Dr. Chapman has related several highly interesting instances. The first of these was that of a gentleman, who, having repelled a wide-spread tetter from the inside of the thigh, was soon after seized with the most afflicting anhelation, which continued with little remission, for nearly a year, resisting every variety of treatment, till the reappearance of the tetter, when relief was procured. More extraordinary, was that of a man, who, having the same sort of eruption on the scrotum, succeeded as he supposed, in curing it. But almost immediately afterwards, he began to sneeze with scarcely any interruption by day or by night for several months. The irritation, however, being transferred from the nasal to the pulmonary tissue, was followed by a change of sneezing for a very oppressed state of the lungs, which for a length of time proved intractable to all remedies. Two days after consulting Dr. C., and before the treatment suggested could have had any effect, the tetter, spontaneously, replaced itself in its original position, and his health was restored. Nearly about the same period he had under his care a lady, for a scaly eruption on the back of the neck, extending into the hairy scalp, by which she was much annoyed. It had long existed, occasionally receding and again recurring. By a mild application it quickly disappeared, and in the course of a few months showed itself on the forearm, gradually assuming a more squamous character. In this state, she left the city, and, as she presumed, was cured of it by another physician. But from that moment, heavy dyspnœa supervened, which shortly proved fatal.

DIAGNOSIS.—The sudden attack and removal of the paroxysms, together with the assemblage of physical signs before described, constitute the distinctive character of the disease. The slighter tonic or permanent spasm which may remain in the interval, and cause an habitual shortness of breath, may also be known by the respiration becoming distinct, not on increased effort, but after holding the breath, as well as by the absence of the signs of other lesions of the lungs or heart. The absence of fever also serves to distinguish it from inflammatory diseases. [To establish the diagnosis of pure spasmodic asthma with certainty, we must first ascertain the absence of every kind of organic lesion that may give rise to dyspnœa.] From spasmodic affections of the larynx, it may be known by the absence of the peculiar hissing or stridulous sound resulting from the passage of the air through the constricted glottis. We have before remarked that bronchial spasm is generally associated with a congested state of the bronchial vessels, ending in secretion; and it therefore rarely happens that during the paroxysm, and especially towards its termination, there are not present also many of the signs of catarrh. So likewise where the asthma is symptomatic of disease of the heart, the signs of this, and of its various pathological effects, are combined with the asthmatic affection.

PROGNOSIS.—Spasmodic asthma, although most distressing and alarming in its attacks, is seldom fatal when uncomplicated with organic disease. It is probable that the spasmodic constriction, although sufficient to cause a painful feeling of suffocation in the lungs, which are perhaps unusually sensitive, always yields before the system can become injured by the imperfect oxygenation of the blood. The view which we have given of the temporary relaxation of the asthmatic spasm favours this supposition, and explains the well-known fact that spasmodic asthma is more distressing than dangerous. But as it is often complicated with other affections of the lungs and heart, or its frequent recurrence may tend to induce them, particularly dilatation of the air-cells, pulmonary congestion and hæmorrhage, dilatation and hypertrophy of the heart, &c., we are not to regard asthma as free from dangerous tendencies. We have known more than one case of hereditary asthma occasionally attacking an individual from the age of childhood to manhood, and terminating at the age of between forty and fifty in pulmonary consumption. [Dr. Watson relates also, several cases of persons affected with genuine asthma, who subsequently became victims of pulmonary consumption; and he states that he has known two or three families in which one individual was subject to asthma, whilst others were scrofulous and phthisical.] In such cases tuberculous diseases probably existed in a limited extent from a very early period: the asth-

matic spasm occasionally supervening on it, and tending to increase it.

TREATMENT.—This is to be considered in relation to the paroxysm and to the general state of the system in the intervals. The first indication is to counteract the exciting cause of the spasm, the second to remove this cause altogether or to lower the irritability on which it operates.

1. To relax the spasm of the bronchial tubes various measures may avail according to its immediate cause: when this is chiefly nervous, with little bronchitic or catarrhal complication, such antispasmodics as ether, valerian, assafœtida, opium, belladonna, and especially the fumes of stramonium, or tobacco, inhaled into the lungs, will sometimes succeed; each of these has proved more successful than the others in particular cases, but seldom retains its efficacy long. [A mixture of opium and sulphuric ether is often of great service in tranquilizing an attack of spasmodic asthma.

42. R.—Tinct. Opii, fʒj.
Ætheris Sulph. fʒij.

M.

Sig. Sixty drops every half hour till relief is obtained.

Much advantage, too, may be derived from small, but very frequently repeated doses of ipecacuanha wine, mixed with an equal portion of good tincture of castor.

43. R.—Vini Ipecac.
Tinct. Castor. āā fʒss.

M.

Sig. Twenty to forty drops every half hour during the paroxysm.]

A more generally and permanently successful remedy is strong infusion of coffee, long ago recommended in this country by Pringle, and much extolled by Laennec. We have known some asthmatic patients, who relied so much on its efficacy, that the very idea of being out of the reach of it would be enough to bring on a fit; and they scrupulously avoided using coffee as an ordinary beverage, lest the habit of taking it should impair its efficacy as a remedial agent. This is a good rule, for this remedy is not free from the tendency of antispasmodics and narcotics, in general, to lose their power by frequent exhibition. [Drinking intensely cold iced-water will sometimes alleviate a paroxysm.—The fumes of paper, which has been soaked in a saturated solution of the nitrate of potash, and then dried, have been highly recommended, and instantaneous relief said to be procured.] In most cases it is easier to avert an asthmatic paroxysm than to stop or to shorten it when it has once begun. Hence, after previous experience has indicated the usual times and signs of its approach, the remedies before named may be given with best advantage in anticipation of the attack. This is especially the case with the

smoking of stramonium, which we have often found useful in this way, and rarely so after the fit has begun. In some cases sudden strong impressions on the system, such as dashing pails of cold water on the body, or passing slight electric shocks through it, have been known to stop a fit of asthma. Strong counter-irritants and revulsives, such as mustard poultices to the epigastrium, [dry cupping,] hot turpentine fomentations to the chest, and irritant pediluvia, in some cases give relief, but in others aggravate the symptoms. [Stuping the whole chest during the fit with flannel rung out of water, as hot as can be borne, is often highly serviceable.] Emetics have the same uncertainty of effect. If the asthmatic spasm be complicated with an inflammatory or congestive state of the bronchial or pulmonary vessels, which is very frequently the case, the treatment recommended for these conditions may be advantageously combined with some of the antispasmodics just mentioned: and when the nervous affection does not form the chief part of the complaint, it is probably dependent only on the altered condition of the membrane, which is either inflamed or congested; and to this condition, therefore, the remedial agents must be chiefly addressed. Under such circumstances depletions and other antiphlogistic measures, which are rarely useful in purely spasmodic asthma, become the best remedies.

2. The fulfilment of the second indication, to diminish excessive irritability of the bronchial muscles, and to remove the causes of irritation by which they are excited, will be best aimed at by various means which tend to restore a proper balance of the functions of the whole system, and to improve the general health. Of these the most effectual are those of diet and regimen. Particular rules can scarcely be laid down, and the experience of the patient is required to give a clue to the most eligible plan; but generally, a simple, light but nourishing diet, with great regularity as to hours, and moderation as to the quantity of food, will be the most suitable. The daily use of cold sponging to the chest, or the shower bath if it can be borne, and of moderate exercise in the open air, avoiding walking against a strong wind, is generally beneficial. Of medicinal agents, besides those necessary to regulate the secretions, which always need attention, the metallic tonics sometimes prove useful in diminishing the morbid irritability of the bronchial muscles, or of the nerves that influence them. We have found in various instances the oxide and sulphate of zinc, the sub-nitrate of bismuth, the nitrate of silver, the milder preparations of iron, severally beneficial in diminishing the tendency to the recurrence of the paroxysms. Probably these remedies act through the nerves of the stomach, which are supplied by the same trunk (the *par vagum*), with those which influence the bronchial fibres; and they may do this directly, or indirectly, by improving the condition and function of the stomach, disorders

of which in some form or other are commonly associated with spasmodic asthma.

The signs of improvement are (besides the less frequent occurrence and diminishing severity and duration of the paroxysms) a more free state of the respiration in the intervals, so that the vesicular murmur is pretty audible without much wheezing, throughout the chest, and is increased in loudness by quicker and deeper inspirations, not stopped or impaired as during the continuance of the asthmatic tendency, when additional effort will often at any time excite the spasm. In the cure of this, as of other spasmodic disorders, it is very necessary to study the circumstances that excite the paroxysms in each case, in order to be able to avoid them; for the frequent occurrence of spasm increases the facility of its return, until it becomes habitual and may be excited under almost any circumstances. The evil of an habitual asthma is not only the inconvenience and distress occasioned by the paroxysm itself, but also the permanent changes which it may induce in the structures of the lung, such as contraction and rigidity of the air-tubes, congestions, emphysema, and other lesions of the parenchyma, and diseases of the heart and whole circulating system.

SECTION II.

HOOPING-COUGH.

THE disease known by the names *hooping-cough*, *pertussis*, *chincough*, *convulsive cough of children*, and which generally occurs once only during life, seems to combine several of the characters of inflammatory affections of the air-tubes with those of a nervous description, already adverted to, and, from its occasional severity and frequent complication with other serious diseases, merits careful consideration.

SYMPTOMS.—The simple or uncomplicated form of hooping-cough generally exhibits *three* stages: in the *first* it is inflammatory—a bronchitis or catarrhal inflammation; in the *second* it is both an inflammatory or at least congestive and nervous affection; in the *third* it is entirely nervous, although it may in some cases be complicated with alterations in the pulmonary structure.

The *first stage* commonly begins as an ordinary cold, often accompanied with coryza, but there is more headache, languor, and often more febrile disturbance than usual; these symptoms sometimes precede the cough, which however begins earlier than in an ordinary cold. The general symptoms vary greatly in degree; being in some cases very severe, in others very slight, and not sufficient to require treatment. In the former case the pectoral

symptoms are also very severe at first, with pain, soreness and oppression of the chest, dyspnoea, and other symptoms of severe bronchitis. The cough is at first hard, short, and ringing, being apparently excited by the irritation of a thin saline-tasted mucus in the glottis. [In fifteen cases Dr. Trousseau found the initial catarrh absent but twice. In sixteen cases collected by Dr. Valleix, in fourteen of which the early symptoms were noted, there was catarrh in all of them. Authors differ as to the duration of this stage; according to some it lasts from four to six days; whilst others assign to it a much longer duration. In an epidemic which occurred at Geneva, in 1838, it lasted from one month to six weeks. (*Lombard.*) Occasionally croup may be the initial symptom, and sometimes the catarrhal period may be prolonged for a considerable time. In twelve cases observed by MM. Rilliet and Barthez, the hoop appeared on the first day once; the catarrh lasted six days in one case; seven days once; eleven days twice; fifteen days five times; thirty days once, and forty-five days once.]

The transition to the *second stage*, which commonly takes place in from four to eight days, is marked by the cough coming on more in fits and of a more violent character. The tickling in the throat is less constant, but when it comes, it cannot be borne an instant, but excites an uncontrollable cough, consisting of many repeated violent expiratory efforts followed by a long inspiration, which, by the hooping or crowing noise often accompanying it, may be known to be drawn through an imperfectly opened glottis. According to Lombard severe nausea sometimes precedes for several minutes the paroxysm. The hooping depends on an undue irritability of the laryngeal and bronchial muscles, so that they do not relax, as usual, during the act of taking breath. But this sonorous back-draught is not always heard in this complaint, particularly if the subject be not very young; and on the other hand it often accompanies other severe kinds of cough in children, in whom the aperture of the glottis is small and disposed to contract. This is further illustrated by the result of auscultation. On applying the ear to the chest of a child during a fit of hooping-cough, one is surprised to hear so little sound of respiration within the chest with all the violent external motions; and during the sonorous back draught, there is scarcely any sound of air entering the pulmonary tissue. This is to be ascribed to the continued contraction of the glottis and large bronchial tubes preventing the air from penetrating to the vesicular texture with sufficient force to produce the ordinary respiratory murmur; for in the convulsive cough of adults there is no obstructed hooping inspiration, but a full forcible one which is heard loudly in all parts of the chest. The other physical signs of pertussis do not differ from those of mild bronchitis; there being often variable sonorous, sibilant, and mucous rhonchi in the upper and middle parts of the chest. The

fits of coughing generally terminate in the discharge of a thin glairy mucus; and such is the violence of the action of the abdominal muscles that the contents of the stomach are often forced up by it. The termination of the cough in vomiting is merely the result of the violence of the action which produces the cough: as soon as the muscular efforts have compressed the chest as far as it will yield, their force falls on the stomach, and in proportion as the cardiac orifice yields is the completeness of the act of vomiting. This disposition is increased by habit; and consequently as the disease advances the fits of cough often terminate more frequently and speedily by vomiting or retching. The violent and convulsive character of the cough is its most characteristic feature; the face and neck become red or purple, and turgid; the eyes are injected; the throat, chest, and abdomen are quite sore with straining, and the whole frame is so shaken, that the child is obliged to lay hold of something to afford support, and seems to be on the verge of suffocation. [In one case observed by Rilliet and Barthez, the paroxysm was divided by a short interval of calm.] It is no wonder, that with such straining the expectoration should be sometimes streaked with blood or that blood should flow from the nose; yet this does not happen very often, but chiefly in the plethoric, or in those predisposed to epistaxis, and, if not excessive, is salutary. [In two cases, Dr. Trousseau met with violent hæmorrhage; in one there was a discharge of blood from the conjunctiva, and in the other a serious epistaxis, which became alarming from its quantity.] No wonder, too, that convulsions, coma, and other cerebral affections, are sometimes induced in young and delicate subjects. [In the case of an adult reported by Dr. Blache, frequent syncope occurred during the paroxysm.] At this time the violent paroxysms of cough sometimes cause mechanical injury of the apparatus of respiration and circulation; the air-tubes and cells become partially dilated or ruptured, the passage of the blood through the lungs is impeded, congestions are produced, the action of the heart is disordered, the foramen ovale may sometimes be re-opened, giving rise to blue discoloration and œdema of the surface, etc. At this period, in severe cases also, there is often remittent fever at night; and with it there may be combined the various inflammatory complications in the chest, head, and abdomen, which constitute the chief source of danger in these cases in pertussis. We shall advert to these hereafter. In slight cases there may be no fever, and little functional disturbance in the intervals of the cough; but the common presence of the sonorous and mucous rhonchi, particularly before and after the cough, and the mucous expectoration in which the cough generally terminates, indicate that in all cases it is still a bronchitic or catarrhal as well as a nervous affection: and in fact, as this stage declines, the expectoration generally assumes the more con-

sistent and opaque form which characterizes the concocted sputa of a terminating bronchitis.

This change, which may occur from the third to the sixth week after the commencement of the disease, marks its transition to the *third* or purely nervous stage. There is great variety in its severity in different subjects: in some the convulsive cough may only come on twice or thrice in the twenty-four hours, and cease in the course of a few days: in others it rapidly loses its convulsive character and subsides like a common cough; in the majority of instances, however, it retains its convulsive character to the last, but becomes less frequent in its attacks, and ceases from six to ten weeks from the commencement of the disease.

[The number and duration of the paroxysms are very variable. In the cases observed by MM. Rilliet and Barthez, they lasted from one-fourth to three-fourths of a minute, and even two minutes. According to the same authors, there were often twenty paroxysms in the twenty-four hours, sometimes less, sometimes as many as forty-eight, and in one exceptional case, seventy-two. Dr. Trousseau arrives at the same results. In the first two or three weeks the paroxysms go on increasing to a period corresponding to the twenty-ninth or thirty-eighth days; they then remain stationary for a certain number of days, and then rapidly decline in frequency. They are generally most frequent during the evening and night. Dr. Lombard remarked that at the period of their greatest violence they were more frequent during the night, and when they declined in intensity, they became more frequent during the day. The total duration of the period of hooping was from fifteen to sixty-five days; the average thirty to forty days.]

The exciting causes of a paroxysm may be crying, change of position, vexation, cold, distension of the stomach, strong odours, seeing a child hoop, &c. MM. Rilliet and Barthez state that they have often provoked it by causing a child to sit up in order to auscult it.] Delicate nervous children often suffer long and severely in this last stage, which assumes somewhat the form of a chronic convulsive disease; and even after it has itself ceased, for a long time it gives its character to any fresh cough that may be contracted from other causes.

[The disorder may last from one to three months; its duration is variable.]

VARIETIES AND COMPLICATIONS.—The first or febrile stage of the disease is complicated occasionally with extensive bronchitis, and more rarely with pneumonia, pleurisy, or croup. These complications generally occur at times of the year, and in situations, in which such affections prevail; or they, as well as other complications, may be the result of individual predisposition developed by the fever which accompanies the disease. [Whenever the

fever is intense and continued, the development of some complication may be confidently anticipated.] The greater intensity of the inflammatory and febrile symptoms, the more continued oppression and pain in the chest or throat, permanent frequency of the breathing and pulse, with the physical signs distinctive of these several affections, mark their occurrence. The cough becomes less violent and sonorous, but still frequent, and in the intervals the mucous or crepitant rhonchus is heard in the chest, or there may be partial absence of the respiratory murmur, with dulness on percussion. Less commonly the membranes of the brain are affected, and the grinding of the teeth, the rolling of the head, intolerance of light, contracted pupil, followed by squinting, vomiting, screaming, &c., indicate the presence of acute hydrocephalus.

With any of these complications unsubdued by treatment, the disease may prove fatal in the course of a few days with the usual symptoms of these affections. In the second stage the most frequent complications are partial pneumonia, hydrocephalus, and gastro-intestinal inflammation. Circumscribed or lobular peripneumony is a very common and fatal complication of severe whooping-cough among the children of the poor. It causes continued dyspnoea with quick pulse and hot skin, and crepitation or obstructed respiration and dulness in some part of the chest. [The constant presence of bronchitis in whooping-cough is denied by MM. Rilliet and Barthez. They found it alone or in connection with pneumonia in only one-half of the cases that proved fatal. Rarely the inflammation consisted in redness of the mucous membrane alone; most generally it was accompanied with continuous dilatation occupying the smaller air-tubes. The existence and intensity of the bronchitis were in relation to the epoch at which the subject had succumbed. In those dying on the 15th, 18th, 26th and 27th days there was no bronchitis; but it was constantly present when the malady was more prolonged.

The same holds good of pneumonia; it was found constantly in those dying beyond the 27th day at the second stage, and sometimes second and third stages. The two phlegmasiæ coincided, and it was difficult during life to indicate precisely the exact period of the invasion of the pneumonia. It was generally partial and lobular. Rilliet and Barthez met with only one case of lobar pneumonia, in a child that recovered; it occupied the summit of the left lung and was developed at the end of three weeks. Epidemics of whooping-cough are sometimes complicated with pneumonia. MM. Rilliet and Barthez deny the frequency of emphysema in pertussis. Its rare occurrence is explained by the mechanism of the paroxysms. Each spell consists of a series of expirations, followed by a single long, whistling inspiration. This series of expirations empties the lungs, and thus acts in an inverse direction to the mechanical cause of emphysema. The

long and whistling back-draught occurs during a spasmodic constriction of the larynx, trachea, bronchi, which does not permit the air to go beyond the principal bronchial ramifications. The expulsion of air, and the incomplete access of air into the air-cells during the paroxysm, are then the two phenomena which explain the absence of emphysema. In complicated cases it exists, but then to a less degree than when bronchitis and pneumonia occur alone; so that hooping-cough so far from producing emphysema, tends to diminish the intensity of this lesion in the diseases which frequently give rise to it. Inflammation, according to these authors, is the sole cause of dilatation of the smaller bronchi; the phenomena of the paroxysm occur during expiration, and the strong inspiration admits air only into the large bronchi.] Effusion into the brain may be apprehended when convulsions come on, or when between the fits of coughing the child rolls his head from side to side, with moans indicative of pain, or when he lies in a lethargic or half comatose state, with dilated or contracted pupil, strabismus, and paralysis or contraction of some of the limbs. This formidable complication is by no means uncommon in young children during the period of dentition. [This complication is by no means rare. Rilliet and Barthez met with it five times in twenty-nine cases. It occurs more constantly in young children. The eldest of their cases was five years old. The disease was very intense in all. The hooping had been established from sixteen to thirty-one days; of seven cases, five succumbed, death following immediately the convulsions.] Gastric mucous inflammation is marked by the characteristic appearance of the tongue, continual thirst, occasional vomiting not excited by the cough, pain or tenderness at the epigastrium, looseness of the bowels, the stools being offensive, dark or clay-coloured: or in some cases constipation, scanty, high-coloured urine, with burning heat coming on at night followed by perspiration, progressive emaciation, &c. These signs of gastric irritation are sometimes combined or followed by those of inflammation and effusion in the head; or if this organ escape, and the abdominal irritation proceed, accompanied by the cough, it may terminate in tuberculous disease of the lungs or of the mesenteric glands. [*Anasarca* sometimes complicates hooping-cough. Rozen observed it in an epidemic in Sweden. According to Lombard it occurs frequently. The state of the urine is not mentioned by these writers. The cases were fatal when the dropsy was general.]

In these complicated cases, if the patient survive the dangerous lesions until the usual period of the third or nervous stage, the phenomena of this stage vary much according to the nature of the complication, the convulsive cough being sometimes absent and sometimes unusually severe in the cephalic cases; while those, in which the gastro-intestinal membrane or the lungs take on per-

manent disease, in some instances retain the convulsive character, and in others they present merely that of chronic cough. [Tubercularization not unfrequently follows hooping-cough. In a large majority of the cases it is limited to the lungs and bronchial glands.]

CAUSES.—Hooping-cough may occur epidemically, sporadically, or it may be propagated by infection. The latter cause is questioned by some writers, but there is as much evidence in favour of the infectious properties of this as there is of any other disease, it having been known to spread among a family and neighbourhood from one case brought from a distant part; and its extension to other children being often prevented by their removal. It resembles the other contagious diseases of children in its rarely occurring more than once in the same individual. Like these, however, the disease spreads more rapidly under certain unknown epidemic influences; and passes by individuals in a manner that proves some bodily predisposition to be necessary for its production. Its epidemic prevalence has been frequently observed to accompany that of measles; the one disease sometimes succeeding to the other.

The period of life in which it most commonly occurs is between the ages of two months and twelve or fourteen years, but it occasionally happens before and after, and a few individuals escape it entirely. [In 130 children attacked with hooping-cough, Blache found 101 aged from 1 to 7 years, and 24 only from 8 to 14. The same proportions were observed by Rilliet and Barthez.] On the other hand when it has occurred during infancy, it occasionally, though very rarely occurs in after life. [We have seen several instances of genuine hooping after forty years of age.] This happened to the writer, who suffered severely from a second attack in Paris in 1826, having probably contracted it during his attendance at the Hôpital des Enfants Malades. Mothers have also been known to have the disease a second time when suckling a child labouring under it. [Dr. Watson mentions a case where a woman in the last weeks of pregnancy, had a child ill with hooping-cough in the house with her, and the new-comer hooped the first day it came into the world, the disease being contracted in utero.] We have seen many instances in which adults, who in early life had pertussis, contract a cough of a convulsive character during the prevalence of the disease among children in the house. It has been occasionally observed, when hooping-cough attacks adults, the paroxysms recur during the night only, interrupting sleep and exhausting the strength. In children also the paroxysms are often more frequent and violent during the night. The infectious properties of the complaint probably last during its two first stages, but this is very uncertain.

[Blache, Rostan, Dugès, etc., have reported incontestable instances of contagion. Dr. Lombard, in the Geneva epidemic of 1818, was enabled to trace the importation of the disease from a neighbouring town; and he observed other positive evidences of contagion.]

ANATOMICAL CHARACTERS.—As whooping-cough rarely proves fatal, except in consequence of its complication with some other disease, it is not easy to learn from anatomy its essential effects. Most writers agree, however, that the lining membrane of the windpipe, from the epiglottis to its larger branches, is more or less injected and often covered by a thick mucus, and the bronchial glands are also red and much enlarged. Dr. Copland adds his testimony to that of Ozanam of Milan that the œsophagus also bears marks of inflammation; and he mentions having observed inflammatory appearances in the medulla oblongata and its membranes, even when there was no other remarkable lesion within the cranium, but he does not state what these appearances were. In the complicated cases, the common effects of inflammation are found in the organs which have been peculiarly affected. Thus in the bronchitic cases the bronchial membrane is much more extensively inflamed than usual, and the tubes are everywhere filled with spurious mucus, sometimes mixed with pus. The results of pneumonia are seen in the engorgement and hepatization of portions of the lungs, in these cases often confined to lobules, particularly about their margin. In more protracted cases, tuberculous deposits are sometimes formed, and the air-cells and tubes are often irregularly dilated. Various products of inflammation are, in some instances, met with in the pleura and pericardium. When the head has been affected, serous effusion and opacity of the membranes have been seen in the brain, and rarely softening of its substance. When there has been remittent fever, the mucous membrane of the ileum, cæcum and colon is found inflamed, and occasionally ulcerated, and the mesenteric glands enlarged; in prolonged cases with a scrofulous tendency, tuberculous matter is deposited in these glands.

PATHOLOGY.—There has been a great diversity of opinion respecting the nature and essential seat of pertussis. Cullen, Guibert, Hoffmann, Hufeland, and most other German authors, consider the disease as essentially nervous, depending on irritation (not inflammation) of various parts of the nervous system, particularly the phrenic and pneumogastric nerves, and causing spasmodic action of the larynx, diaphragm and stomach. Leroi, Webster, and Begin ascribe the disease to inflammatory irritation of the brain and its membranes. Watt, Badham, Dawson, Dewees, Guersent, Laennec, and most other French authors hold

the disease to be essentially bronchitic or catarrhal, with the addition of convulsive action of the diaphragm and larynx, excited, according to some, by an excessive sensibility of the inflamed bronchial membrane. A third view, particularly maintained by Desruelles, is that hooping-cough depends on inflammation of the bronchi speedily causing irritation in the brain, whence is reflected convulsive excitement of the diaphragm, muscles of the larynx, &c., which gives to the cough its peculiar character. Dr. Copland considers the disease to be essentially a nervous irritation, commencing in the respiratory surfaces, and through the nerves, chiefly the pneumogastric, transferred to the medulla oblongata, whence it again affects the respiratory apparatus and sometimes the stomach; and that predisposing or concurrent causes may readily convert this irritation, at either of its seats, into inflammation.

In reference to these different views, we may remark that in many instances they do not sufficiently regard the physiological character of those morbid motions which form the chief feature of hooping-cough. Thus we find much ascribed to the phrenic nerve and diaphragm, when it is obvious that these agents of inspiration are little, if at all, concerned in the motions which constitute the cough. We regard hooping-cough as originating in a specific irritation (almost always inflammatory at first) of the lining membrane of the upper portion of the air-passages. This irritation is in the first stage constant, and accompanied with cough and expectoration, like those of common inflammatory catarrh; but in the second stage it peculiarly increases the irritability of the laryngeal constrictor and bronchial muscles, and of the nerves which excite the contractions of these as well as of the expiratory muscles which are sympathetically associated with them—those in fact which are concerned in the act of coughing. The peculiar cough of pertussis resembles that excited by a foreign body directly irritating the glottis; in fact it is properly called *pertussis*, for it consists of an exaggeration of all the actions of an ordinary cough and of nothing more; and there is no more reason for seeking its cause in the brain or spinal marrow, than there is for referring excessive vomiting or dysenteric straining to this seat. It is unnecessary to go further than the respiratory apparatus for an explanation of the phenomena of hooping-cough. The irritation which at first extends to the vessels and is more constant, becomes afterwards purely nervous, and like other local nervous affections, such as neuralgia, spasms, nervous colic, &c., manifests its effects only occasionally, perhaps under the influence of some additional exciting cause. The various complications which so much increase the danger of hooping-cough, we would regard chiefly as the effects of the violent cough, sometimes assisted by predispositions to particular diseases or by co-operating

causes. Any one who has witnessed the severe paroxysms of whooping-cough can scarcely wonder that it may produce in the head, in the lungs, and in the abdomen, serious congestions, which previous tendencies, or additional exciting causes, may readily convert into inflammation and its effects—hydrocephalus, pneumonia and intestinal disease.

[MM. Rilliet and Barthez consider whooping-cough as a specific neurosis, without analogy to any other malady, and with Jos. Frank, would assign it a place in the nosological scale between the neuroses and continued fevers. The evident influence of the nervous system is seen in all the phenomena of the cough, and we have seen that when tuberculated bronchial glands were in contact with the pneumogastric nerve, and probably compressing it, a convulsive and paroxysmal cough takes place, and a convulsive cough has been known to follow a wound of the pneumogastric nerve. But besides a single lesion of innervation, there is something additional. Its propagation by contagion, its epidemic character, and the general immunity against a second attack—all approach it to the eruptive fevers—accompanied too as it is by a period of incubation, and by prodromic symptoms.]

DIAGNOSIS.—The convulsive character of the cough, consisting of a rapid succession of violent short expirations, followed by a long inspiration, which is whooping in young children, forms the most distinctive feature of pertussis. Its termination in the discharge of glairy mucus, or of the contents of the stomach, also seldom happens habitually in other coughs. The convulsive or hysterical cough of adults sometimes exactly resembles pertussis even in the hoop; but the history of the case, and the alternation of the affection with other nervous complaints, will serve to distinguish it.

[We have seen that the invasion of whooping-cough was in the large majority of cases similar to that of a common cold, and it is very difficult, if not impossible, to diagnose whooping-cough during the first period, and the circumstances of being exposed personally to infection, or the power of an epidemic, can only lead us to suspect it.

The *differential diagnosis* of whooping-cough has been generally lightly passed over by writers. MM. Rilliet and Barthez consider that the disorder may be confounded with intense bronchitis, accompanied with a violent spasmodic cough, and with tuberculation of the bronchial glands.

Acute spasmodic bronchitis generally commences suddenly, with paroxysms of cough, whilst whooping-cough is almost in all cases preceded by a catarrhal period. The paroxysms are less severe, and do not terminate with a deep whistling inspiration, stringy expectoration, and vomiting; nor is there severe fever generally present from the commencement, and the characteristic

rhonchi of bronchitis are absent; in spasmodic bronchitis the thoracic symptoms are continuous; and it may occur repeatedly. When these two disorders are very prolonged, the two diseases in their latter period offer a very remarkable resemblance. Both are accompanied by emaciation, the habitus of phthisis, and hectic. The paroxysms of hooping-cough are no longer at this period accompanied with whistling, and resemble closely those of bronchitis. But how much they may be confounded at this period, they are very distinct at their debut, and the distinction is very important to establish, since their treatment is different, and the one is highly dangerous, and the other much less serious.

The diagnosis between hooping-cough and tuberculization of the bronchial gland is still more difficult; the distinction is important and delicate; important, inasmuch as it is necessary to distinguish a curable disorder, from one necessarily mortal; delicate, because hooping being sometimes followed by phthisis, it is difficult to distinguish the effect from the cause. This important point has already been dwelt upon (p. 471.) To complete the diagnosis, ascertain the age of the patient, the causes influencing the appearance of the disorder; inquire if by constitution or descent phthisis may be suspected; inform yourself if before the hooping, the patient had grown pale and emaciated, and was subject to a cough.

In the third stage when the paroxysms are rare, and not accompanied with hooping, or have ceased altogether, and the cough is simply catarrhal, when in fact the hooping-cough has been transformed into dilatation of the bronchi, which causes these symptoms, the disorder may be confounded with pulmonary or ganglionic phthisis. The diagnosis is the more difficult, as it is precisely at this period that phthisis appears in certain cases of hooping-cough. The emaciation, hectic, debility, sweats, paleness of the skin, the whole train of symptoms are the same; auscultation alone can throw some light upon it. Even this means sometimes fails, and the ulterior march of the disorder is often the only criterion to recognize the nature of the complication. If the child regains its flesh, gaiety and strength, the perspiration and fever cease, the colour returns, it is most probable that the hooping-cough is not complicated with tubercles. If, on the contrary, the fever persists, the emaciation increases, the appetite decreases, an abundant diarrhoea appears, the tubercular character of the affection is established beyond doubt.]

PROGNOSIS.—Hooping-cough, when occurring in children previously healthy, and not disposed to visceral disease, and when unattended with high fever at its commencement, or with great violence and frequency of the paroxysms afterwards, is not a dangerous disease. But it is highly dangerous and destructive when,

either from the delicacy or previous tendency of the subject, or from the violence of the cough, it becomes complicated with inflammatory or congestive lesions of the head, chest, or abdomen. When, therefore, it attacks young children, under two years old, who are under the additional influence of the irritation of early dentition; or when it attacks children who are delicate from constitution or prior disease, or who belong to a family in which hydrocephalus or scrofula has prevailed; or when it comes on in any subject with high fever, difficult breathing, and other signs of complications; or when from the extreme violence and frequency of the cough these may be expected to ensue,—the prognosis must be expressed in terms of uncertainty.

[When the paroxysms are very severe, they may occasion death. Lancisi has reported an example, and M. Bland de Beaucaire another. Convulsions are the most serious complication; next bronchitis and pneumonia. The greater danger of extreme youth in the disorder is probably due to the complications occurring at this period being more dangerous. According to Jos. Frank, hooping-cough is of longer duration, and more dangerous when it occurs in winter than at any other period. The character of the reigning epidemic must also be borne in mind. The prognosis should be made with caution, especially at the commencement, as the intercurrent diseases appear often suddenly, without any warning. Even during the third period, other complications may arise, rendering the convalescence tedious, or involving the death of the patient. According to Trousseau, the duration of the disease is frequently in proportion to that of the initial catarrh.]

TREATMENT.—The three stages which the disease presents, form the ground of indications of treatment, varying as the complaint advances; and the complications, when present, will also furnish further indications. In the first stage moderate antiphlogistic measures; in the second, these in combination with expectorants and sedatives to allay the nervous and muscular irritability; and in the third stage, antispasmodics and nervous tonics,—form the chief indications of treatment of simple hooping-cough. In the milder cases, very trifling measures, such as an occasional emetic and mild aperients, and avoiding imprudent exposure, when the weather is variable, may suffice; and, except in the early stages, confinement is unnecessary: in the severer forms, however, close attention to the symptoms will be required throughout the complaint.

The first stage is to be treated much in the same way as ordinary catarrhal bronchitis, which it resembles. Blood-letting only in the plethoric or when inflammation runs high, antimonial expectorants, and occasional mild mercurial and other aperients, are the chief remedies. If there be much heat of skin, a few doses

of James's powder, or of an antimonial saline with nitre, should be given.

[An emetic administered in the commencement of the disease, is thought by many practitioners to afford the greatest relief. Ipecacuanha is perhaps the best form in which it can be given, though if the child is over two years of age, robust, and the tendency of the disease is decidedly inflammatory, tartar-emetic may be employed with safety. Ipecacuanha may be afterwards continued in small doses during the first stage, and the acute period of the second. It is also often combined with advantage with sulphur and belladonna, or hyoscyamus. Dr. Condie says, that he has followed this practice in a very large number of cases, with the happiest effects.]

44. R.—Pulv. Ipecac. gr. iij.
Sulph. præcip. ʒss.
Ext. hyoscyam. gr. iv.
M.—Div. in chart. xij.
Sig.—One every three or four hours.

A full dose of calomel should be administered at the outset of the attack, followed by castor oil. A few leeches, or cups to the chest may be advantageously resorted to if the symptoms are inflammatory.]

In the second stage, the antimonial expectorant may be continued with advantage; but it must now be combined with a sedative, to diminish the violence of the paroxysms of cough. These paroxysms generally terminate with the expectoration of glairy mucus; and, by favouring this secretion, antimonial or ipecacuanha wine in small doses, combined with an alkali, as in bronchitis, will generally shorten the duration of the fit. Full emetic doses have been very strongly recommended with the same view; but, except in case of accumulated bronchial secretion, we consider that equal benefit may be derived from expectorant or slightly nauseating doses, for they are far less weakening, and are quite sufficient to induce vomiting if that be desirable. Of sedatives, those most recommended are hydrocyanic acid, belladonna, and opium. The first has been highly extolled by Drs. Granville, Elliotson, and Roe; but its administration demands great caution, especially in young children, for its sedative influence affects the heart as well as the muscles and nerves of respiration; and the circulation of very young subjects, if suddenly depressed, does

[45. R.—Acid. hydrocyan. ℥j.
Vini Ipecac.
Vini Ant. et. Potass. tart. āā. fʒj.

M.

Sig.—A teaspoonful every morning and evening, if no uneasiness, sickness, or dizziness is produced.

This prescription is for a child six months old, one drop of the acid for each additional year, after one year.]

not readily recover its power. Belladonna has been much recom-

mended by several continental practitioners. We have found it more safe and more effectual than prussic acid; and its dose may be considerably increased without any real risk. We have given a quarter of a grain three times a day to a child of two years old, half a grain to one of four, and a whole grain to one of eight years of age; and increased these quantities to double and more when they ceased to relieve. These doses generally cause dilatation of

[44. R.—Pulv. Rad. Belladon. gr. v.
Ipecac. Comp. gr. x.
Sulph. præcip. ℥ss.
Sacch. Alb. ℥ij.

M.—Div. in pulv. xx.

Sig.—One every three hours to a child three years old.]

the pupil; and we conceive that the remedial agency of the drug depends on the same power to diminish the irritability in the laryngeal and bronchial nerves and muscles, which is thus evinced with regard to the iris. In a few cases there have been some feelings of heat and dryness in the throat, giddiness, and pain over the eyes; but these symptoms soon cease when the medicine is discontinued. They are more alarming than dangerous, for instances have occurred of upwards of a drachm of the extract being taken without any bad effects further than the continuance of these symptoms for a day or two. Belladonna often signally diminishes the violence and frequency of the paroxysms of cough; but as it is liable to lose its efficacy by constant use, it is better to intermit it for a few days, and then resume it. In the more violent cases, it is necessary to resort to the stronger sedative—opium. It is best given in form of solution of one of the salts of morphia, combined with ipecacuanha and small occasional doses of calomel or hydrargyrum cum cretâ. Its administration requires much caution in very young children and those with cephalic symptoms: in these it should be always combined with calomel. Syrup of poppies is objectionable on account of the uncertainty of its strength. [The flowers of sulphur have been recommended as a specific in pertussis by Horst. He gives it throughout the whole course of the disease, in doses of three grains three or four times a day, for children from two to four years, and ten to fifteen grains in older children. MM. Rilliet and Barthez state that they have seen this medicine of great service in the hands of Dr. Jadelot.]

At the early part of the second stage, blisters are often beneficial, especially if there be more than usual bronchial inflammation: with young children they should not be left on for more than three hours. Afterwards stimulant and anodyne liniments rubbed over the whole chest occasionally prove useful. Camphorated liniment, with additions of oil of turpentine or amber and ammonia, may be applied.

[45. R.—Lin. Camph. f̄iv.
 Ol. Succini,
 — Rosmarini, āā f̄ij.
 M.—Ft. Liniment.]

Tartar-emeti^c ointment has also been recommended for the same purpose ;

[46. R.—Ant. et. potass. tart. ʒjss.
 Adipis, ʒj.
 M.]

but it is less eligible, for the painful pustules which it excites prevent the continuance of the daily friction to which embrocations seem to owe much of their efficacy.

In the third stage, when the complaint is purely nervous, besides the sedatives and antispasmodic embrocations, another class of remedies becomes of great utility—tonics and even stimulants. Bark, myrrh, preparations of iron, arsenic, sulphate and oxide of zinc, nitrate of silver, assafœtida, musk, tincture of cantharides, and many other medicines of this class, have been much extolled by different writers; and each, perhaps, is occasionally useful in particular cases. In the choice of them, the practitioner must be guided by general principles or analogies. Thus in cases presenting a periodic character attended by debility, bark or arsenic may be most suitable: in those of a more convulsive type, assafœtida, musk, or tincture of cantharides, followed by the preparations of zinc or silver, may be found useful; whilst in cases decidedly asthenic, steel medicines are far more effectual. Of the latter, the ammoniated iron and carbonate of iron are generally the best preparations. M. Lombard of Geneva has recently written strongly in favour of the carbonate of iron, which he uses to the extent of twenty-four to thirty grains in the day even for very young children. In the employment of this and other tonic remedies, it is important to keep the excretions free; and to withhold the tonic, if there be any signs of obstruction, inflammation, or vascular irritation.

DIET AND REGIMEN.—In the early stage the diet must be light, consisting of milk and farinaceous food. In the second stage white meat or jelly may be allowed; and children who are pallid may sometimes with advantage be permitted to take meat and the more nourishing articles. In the third stage, the diet may be as in health. In the first or inflammatory stage of whooping-cough, the child should be confined to the house and warmly clothed; and exposure of every kind should be avoided as much as in bronchitis. But towards the end of the second stage, when all feverishness and sharpness of the pulse have subsided, much benefit may be derived from the open air, and especially from a change of air. In the last stage, a change of air is almost a spe-

cific; any kind of change, and although only to the distance of a few miles, will sometimes entirely remove a cough that has baffled all medicines.

TREATMENT OF THE COMPLICATIONS.—When in the early stages of the disease, connected with its febrile onset, there are signs of inflammation in the head or chest, the appropriate antiphlogistic treatment must be employed, but not with the same freedom as if this inflammation were the only lesion. No antiphlogistic treatment will stop the course of hooping-cough; and a certain amount of strength must be reserved to support the patient through it. The congestive and inflammatory complications arising in the second stage from the violence of the cough and other concurrent causes, may be more successfully guarded against than cured. A few leeches to the head or chest, when any signs of congestion or irritation show themselves there, the occasional exhibition of mercurial aperients, the removal of dental irritation by free scarification of the gums, and the continued use of measures calculated to diminish the violence and bad effects of the cough, constitute the chief means of preventing the production of serious disease. Of these, none is more important than the precaution of raising the child to a proper posture when attacked by the cough. It is a case in which a careful nurse is invaluable. The child should never be allowed to lie, or to hang its head down, during the severe fits. The paroxysms when very severe, and causing great turgescence and lividity of the face, may often be cut short by dashing cold water on the face, or by blowing into the ear. When once hydrocephalus or pneumonia has been induced, it must be treated, as far as the strength will bear, in the usual way; but from the weakness resulting from the previous disease, and from the repetition of the cough which it yet induces, these secondary forms of lesions are more fatal than when they occur idiopathically. Remittent fever, or other symptoms of gastric irritation, must be treated on the usual plan of mild alterative aperients, a strictly regulated diet, occasional warm baths, &c. In case of chronic bronchitis, pneumonia, or pleurisy, which in some instances succeed to hooping-cough, the treatment recommended for these affections must be adopted.

The convulsive cough of adults, not of a specific nature, is generally associated or alternated with other forms of spasmodic or convulsive disease, in which there is a great mobility of various muscles, an exaltation of the natural relation which subsists between certain nerves and muscles which they influence. In several such cases, we have found extract of belladonna with the pilula aloës and assafœtida, and a galbanum or pitch plaster to the chest or back, give most effectual relief. Where the complaint is

more obstinate, a course of the metallic salts, subnitrate of bismuth, nitrate of silver, sulphate of zinc or ammoniated copper, is often successful in removing it. They may generally be much aided by the shower-bath, country air, exercise, and other means which diminish the mobility of the nervous system.

Name of the sign.	Physical cause of the sign.	Ordinary seat of the sign.	Diseases in which it is observed.
Wooden character of sound.		Infra-clavicular or inferior regions; most common in the former.	Chronic pleurisy, whether simple or tuberculous, with dense pseudo-membranous matter forming a solid stratum between the walls and lung.
Tympanitic character of sound.	Unnaturally abundant quantity of air in the subjacent parts, together with increased tension of the walls.	Left infra-clavicular and mammary regions; also axillary and infra-axillary on either side.	Pulmonary { atrophous; emphyse- } hypertro- ma. } phous. Pulmonary atrophy. Pneumothorax. Hydro-pneumothorax.
Tubular character of sound.	Any condition which brings the larger bronchi unnaturally near the surface, and so within the reach of percussion; or the presence of a solid substance between those bronchi and the surface.	Lower part of infra-clavicular and upper part of mammary regions; most frequently observed on the left side.	Pleuritic { general pe- riod of re- effusion } traction. partial. Accumulation of pus retained and lying over bronchi. Pneumonia. (Very rare.) Dilatation of bronchi. Tuberculous cavity of small (rarely of large) size. Chronic consolidation of lung. Cancerous mass round bronchi.
Amphoric character of sound.		Antero-superior part of chest on either side.	Tuberculous cavity of large size, having walls generally and equably condensed.
Cracked-metal character of sound.	Sudden propulsion of air (forcibly expelled from a cavity) against the walls of the passages with which it comes in contact.	Antero-superior part of chest on either side.	Tuberculous cavity of large size, with anfractuous walls, and communicating freely with the bronchi; the corresponding parietes being at the same time particularly yielding. Bronchitis.
Movableness of the limits of dulness of sound.	Movableness of the material causing the dull sound.	Inferior regions of the chest.	Pleurisy, especially at period of gravitating effusion. Hydrothorax. Hydro-pneumothorax.
Comparatively deficient increase of clearness at the close of a full inspiration.	Interference with complete expansion of the lung.	Either infra-clavicular region.	Slight irregularly disseminated induration, tuberculous, or other.

[The following paragraph should have been inserted at p. 330:

A highly important addition to the morbid anatomy of tuberculous disease, has been made by Schroeder Van der Kolk and M. Guillot, respecting the vascular condition of the lung. It is ascertainable that the branches of the pulmonary artery stop or cease to be permeable at a distance of three, four, or five millimeters from tubercles or gray granulations; the length of vessels impermeable increases with the augmentation of the tuberculous masses, so that when these are considerable, or when they have given place to cavities, a sort of investment, two centimeters thick, may be found around them, presenting not a single ramification of the pulmonary artery. By injection and microscopical examination, it is further discoverable that this total absence of vascularity is only temporary; after a time, red lines, tapering off at either end, and in their widest part equaling a millimeter in diameter, become discernible. At first these vessels are perfectly isolated, but in process of time communicate with the bronchial arteries, or with those of the walls of the thorax. The latter communication is effected by means of new vessels developed in the pleural false membrane, (the particular discovery of Van der Kolk.) The amount of new vascularization effected in this way increases greatly with the progress of tuberculous destruction; the rete spreads eventually, it may be, through a great part of the affected lung, and replaces the system of the pulmonary artery which has ceased to be discoverable. An inquiry naturally presents itself, as to the influence on oxygenation exercised by this novel condition of supplementary vessels. It is in truth aortic blood, that by means of the bronchial arteries and new system of vessels spreads through the lungs; and M. Guillot has ascertained that this blood must return to the heart by the bronchial, pulmonary, and azygos veins, as he ascertained that the substance of injection thrown in by the aorta is found in these veins. Now this condition of circulation is one that manifestly cannot subsist without materially altering the blood of phthisical subjects, and thereby affecting their organization generally. The main result in respect of function may be expressed thus,—that in proportion as tuberculization advances, the lungs acquire increasing capacity for arterial, and lose it for venous blood.]

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THE END.

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