



*With the Authors'
Compliments*

DISEASES OF THE LUNGS.

CROUPOUS PNEUMONIA.—HYPOSTATIC PROCESSES.—EMBOLIC
PNEUMONIA.—FAT EMBOLISM.—HYPERÆMIA AND ŒDEMA.
—ATELECTASIS.—EMPHYSEMA.—GANGRENE.—NEW
GROWTHS.—PULMONARY CONSUMPTION.—
TUBERCULOSIS.

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CROUPOUS PNEUMONIA.

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The two leading peculiarities of *Jürgensen's* article on this subject are his vigorous advocacy of the theory that pneumonia is an infectious disease, and the view that a fatal result is generally due to failure of the heart. In the second edition of *v. Ziemssen's* Encyclopædia, with enlarged experience and basis of facts, he emphasizes these views, as well as the various conclusions to which statistical analysis had led him in the first edition; but makes no very material changes. During the last few years, attention has been reawakened from widely different quarters to a class of cases of pneumonia characterized as "asthenic," "adynamic," "bilious," "typhoid," "pythogenic," "endemic," "epidemic," "contagious," "erysipelatosus," and the like; and the burning questions in relation to this disease are to-day: I. Is pneumonia an infectious disease, or is it a simple inflammation? II. Is there an asthenic, etc., form of pneumonia, distinct from the ordinary or less severe form; or is there but one form, the manifestations of which differ only according to the intensity and concentration of the exciting cause and the power of resistance of the patient?

To the consideration of these two questions, and an attempt to indicate the light which has been thrown on their solution since 1873, it is proposed largely to limit this report.

I. A better and more widespread understanding of the part played in the causation of disease by bad hygiene, or, as *Simon* graphically puts it, *filth*, has naturally prepared the way for the reception of the doctrine of the infectious nature of pneumonia; and there is no doubt that *Jürgensen's*

views on this point have gained many adherents since their promulgation. They have been strongly adopted by *Sturges* and *Flint* among others. The latter calls the disease "pneumonic fever," as does *Bernheim* (*Leçons de Clin. Méd.*, 1877, p. 17 et seq.), and says that name is as appropriate as the term enteric applied to typhoid fever. He derives his grounds from the morbid anatomy, etiology, clinical history and treatment of the disease; and states them so clearly that, in view of the great and well-deserved respect which is universally accorded to Dr. *Flint's* opinion on medical questions, a very brief abstract of them can hardly be out of place.

MORBID ANATOMY.

It is not easy to reconcile the large quantity of the exudation; its probable derivation from the branches of the pulmonary artery; its complete removal without injury to the air vesicles; its gradual and sometimes successive extension over one or several lobes, and the partiality of the disease for the lower lobes, especially the right, with the deduction that the products in pneumonia are the result solely of a local inflammatory condition.

ETIOLOGY.

Neither local affections of the lungs, bronchial tubes, nor pleura, nor violence applied to the chest ever give rise to acute lobar pneumonia; and here it may be added that *Heidenhain* (*Virchow's Archiv*, Bd. 70, p. 441) could not succeed in exciting croupous pneumonia in dogs and rabbits artificially. The inhalation of hot and cold dry air through a canula in the trachea had absolutely no effect on the lungs or the height of a thermometer in the trachea; but moist cold and heated air caused lobular pneumonia. *Sommerbrodt* (*Virchow's Archiv*, Bd. 55), in connection with experiments on the relation of blood in the air-passages to phthisis, found that microscopically local spots of croupous pneumonia resulted from the introduction of a solution of the chloride of iron into the lungs. *Jürgensen* and *Schüppell* repeated his experiments carefully on dogs, and found that even anatomically the product differed from that of croupous pneumonia. In short, croupous pneumonia has never up to the present time been produced artificially.

"Pneumonia," Dr. *Flint* continues, "as is well-known, is not infrequently an intercurrent affection in the course of other essential fevers, namely typhus and typhoid fevers, measles, diphtheria, etc. In these instances the determining cause must be constitutional, and yet, as the affection is only an occasional complication, the determining cause involves something which does not necessarily pertain to these fevers. This something, it is reasonable to conclude, is pneumonic fever. Hence it follows that pneumonic fever may be associated with other febrile diseases. The blending of different fevers may be considered at the present time as a well-established pathological doctrine. An example with which all of us are familiar is the typho-malarial fever."

A specific cause is not as yet demonstrable, but the same remark is also true of malarial and other essential fevers. The prevalence of the disease at certain seasons of the year; the relative immunity of some climates over others; the fact that it has, at certain times and places at the South, been known to prevail to an extent entitling it to be called endemic, and the fact that at different times and places the disease has varied as regards its phenomena and rate of fatality, are all adduced as etiological arguments in favor of the specific nature of the affection. Are not the same arguments equally potent in favor of the existence of bronchitic and pharyngitic fever?

CLINICAL HISTORY.

The disease is generally ushered in by a well-marked rigor followed by fever and a rapid and pronounced rise in the temperature, which fever cannot be symptomatic merely, for the reason that often no physical signs can be obtained until several days have elapsed; that the pulse and temperature afford no indication of the extent or extension of the disease; and that defervescence often takes place decidedly before it is possible to detect any change in the physical signs—in other words, that defervescence is not determined by conditions which relate to the local lesion. In fact it is a self-limited disease. The analogy to typhoid fever, which in several points of view is apparent, is further shown by the frequent occurrence in pneumonic fever of what are known as typhoid symptoms. It is true that they occur in various diseases, but they are far more frequent in pneumonic fever than in any other disease, except typhoid and typhus fevers. They cannot be attributed to the interruption of the respiratory function, for they are rare in such diseases as pleurisy, capillary bronchitis, and asthma; but are undoubtedly due to the fever, irrespective of the pulmonary affection.

Pneumonic fever, again, has no immediate tendency to relapse; in a large number of cases recorded by Dr. *Flint* relapse is not noted in a single instance, nor does he recall such an occurrence in any unrecorded case. It never persists in a chronic form; clinical experience shows that it does not eventuate in phthisis, and if death does not take place from the disease, its complications, or its accidents, recovery follows without any risk of the persistence of the local affection in a chronic form.

TREATMENT.

The influence over the disease of antipyretic remedies—quinine, salicylic acid compounds, and cold water—speaks also in favor of the doctrine of essential fever.

Dr. *Flint* has seen the disease rendered abortive in a certain proportion of cases by 20–40 grains of quinine daily, and when this result has not followed, the disease is often favorably modified in a greater degree than by smaller doses.

Finally he defines the affection as “a fever characterized anatomically

by an abundant exudative deposit in the air-vesicles of a single lobe, or of two, and sometimes three lobes of the lungs with, in general, circumscribed bronchitis and dry pleurisy. It is a fever which rapidly reaches its maximum of intensity, and has a short course, the duration averaging about eleven days. It proves fatal chiefly in consequence of associated diseases, complications, or accidents, and the mode of dying is by asthenia. It is non-communicable, and depends on a cause, or causes, specific in character, the nature of which is at present unknown, but having relations to season and climate. It sometimes aborts spontaneously; and it is in some instances arrested by remedies. If not arrested it may be favorably modified, its duration abridged, and the danger to life diminished by treatment addressed, not to the pulmonary affection, but to the fever."

It will be observed that *Flint's* arguments are essentially the same as those of *Jürgensen*, though they are more elaborate as well as more concise. In the presentation of the other side free use is made of critiques on *Jürgensen* and *Sturges* which appeared in the *Brit. and For. Med.-Chir. Review* for January, 1877, and on *Sturges* in the *Edin. Med. Jour.* for the same month and year.

Both authors—and presumably *Flint*—follow *Hirsch* and *v. Ziemssen*, of Berlin, who propounded his views in 1858, based largely on the London mortality returns of sixteen years (1840–56). *Buchan* and *Arthur Mitchell* (*Journal of the Scottish Meteorological Society*, July 1874–75, p. 190) have investigated the same subject on the basis of thirty years of the same returns and have not found *v. Ziemssen's* views in any way supported. On the contrary, they have found the mortality curve for pneumonia to be very steadily marked from year to year, and to be essentially the same as that from bronchitis. The pneumonia curve also differs *in toto* from those of typhus and typhoid, or even simple continued fever, as well as from that of pleurisy, the curve of the latter being somewhat analogous to that of rheumatism and pericarditis. There is, therefore, nothing in these statistics—the most perfect in the world and extending over a longer period than any others—that lends the slightest support to the theory that pneumonia is a specific fever of any kind, or indeed anything else than an inflammation pure and simple. Prior to 1869 all fevers were classed together in the London mortality returns, and between 1840 and 1856 typhus fever prevailed in that city more or less. We know that typhus and typhoid have a very different seasonal mortality, that both of them differ very materially from that of pneumonia, and, therefore, how much value to attach to the curve figured on page 29 of the translation of volume V.

It is true that in pneumonia the fever often abruptly ceases before the local lesion is resolved; in a healthy subject this is by no means the rule, but, be that as it may, the rapid cessation of a frequently very high temperature with the continuance of the local lesion often for a very long time is a daily occurrence in embolic pneumonia, which is purely a local process and could not possibly be supposed to have even the most remote

connection with any form of specific fever; and, indeed, it requires but a slight acquaintance with pyrexial processes to discover that the period of convalescence or repair is never pyrexial, or, as *Burdon-Sanderson* has stated, "does not form part of the febrile process."

As for *Flint's* assertions that pneumonia never persists in a chronic form, and that it never leads to phthisis, it can only be said that many other first-rate authorities do not agree with him. One of the causes of interstitial pneumonia is claimed to be a croupous exudation which did not undergo absorption. *Jürgensen* himself says that this sequence, though not common, cannot be doubted by a physician of large experience (2d Ed. v. *Ziemssen's Encyclopædia*).

As was hinted above, many of the arguments for the specific nature of pneumonia have a very wide application, and speak quite as strongly for the specific nature of bronchitis, pharyngitis, and some other affections. Very likely they do partake of this nature at times, but there can be no question that they are very often simple inflammations. So with pneumonia; may it not be that the disease is sometimes an essential fever, sometimes a simple inflammation? Further than this I do not see how we can go at present. We have had a pathology of the humors and of the solids; we now bid fair to have a pathology of the specifics.

Klebs (*Arch. f. Exp. Path.*, Bd. IV., p. 420) figures and describes an organism, *monas pulmonale*, which he found in the ventricular fluid of patients who died of pneumonia, and in the sputa during life, and by injecting which in rabbits he has produced lobular pneumonia, with which was associated meningitis, nephritis, etc. He thinks that this explains the frequent association of pneumonia and erysipelas with the above affections, as well as pleuritis and pericarditis. These observations are as yet entirely lacking in confirmation by others, and caution is never more imperative than in connection with these low forms of life. That pneumonia may apparently be set up by sewer gas is shown by a striking outbreak (*Med. Times and Gaz.*, April 4th and June 20th, 1874), quoted nearly as abstracted in the *Irish Hospital Gazette* for Nov. 1st, 1874.

Sewer-Gas Pneumonia.—On Saturday, March 14th, the parish sewer in the road nearly opposite a first-class boys' school, at East Sheen, near London, was opened by order of the sanitary authorities for the purpose of inserting a ventilator protected by a charcoal screen. The headmaster remonstrated, and backed up his own objections by a certificate signed by several eminent medical men, including *Sir William Jenner*, two of whose sons were students at the school. *Sir William Jenner* especially mentioned the danger of pneumonia in connection with the probable escape of sewer-gas in the vicinity of the school. The authorities persisted in their scheme with a trifling modification. March 20th, a high tide in the Thames blocked up the mouth of the sewer, and the compressed gases forced an opening through the ventilator. The rooms of the school facing the road were filled with a foul-smelling sewer air. Next morning, a boy sleeping in one of these rooms was taken seriously ill with pneu-

monia; on the evening of the same day two other boys and two servants became similarly affected. One of the servants ultimately died. The school was broken up, and the authorities were ordered to remove the ventilator and close the opening on the evening of the 21st, after which all smell ceased, and no additional cases of illness of any kind occurred in the house. For fifteen years previously, no illness attributable to bad drainage had occurred, and competent inspectors pronounced the sanitary arrangements of the house excellent.

The fact that pneumonia was predicted lends additional interest to the above report. We are not given to understand that the cases presented any peculiar clinical features.

II. What is the position of the severe form of pneumonia called typhoid, asthenic, adynamic, nervous—does it differ etiologically from the common form or not? *Jürgensen* puts this question (2d Ed. v. *Ziemssen's* Encyclopædia), discusses it briefly, and answers: "Personally I do not hesitate to express my firm conviction that there is but one pneumonic poison; it is just as with roses: either each kind of rose forms a species, or there is but one species including many varieties."

Laennec (*De l'auscultation médiate*, 4th Ed., Vol. I., p. 595) observed and described an affection which prevailed among the conscripts of 1814, and was called by him epidemic pneumonia. A remarkable epidemic of contagious pleuro-pneumonia started in Canada during the war of 1812, and spread through the United States far into the South, though all facts of this kind seem to have been lost sight of under the universal prevalence of the doctrine of the simple inflammatory nature of the disease, until *Hirsch* formed a chronological list of similar epidemics occurring between 1521 and 1858.

Within a few years the subject has been brought prominently forward by *Liebermeister*, *Friedreich*, *Fisner*, *Leichtenstern*, and others; and our knowledge has been enriched by the report of carefully observed and most interesting local outbreaks which are worthy of being dwelt upon at some length.

In the *American Journal of the Medical Sciences* for January, 1876, *Rodman* describes a series of cases observed by him in the prison at Frankfort, Ky., at a time when there was but little pneumonia about, and it was only among the prisoners that this form of the disease occurred. Between January 1st and February 24th, 1875, 16 cases of ordinary pneumonia occurred in the prison, one of which was fatal. About the last week in February, it was evident that the type of the disease had radically changed, and the number of cases was greatly increased. The whole number of cases of pneumonia from January 1st to July 1st was 118; of these, 98 were of a peculiar type, and 25 of the 98 were fatal. The disease is said to have resembled closely ordinary pneumonia, both as to physical signs and post-mortem appearances, though it is mentioned that the sputa were generally either pure blood or a dirty brownish-black in color.

Pain was not a prominent symptom, and in many cases the lung-con-

solidation was revealed only by physical exploration. The pleura was implicated oftener than in simple pneumonia, and in several cases circumscribed empyema was found. The bowels did not seem to be much affected, but the dejecta were excessively offensive. The liver was enlarged, and, in fatal cases, filled with dark syrupy blood; no mention is made of the spleen or kidneys. Men died with hepatization of but a single lobe, and the disease was very treacherous as regards prognosis. The average temperature seldom ranged as high as in ordinary pneumonia. The patients might seem better as regards the pulse, respiration, temperature, cough, and expectoration; but take a sudden change for the worse and die. Carbonate of ammonia, on which previous experience has led Dr. *Rodman* to rely greatly, proved useless; and much better results seemed to follow the administration of quinine, and the tincture of the chloride of iron, with liberal diet and free stimulation. Convalescence was very protracted.

The cell-house is 310 feet long, 43 feet wide, and 75 feet high, and contains 648 cells, each of which contains $170\frac{2}{3}$ cubic feet of air; and the cells, like the cell-house, are very poorly ventilated. Feb. 1st, 694 men were confined in these cells, and during this month the number of prisoners received was so much in excess of those discharged, that by March 1st 735 men occupied these same cells. There are six tiers of cells on each side of the house, but those next the roof, 108 cells, cannot be used, it being almost certain death for any one to sleep in them, especially in summer. It was consequently necessary to double the men in some of the cells, and this was done in the uppermost tiers. The strongest cells are near the floor, and are reserved for the whites, who are more apt to escape than the negroes. Every man takes a night bucket with him to his cell, only intended to be used in case of emergency; but rather than wait their turn at the privy, 400 of the men will use their buckets in the cells between dark and daylight in spite of severe penalties. The basement tier was comparatively free from bad odors, and there was less sickness there than in any other part of the house. The odor increased with each tier, and, when the top was reached, the stench was almost unbearable by one unaccustomed to it. Of the 25 who died, 24 were negroes (occupying the upper cells) and 14 were new prisoners, reckoning those as new who were received after January 1st. The new prisoners were to the old numerically as one to four. These facts show the causative agency of the bad air, and illustrate the greater susceptibility of a stranger over a native, so to speak, to zymotic poison. We are all familiar with the frightful ravages caused by the importation of measles into the Fiji Islands not many years since. We shall have further evidence to bring on this point later.

Overcrowding and consequent intensification of the poison seems to have been the exciting cause of this outbreak, for the condition of the men was in other respects precisely the same as during the time that the pneumonia presented no distinctions from the ordinary type. *Rodman* states that twice before in the history of the prison pneumonia prevailed

to a fearfully fatal extent, and in both instances coincided with marked increase in the number of the prisoners.

Dr. *L. Dahl* (*Dublin Journal*, I., 1875, p. 405) describes an outbreak of pneumonia in the Akerhus prison, Christiania, which commenced in Dec., 1866, and terminated in May, 1867. Among an average of 360 prisoners in that period, 62 cases occurred with 15 deaths. The weather was very cold at the height of the epidemic, but the prisoners who worked in-doors were about equally attacked with those who worked in the open air. Prof. *Boeck* attributed the outbreak chiefly to *overcrowding*, and Dr. *Dahl* calls attention to the improved state of affairs coincident with a diminution in the number of the prisoners from 387, Jan. 1st, to 278, Dec. 31st, 1867. A former similar outbreak occurred in the prison in 1847, and coincided with a prevalence of scurvy.

Kühn (*Deutsch. Arch. f. klin. Med.*, 1878, p. 348, and *Berliner klin. Wochenschrift*, Sept. 15th, 1879) contributes reports of outbreaks in the House of Correction at Moringen, Hanover, in the years 1875 to 1878, which differ in some respects from that of *Rodman*. In the year 1874, it was noticed that there was an unusual amount of sickness among the prisoners, and that this increase was chiefly in diseases of the respiratory organs. Pneumonia ran a peculiar course, much more like that of an infectious disease than of the ordinary type. There were also a considerable number of cases of an ill-defined febrile affection, the onset of which was preceded by pain in the head and back, and malaise, which ran a mild course with sudden defervescence about the tenth day, and was followed by tedious convalescence. The most prominent symptoms were either those of gastric catarrh or of bronchitis and lobular pneumonia. Enlargement of the spleen was nearly constant. In 1875, cases of illness were still more numerous, the maximum being reached in February, when ten and a half per cent was the daily proportion of the sick. During the year there were only eleven cases of pneumonia of the ordinary type, but during the first nine months there were eighty cases of general febrile disturbance, more severe and, at the same time, less vague in character than those of the year before. After prodromata lasting from five to eight days, rigors and a rapid rise of the temperature to 103–104.5° came on; during the next few days simple sore throat, enlargement of the spleen, and, in the severer cases, albumen in the urine appeared; but the belly presented neither spots, distention, nor tenderness. Not till the third or fourth day could consolidation of the lung be detected; this consolidation was generally lobar, very often of the upper or middle lobe, and sometimes disappeared without ever becoming complete, to reappear in another portion of the lung, thus resembling the so-called "wandering or migratory pneumonia." Foci of lobular pneumonia were very common in the upper lobes, both with and without a lobar process in the lower lobes. Severe pleuritic symptoms were constant; meningitis was noted in five cases, and the cerebral symptoms in general were second in prominence only to the pulmonary. Pericarditis occurred in twenty-five per cent of all the cases, and the albuminuria

generally continued as long as the pyrexia. It was present in every case in which the temperature surpassed 104° . In two-thirds of the cases which proved fatal from the direct effects of the disease, the solitary follicles and Peyer's patches were swollen, but not ulcerated. In fact, the symptoms were those of severe general blood poisoning, but the course was decidedly shorter than that of typhoid fever, and the temperature curves were more like that of pneumonia. Sixteen cases were fatal, and in fourteen of these the pneumonia was exclusively of the lobar variety. That the affection was contagious to a degree is shown by its appearance in nurses and chronic patients in the hospital; and above all, by the fact that one of the overseers took it home to his family who lived at some distance and never came into direct communication with the prison.

Kühn himself was laid up several days with malaise, and about the same time his coachman, whose duty it was to brush his clothes, fell ill. Then the housemaid who undertook this duty was taken sick, and finally his daughter, a child of four years; the two latter cases being quite severe, and followed by tedious convalescence and loss of the hair. As soon as the housemaid was sufficiently well she went to her friends, who lived some miles distant, taking with her articles of clothing which had been used and kept in her room during her illness. She occupied the same bed with her sister, who, just eight days after the arrival of the sister at home, was also taken ill in precisely the same way.

The above facts taken together lead Kühn to formulate the following conclusion: "*There is then a contagious affection, the course of which is the same as that of primary asthenic pneumonia, but which is entirely distinct from ordinary pneumonia, and differs no less from it than does typhoid from typhus fever.*"

In this epidemic again we find that overcrowding seems to be the exciting cause. The prisoners were chiefly incorrigible tramps and beggars, and averaged about one hundred and eighty in number previous to 1874. In that year the influence of hard times began to be felt and the number of prisoners was about one-third larger than could be properly accommodated. New buildings were undertaken, and by the end of 1876 there was room for six hundred prisoners, but commitments increased in still larger proportion, and overcrowding was constant, continuing at least into 1878, though in a less degree. It is stated that the sanitary arrangements were excellent, but on these points the account is not as full and clear as could be desired, and we are told that wooden buckets were used in many of the dormitories for the reception of the renal and alvine discharges. Great pains seem to have been taken to keep these buckets clean, and it is certain that the hygiene of the place was vastly superior to that of the Frankfort Prison. It will also be noted that the German mortality was less. In the town of Moringen itself, there was during the year 1875 decidedly less typhoid fever than in previous years; but diseases of the respiratory organs were rife, as well among adults as children, and partook in their course and complications somewhat of the nature of the prison disease.

During 1876, 1877, and 1878, this form of pneumonia continued to be the prevailing disease in the institution. According to *Jürgensen*, pneumonia constitutes 3% of all diseases, and 6.4% of all diseases of the internal organs; but in 1878 the proportions in the Moringen workhouse were 8.81% and 17% respectively; catarrhal, cheesy, and secondary pneumonia being carefully excluded from the statistics. The number of cases was fifty-eight, seventy per cent of which occurred during the two months of March and April. A few of these cases differed in no respect from ordinary pneumonia, but the great majority were of the previously described type. Eight were fatal, a proportion of 13.80%. The post-mortem appearances were much the same as in 1875, except that the swelling of the intestinal glands was decidedly less marked. The less intensity of the epidemic of 1878 is also shown by the fact that though a nurse in charge of a ward containing several pneumonia patients was taken down with the disease, there is no evidence that it was communicated to any person outside of the institution. In 1877, 71.82%, and in 1878, 77.58% of the cases were in those who had been less than six months inmates of the prison, while only 31.99% of the whole number of prisoners had been there six months or more.

Grimshaw and Moore (*Dublin Journal*, I., 1875, p. 399), call attention to a type of pneumonia which was common in Dublin during the warm months of 1874, and which they characterize as "pythogenic." The distinctive symptoms were sudden invasion, the frequency with which the disease was arrested in the early stage, and a less liability *constantly* to attack the lower lobe of the right lung. It is stated that the disease is not usually very fatal, but that an accurate percentage of mortality cannot be given because of the difficulty in distinguishing some of the cases from enteric fever on the one hand, and true pneumonia on the other. All of these patients came from houses the sanitary condition of which was far from satisfactory. They refer to an epidemic of pleuro-pneumonia in some ships of the British Mediterranean fleet in 1860; the disease was of an asthenic type accompanied with great congestion of the lungs, and, in many cases in the ship chiefly affected, with scorbutic symptoms. Overcrowding and defective ventilation were the most tangible causes, and there were good grounds for supposing that the affection was communicated by the sick landed from the vessels to the patients in the Maltese hospitals.

Some of the conclusions drawn by the authors in their paper are as follows:

1. That the bibliography of pneumonia indicates the existence of a form of the disease which arises under miasmatic influences and is contagious.
2. That its etiology justifies us in regarding it as a zymotic affection and in terming it "pythogenic" pneumonia.
3. That pythogenic pneumonia presents peculiar clinical features which enable us to distinguish it from ordinary pneumonia.
4. That whereas ordinary pneumonia is specially prevalent during a

continuance of cold, dry weather with high winds, and extreme variations in temperature, pythogenic pneumonia reaches its maximum during tolerably warm weather, accompanied with a dry air, deficient rainfall, hot sun, and rapid evaporation.

Barella (*Bull. de l'Acad. de Méd. de Belg.*, No. 2, 1877) supports the views of *Grimshaw* and *Moore*, and adds that the disease has often at the beginning abdominal symptoms which make it look much like typhoid fever. In this connection it may be well to refer to *Murchison's* teaching, that in cases where the diagnosis is doubtful between pneumonia and typhoid fever, the appearance of consolidation before the tenth day of the disease points to the former affection.

Hardwiche (*Gaz. Méd. de Paris*, 1876, p. 515) reports some cases in which the disease seemed to be contagious, but they are so lacking in details as to be of little value.

Kelemen (*Pester Med. Chi. Presse*, XII., 1776, 45-46) alludes to four cases of "migratory pneumonia," and adds one of his own. *Waldenburg* compares the disease to erysipelas migrans, and *Friedreich* believes that they are practically the same thing, as he has seen many cases of migratory pneumonia during the prevalence of erysipelas. In ordinary pneumonia one, two, or (very rarely) three foci are co-existent and disappear together, even if they do not begin at the same time; but in the migratory variety one focus makes its appearance and is followed by another, and another, the new one not appearing until its predecessor has vanished. The foci may run through all three stages, or never go beyond the stage of engorgement. In these five cases the maximum number of foci was ten, the minimum four.

The limits and purposes of this report do not permit of anything more than a passing allusion to the typhoid pneumonia of which so much was heard during the late civil war, and to the possibility of some connection between the pleuro-pneumonia of cattle and certain epidemics in man.

At what conclusions as to the etiology and pathology of pneumonia do the above facts, in connection with other knowledge and experience, enable us to arrive?

A good deal can be said in favor of each of the four following statements, and the profession doubtless comprises adherents of each:

1. True pneumonia is simply a local inflammatory disease, but many general constitutional affections are at times accompanied by a pulmonary lesion which bears a close resemblance to simple pneumonia, though it is in reality a part of the constitutional process; the results of this process happening, for some cause unknown, to be localized largely in the lungs.

2. Pneumonia is often simply an inflammatory disease, but may depend on various miasmatic influences and then present decided variations in its course and symptoms.

3. Pneumonia is never a simple inflammation, but always an infectious disease arising from a single specific cause as yet unknown, and

varying in its effects according to the intensity of the poison, the power of resistance and the surroundings of the patient.

4. Pneumonia is always an infectious disease arising from dual, possibly plural, specific causes. Of these causes one produces sthenic fever, of more or less definite type, and with localized lesions, while the other or others produce an asthenic fever far less definite in type and with more or less extensive lesions of other important organs and parts as well as of the lungs.

Of these statements the second is that which to me individually seems most in accordance with the facts at our disposal to-day, though any statement as to a matter of this nature is merely a halting-place, as it were, on our journey, from which we cast our eyes over that part which lies behind, and mentally remeasure and consider the length and obstacles of the path before us.

Other aspects of the disease require but brief mention. *Marshall* (*Medical Record*, N. Y., Vol. 17, 1880, p. 185) reports a case of pneumonia with recovery after a temperature of 110°. It is interesting to note that, while *Jürgensen* and *Sturges* agree in the main as to the infectious nature of pneumonia, they differ as to treatment. The latter advocates moderate bleeding as a means of relief to the dyspnoea, even after a considerable extent of the lung has become solid—so late as the third or fourth day, but says that the cold bath is less applicable to pneumonia than to other febrile conditions where the functional defect is less ominous, because he regards exceptionally high temperature in pneumonia as simply an indication of a necessarily fatal condition of the lung, and sees no reason to employ cold bathing as long as the pyrexia is moderate. As to the utility of stimulants to tide over a period of depression, he agrees with *Jürgensen*.

Hamburger reports that in the winter of 1877-78 seventy-seven cases of croupous pneumonia were treated at the Strassburg hospital. Of these, seven died, and the heart was healthy in every case—in other words, death was not due to cardiac failure.

HYPOSTATIC PROCESSES IN THE LUNGS.

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(The following is translated from the second edition *v. Ziemssen's Encyclopædia*.)

In *diagnosis* there are two great sources of error.

A *croupous pneumonia*, which supervenes on a long-standing malady attended with considerable fever, may give rise to such slight symptoms as to escape notice, unless examinations are often and carefully made. The same remark is true of croupous pneumonia in feeble and aged persons, especially when emphysema and chronic bronchitis are also present. If, under these circumstances, *bilateral* consolidation is found over the lower lobes, the chances are very strong that the condition is one of hypostasis. *We must not, however, entirely lose sight of the facts that unilateral hypostasis and bilateral croupous pneumonia are sometimes met with.* A diagnosis which is based merely on the ground that one only, or that both sides are involved, is not much better than a guess. In many, yes, in most cases, the history or other points which one will have noted if the cases have been some time under observation, will throw all necessary light upon them.

It is well known that *collapse* in a greater or less degree always occurs at the anterior borders, and the lower and posterior portions of the lungs of patients with feeble respiration, who are compelled to lie on their backs for long periods. A good deal of attention has been devoted to this point now for a series of years at the *Kiel* clinic, and *Bartels* has inspired a number of dissertations on the subject containing the results of his experience (see bibliography). Collapse of the lower and posterior portions of the lungs occurs in connection with various apparently quite distinct diseases, provided that they have the common factors of superficial respiration and the constant maintenance of the same bodily position; and this collapse may be sufficiently marked to give rise to physical signs if the disease be of long duration. *Portions of pulmonary tissue thus collapsed may become the seat of hypostasis and catarrhal pneumonia*, the latter either in isolated patches or involving the whole area. Both conditions may be associated, or either may exist independently of the other.

Bartels has shown that when the body is horizontal, the muscles which serve to dilate the thorax work at a disadvantage as compared with either the erect or the sitting posture. In the prone position the contents of the abdominal cavity gravitate upwards and press against the diaphragm; in standing or sitting, on the other hand, the exact reverse is the case, and all the abdominal viscera gravitate downwards toward the pelvis. The anterior wall of the belly serves as a support, but when the body is horizontal on the back, the weight comes entirely on the spinal column, the lateral surface of the abdomen, and the diaphragm. Of all these surfaces the diaphragm is that which offers least resistance to the pressure, is consequently the first to give way to it, and thus encroaches on the pulmonary space. In the prone position again, the distance between the crest of the ilium and the lower ribs is increased, and the diaphragm is put at a greater disadvantage by this increased tension of the abdominal wall. The observation that the vital capacity of the lungs is less in the recumbent than in

the erect position (*Hutchinson, Wintrich, Panum, Pfahl-Quincke*) is entirely in accordance with these facts. In very muscular persons, the difference is not indeed very great, certainly during the short time required to respire a few times while an observation is taken with the spirometer, but in rather feeble persons it is as great as 400–600 c. cm., even when the full inspiratory force has been called into play only a few times and no real fatigue has been incurred.

A plain statement of the matter may be made as follows: A change from the erect to the recumbent position increases the forces which oppose respiration to such a degree that a decidedly greater demand is made upon the muscular power to counteract these forces in a measure, even for a brief period; to counteract these entirely is impossible. If the dilatation of the thorax incident to inspiration is lessened, or, in other words, if the difference in the atmospheric pressure within and without the thorax is diminished, the lungs tend to approximate to the position at which their elasticity is exhausted, and this the more in proportion as the respiration is feeble. The conditions which experience has taught us favor collapse are pain on inspiration from peritonitis, double pleurisy, or acute rheumatism, feebleness of the respiration from long-continued fever, and loss of muscular power from tonic spasm, such as that of tetanus. If something be superadded to these conditions which favors nutritive changes in the walls of the vessels—hypostasis, the escape of the constituents of the blood, both formed and amorphous—is the result. That this whole process may go through its several stages in a short period of time is proved by the existence of well-marked collapse and hypostasis in a patient who died from tetanus on the fourth day after seizure (*Erhardt*). When favorable conditions for the development of catarrhal pneumonia are present, this process is also set up, either in isolated patches, or uniformly distributed over the whole collapsed portion of lung.

Theoretically, doubtless, collapse, hypostasis, and catarrhal pneumonia are quite distinct processes, but their underlying causes are so often associated during life and their physical signs are so similar that it is often practically impossible to differentiate them at the bedside.

EMBOLIC PNEUMONIA.

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PATHOGENESIS AND ETIOLOGY.

As to the question whether hæmorrhagic infarction is invariably due to embolism, both *Jürgensen* and *Gerhardt* call attention to the fact that sometimes no embolus is to be found. That state of things is more common during the course of some infectious diseases, and thus naturally suggests the possibility that nutritive disturbance has so altered the walls of the vessels within a limited area of the lung as to allow the escape, not only of the coagulable plasma, but also of the red blood-corpuscles. This explanation must, of course, remain purely hypothetical until the existence of such nutritive disturbances is proved.

Our authors are also agreed as to the statement that those valvular lesions are most apt to lead to thrombosis in the systemic veins which bring about accumulation of blood in the same: similar results are liable to follow degeneration of the cardiac walls, especially when, as *Jürgensen* has found to be the case in Tübingen, such degeneration is predominant in the right heart. The size of an embolus does not alone determine the extent of the resulting infarction, for the greater or less supply of blood from other sources to the occluded vascular territory must also be taken into account; and in the case of metastatic abscess, there is still another factor to be considered: septic action, namely, may extend by contiguity into tissue supplied by arteries, other than that which is occluded.

As to the *method of development* of hæmorrhagic infarction, our knowledge has been materially increased these last years. *Jürgensen* states that he regards the views of *Cohnheim* as unassailable, and these views assigned a very important part in the production of infarction to accumulation and stasis of blood in the pulmonary veins, due, simply, to complete loss of arterial pressure in the territory of the occluded artery. *Litten's* latest experiments (1879) agree entirely with those of *Küttner* and *Lichtheim*, and essentially modify the results of his and *Cohnheim's* experiments expounded in the second German edition of *v. Ziemssen's* Cyclopædia. He finds, namely, that in rabbits and dogs, though the hilus of one lung be ligatured *en masse*, infarction takes place, and a certain circulation is carried on through the arteries which supply the pleura, mediastinum, and pericardium. Venous accumulation cannot, therefore, be the cause of infarction, inasmuch as it may occur when the pulmonary veins are tied. *Küttner* also showed that there is pretty free communication in the capillaries between the branches of the pulmonary and bronchial arteries. He tied the pulmonary artery and veins of one lung, and then introduced considerable quantities of fluid, with cinnabar in suspension, gradually into the circulation. The pigment was found in the branches and trunk of the ligated artery, in the capillaries of the

alveolar walls, and in the pulmonary veins, and the bronchial arteries were dilated. The whole tract of the pulmonary artery and veins were filled with plugs containing the pigment. *Cohnheim* and *Litten* used an aqueous solution of aniline-blue in their experiments of 1875, a pigment which we now know is thrown down in the smaller arteries and veins, and plugs them. They were thus led to the erroneous conclusion that the branches of the pulmonary artery are practically terminal arteries, and have no communication with the bronchial artery.

As proof that backward circulation does not take place in the pulmonary veins, *Litten* adduces the fact that when the pulmonary and bronchial arteries, as well as those external arteries which communicate with the lung, are all tied, that is when *all* arterial supply is cut off from the lung, while the pulmonary veins are left open, engorgement and infarction do *not* take place. But if the pulmonary artery alone, or the pulmonary and bronchial, or the whole hilus be tied, these results are constant. Physiologically, *i. e.*, with free circulation, the blood-pressure in the pulmonary artery is all sufficient to overcome the resistance to the onward flow in the capillaries, which, in the lungs, are unusually large, and offer less resistance than capillaries in general. But when the pressure in the pulmonary artery ceases from occlusion of that vessel, the collateral circulation through the bronchial and external arteries is sufficient, indeed, to prevent a backward current in the veins, though not sufficient to force the blood onward to the right ventricle rapidly enough to prevent hyperæmia and diapedesis. The capillaries and smaller veins are in precisely the same condition of distension and dilatation as when the vein into which they empty is narrowed in calibre. *Litten* found the same results in experiments on the kidney and spleen. *Infarction does not take place, in short, unless arterial blood from some source is still sent into the part after its main supply is cut off.*

In illustration of the great powers of resistance of the pulmonary artery to disturbances of nutrition, and of the different results of sudden and gradual occlusion of that vessel, *Jürgensen* reports the following case:

A woman of 54 died with general dropsy dependent on degeneration of the walls of the heart. On autopsy, the main trunk of the right pulmonary artery and its larger branches were found completely filled with a coagulum as thick as the finger, partially adherent to the wall of the vessel, laminated, externally grayish, internally reddish-black in color. The main coagulum was about 4 cm. long, and sent off numerous fresh offshoots into the lateral branches of the vessel. The intima was very atheromatous, thickened, and fatty in spots. The right lung was simply anæmic and œdematous, and entirely free from infarction. The condition of the thrombus clearly indicated that occlusion must have been gradual. The accumulation of blood in the systemic veins was so great that, when the large trunks at the root of the neck were incised, the blood spurted out in a stream three inches in height. Toward the last the circulation in the lung must have been excessively slight, and yet no marked tissue lesions were found.

The writer of this article has reported a somewhat similar case (*Boston Medical and Surgical Journal*, 1880, I., p. 242). The patient, becoming insane, was sent to an asylum, and was there so uncontrollable that it was necessary to put him into a padded room; and yet there was at the time almost complete occlusion of the right pulmonary artery, beside chronic disease of both lungs.

SYMPTOMATOLOGY AND DIAGNOSIS.

In the above case there was an hereditary tendency to insanity; but it is interesting to note that *Gerhardt* seems frequently to have seen cerebral symptoms supervene on embolism of the pulmonary artery in patients with weak hearts. According to his experience, loss of consciousness is very apt to be the first symptom of extensive embolism, whether death occurs soon after, or not. He finds that there is great variation in the degree of the cerebral symptoms: there may be a fainting fit, or merely transitory disturbance of some of the special senses. In one case the sense of hearing remained intact, while that of sight was lost. More or less well-marked signs of cardiac weakness follow the lodgment of the embolus, and it is said that an increase in the area of cardiac dulness is demonstrable. The brain symptoms are attributed to cerebral arterial anæmia.

If the embolus be very large, death may be almost instantaneous, or may be preceded by collapse, intense dyspnoea, or even convulsions. Such deaths are not very uncommon after confinement, and have been reported in increased numbers of late years. Though it is the rule that the temperature does not generally rise for several days after the occurrence of embolism, *Jürgensen* states it cannot be denied that fever attributable to this cause sometimes appears very soon. He agrees with *Gerhardt* that the character of the sputum is not absolutely pathognomonic of infarction. If the expectoration is moderately copious, careful examination will always enable us to distinguish it from that of croupous pneumonia; but that we may be deceived in other ways is shown by the following case:

A woman of 34 came under treatment with right hemiplegia, loss of the power of articulation, and aphasia. She was first seen ten days before her death, and the leading points of the clinical diagnosis were confirmed at the autopsy: failure of the heart from mitral stenosis and insufficiency, and great dilatation of the right cavities. A pleuritic effusion reaching as high as the third rib on the right side was also detected, and part of the expectoration was precisely like that due to hæmorrhagic infarction. This, and the presence of all the conditions of thrombosis led to the diagnosis of infarction in the right lung. The day before death a bloody sputum was thrown out, of the same character as before. Neither thrombus nor embolus was found in the lungs, but the bronchi contained a dark-colored secretion mixed with blood, and there was hæmorrhagic pleurisy. In the *left* auricle was a red, partially softened thrombus.

According to *Gerhardt*, the character of the sputum in cancer and echinococcus of the lung may also be similar to that after infarction. After the lapse of two or three weeks, hæmatoidin, both in the form of granules and crystals, takes the place of the blood-corpuscles. Bloody expectoration may be entirely lacking in hæmorrhagic infarction: its absence was noted by *Gerhardt* in two cases out of fifteen.

The authorities are not unanimous as to the size which must be attained by an infarction before it will give rise to physical signs. *Gerhardt* expects to find decided dulness on percussion as a rule over an infarction which is seated at the periphery of the lung, and involves an area of from one to four cubic inches. *Jürgensen* does not doubt that this may be the case with so experienced and conscientious an observer as *Gerhardt*, but questions whether others will succeed so well, even when the dull area is increased by a zone of œdematous tissue around the infarction. If emphysema is present to any marked degree, it may be difficult to determine positively the existence of even pretty extensive consolidation. *Laennec*, *Skoda*, and *Hopf* are all very guarded in their statements on this point.

TREATMENT.

Prophylaxis deserves passing mention in cases of peripheral thrombosis. Patients should be kept as quiet as possible until the thrombus has disappeared, for bodily movements tend to detach it and allow its being swept into the circulation. *Gerhardt* recommends large doses of morphia subcutaneously to relieve the attacks of dyspnœa, and musk and alcoholic stimulants may be used to excite the heart.

FAT EMBOLISM OF THE LUNGS.

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Inasmuch as the occurrence of fatty embolism of the lungs is not even hinted at in *v. Ziemssen's Cyclopædia*, it would seem not out of place to describe the condition briefly here.

Zenker and *E. Wagner* were the first to discover that the smaller vessels in the lungs may become plugged with fat. The former attached no practical importance to the condition; but the latter was led to connect it with the origin of metastatic abscesses, and in his second publication on the subject expressed his surmise that sudden fatty embolism might be fatal through pulmonary hyperæmia and œdema, though he could bring forward no proof of this. We now know that *Wagner's* surmise was quite correct, and that many deaths after injuries which were formerly supposed to be due to shock, as well as death for which we were at a loss to account in some other affections, are in truth due to fatty embolism of the lungs.

There is reason to think that in almost every fracture of the long bones, at least, more or less of the medullary fat gets into the veins, and is carried into the circulation, but it is only very exceptionally that the quantity is sufficient to give rise to any symptoms or disturbance. Some of the fat may pass through the pulmonary circulation and be deposited in capillaries or small vessels elsewhere, especially if the action of the heart be feeble.

As a typical case I will cite that reported by *Bergmann* (*Berl. klin. Wochen.*, No. 23, 1873). A fall of thirty feet resulted in comminuted fracture of the thigh. After a short time complaint was made of pain in the chest, and later a frothy, bloody expectoration appeared, the respiration increased in frequency, the lips became livid, the temperature rose, and fine moist râles were heard throughout both chests. *B.* made the diagnosis of œdema of the lungs caused by fatty emboli, eliminating traumatic pneumonia, and pulmonary hemorrhage. Death occurred forty-nine hours after the accident. At the autopsy both lungs were hyperæmic, œdematous, dotted with small dark spots, and contained hemorrhagic infarctions the size of a pin's head.

Egli (*Jahresbericht der gesamt. Med.*, 1873, p. 214) reports two cases of fat embolism in which the source of the fat was supposed to be thrombi in the right heart which had undergone puriform softening. The degenerated blood-clots were found to contain large and small fat-drops.

Riedel reports two cases of injury to the soft parts, in one of which fatty embolism occurred to a great, in the other to a slight degree. He also found it in three cases of inflammation of the bones, with and without subsequent operation on the same. In two cases of inflammation of the soft parts he found no trace of it.

Out of 250 bodies examined by *Flournoy* in the Pathological Institute at Strassburg, fatty emboli were found in 26 cases—about 10 per cent—but he throws out three of these as they were imperfectly reported. The remaining 23 cases he divides into two groups with reference to etiology; the first group containing 13 cases, the second 10. Of the first group there was injury to the bones in five cases, osteo-myelitis in one, acute suppuration in fatty tissue in two, suppuration in both bone and soft parts in five. Of the second group there was contusion of the soft parts in one

case, but in the other nine there was no injury whatever, either to the bone or soft parts. Six of these, however, presented peculiar changes in the bone-marrow which *F.* considers the source of the emboli. The marrow, namely, was very soft, fluid, and dark in color; and microscopic examination showed that these changes were due to intense hyperæmia and marked atrophy. He does not attempt to decide whether the condition arose from hæmorrhage or from simple hyperæmia with laceration of the fat-cells and thus absorption. In support of his view that the hyperæmia of the marrow is the cause of the embolism he cites the case of an old person whose bone-marrow was atrophic, but pale in color, and in whom no embolism could be found. In three of his cases the condition was the sole apparent cause for death, and in many of the others no doubt contributed materially toward the fatal result. He has collected and analyzed 140 cases, including his own, and finds that in 18 of these—12.86 per cent—death was due to fatty embolism alone. Injury to the bones was responsible for 72 per cent of the cases, and one case was due to fatty softening of the brain.

Sanders and *Hamilton* (*Edinburgh Med. Journ.*, July, 1879) report a case of diabetes mellitus with death from fatty embolism. One morning dyspnœa came on, followed in the evening by unconsciousness, twitchings of the extremities, and death at four the next morning. Lipæmia was very marked and the embolism seemed to be largely confined to the lungs and kidneys, which were in other respects sufficiently healthy. No fat was found in the uriniferous tubes. It is probable that we have here the true cause of the sudden dyspnœa, coma, and death, which is not infrequent in diabetes, and which has been attributed to acetonæmia by *Kussmaul* and *Balthazar Foster* among others.

Fatty emboli in the lungs and other tissues may be detected by treating sections with perosmic acid, which turns the fat-drops a deep and uniform black without attacking the other structures.

Wiener has shown experimentally that the fat is absorbed into the circulation and eliminated with the urine by the kidneys.

HYPERÆMIA AND ŒDEMA OF THE LUNGS.

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PATHOLOGY AND ETIOLOGY.

Welch and *Mayer* are led to conclude from experiments on dogs and rabbits that none of the explanations which have been current up to the present time as to the mode of production of acute general pulmonary Œdema are really satisfactory.

The former author criticises the use which has been made hitherto of the term "collateral" hyperæmia and Œdema, and remarks that two very different conditions have been included under it: A sharp distinction should be drawn between local serous transudation in the vicinity of inflammatory foci and new formations, and acute general Œdema. He agrees with *Cohnheim* that the former depends on inflammatory changes in the walls of the vessels primarily; and only secondarily, and in small measure, on compensatory increase in the blood-pressure within the vessels of the part. General Œdema, on the other hand, generally comes on suddenly and may as suddenly disappear; it affects both lungs, occurs in connection with a great variety of diseases, but is a constant accompaniment of none, and very often appears during the agony, an attendant rather than the cause of death.

Welch then ably discusses the causes of pulmonary Œdema as laid down by *Niemeyer* in his Handbook of Medicine and *Hertz* in the Cyclopædia, showing that some of them are unsound and that neither individually nor collectively do they serve to explain the facts. His experiments were chiefly directed to the attempt to produce Œdema from passive congestion in the lung, which latter may be brought about by obstruction to the circulation in the aorta, the pulmonary veins, or the left heart. He found that it was necessary to tie the aorta itself between the innominate and left subclavian, and all its branches except one—either one of the carotids or the right subclavian—before he could induce pulmonary Œdema as a constant result; or, in other words, *that obstruction to the systemic circulation can give rise to pulmonary Œdema only when such obstruction attains a degree scarcely conceivable in the human subject*. He then experimented on the pulmonary veins and found that *œdema did not result, nor was the pressure in the pulmonary artery materially increased, until the circulation was nearly completely shut off through all of them*. Occlusion of all the pulmonary veins of one lung was followed by infarction, never by Œdema. He then turned to the left ventricle and found that he could often succeed in paralyzing it in the rabbit by pinching the wall between the fingers, while the right ventricle retained its activity for a time; and *general pulmonary œdema was the invariable result*. The right ventricle is more easily paralyzed than the left, owing to the thinness of its walls, but paralysis of this was never followed by Œdema. From these considerations he forms the hypothesis that general pulmonary Œdema is due to *predominant weakness of the left ventricle*, and then goes on to show that this hypothesis will explain the facts and ac-

count for the great rapidity with which œdema may appear and disappear and its remarkable inconstancy.

Mayer's experiments bear out those of *Welch*, but also throw some new light on the subject. He found that if the arteries ascending to the brain (innominate and left subclavian) are laid bare according to *Kussmaul's* method and occluded, non-curarized animals get severe convulsions and, in the great majority of cases, extensive pulmonary œdema. In curarized animals, treated in the same way in other respects, œdema does *not* occur. After closure of the above-named arteries, the œdema was so marked as not to require a post-mortem to prove its existence. The tracheal canula was filled with a reddish frothy fluid within one or two minutes, and this fluid was so abundant as to render prompt artificial respiration fruitless. Arterial tension is greatly increased by the anæmia of the brain, while the forcible respiration and muscular spasms certainly contribute materially to forcing the blood upwards to the right ventricle. In the curarized animal the muscular fibre is paralyzed, and consequently forcible respiration, spasms, and œdema are absent. In short, the conclusion is that those conditions which materially hinder the discharge of the blood from the left ventricle or the lungs bring about at the same time indirectly through the cerebral centres other conditions which increase the accessory onward pressure of the blood, and keep the right ventricle so fully supplied that stasis in and œdema of the lungs result.

ATELECTASIS.

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ETIOLOGY.

Lichtheim produced atelectasis experimentally on rabbits by closure of a main bronchus with laminaria tents, by ligation, and by opening the pleural cavity. His results confirm the idea of *Virchow* that the air which is shut in by the closure of the bronchus is absorbed by the blood-vessels, and go to show that the elastic contractility of the pulmonary tissue continues to act until the air is completely absorbed.

He thinks his experiments show that atelectasis in connection with fluid in the pleural cavity is not always due to compression, as has been almost universally held. Very large effusions do, it is true, compress the lung and squeeze the air out of it; but a different explanation must be

given in some cases of moderate serous effusion in which the pressure exerted on the lung by the fluid must be decidedly less than the ordinary atmospheric pressure, and yet that portion of lung immersed in the fluid is leathery and completely devoid of air, though not also of blood.

In these cases, that part of the lung which lies below the level of the fluid cannot follow the inspiratory enlargement of the thorax, and the air which it contains, not being renewed, must necessarily be *absorbed*.

If this view be correct, the number of cases of atelectasis by compression is much smaller than has been supposed.

TREATMENT.

Kjelberg, of Stockholm, recommends a new method which he has employed in three cases of congenital atelectasis. A wooden frame was placed over the bed and covered with blankets so as to form a sort of tent, and this was converted into a steam bath by keeping a vessel of hot water in it constantly, the water being renewed every half-hour. The temperature was thus kept at 26°–30° C. and the treatment continued during eight to fourteen days. As the respiration and general condition improved, the temperature was gradually lowered and the coverings removed, but the air of the room was still kept moist for some time. *Hertz* tried this method in one case, but had no great success with it, and truly remarks that the difficulties in the way of carrying it out thoroughly are not inconsiderable.

The last-named author reports favorably on the use of compressed air, especially during the stage of absorption of pleuritic effusion (second edition of *v. Ziemssen's Encyclopædia*). "I have repeatedly seen this method exert a favorable influence, not only in aiding the re-expansion of the lung and thus diminishing the risk of permanent deformity of the chest, but also in promoting rapid absorption of the fluid. It has been attended with specially happy results after thoracentesis. Expiration into rarefied air, should, however, be combined with the inspiration of compressed air to a certain extent, in order to avoid undue dilatation of the sound tissue. For when a considerable portion of lung is compressed the healthy portions are liable to be the seat of collateral hyperæmia, with œdema and consequent loss in elasticity; and these parts will offer less resistance to the increase in pressure of the inspired air and be in danger of becoming permanently emphysematous." This method is to be preferred to *Hauke's* pneumatic cuirass, which is said to exert eccentric force on the parietes and lungs when it is applied to the chest, and the air between the body and the cuirass is rarefied. It is true that *Hauke* recommends his procedure especially for asphyxia in new-born infants and collapse of the lung in children, cases in which co-operation on the part of the patient is, of course, out of the question.

EMPHYSEMA.

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HAY ASTHMA.

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THEORY OF THE DEVELOPMENT OF EMPHYSEMA.

That forcible inspiration may be a cause of emphysema is shown by *Waldenburg's* pneumatometric investigations. He found that in bronchitis and asthma inspiration is normal, while expiration is deficient; the air is thus expelled through the narrowed bronchial tubes only imperfectly, and carbonic acid accumulates sufficiently to increase the demands of the system for oxygen. This demand is partially satisfied through forcible inspiration, but at the same time more air enters the alveoli than can be expelled, and thus dilatation of the alveoli, loss of elasticity, and emphysema are induced.

Hertz thinks it very doubtful whether increase in the inspiratory force alone can produce emphysema in healthy lungs with unimpaired expiration; for it is reasonable to suppose that the increased pressure is, under these circumstances, so uniformly distributed throughout the lungs as to be incapable of doing mischief. According to *Waldenburg*, unwonted calls upon the respiratory organs, as in much mountain or stair climbing, may cause emphysema, and the author cites the case of a medical student in support of this view. The young man came from a small place where the houses were low to Berlin, and there took a lodging in the fifth story; he became emphysematous, apparently from mounting the four flights rapidly several times every day. *Pepper* (*Phila. Med. and Surg. Reporter*, April, '74, p. 373) thinks that prolonged and severe exercise of the muscles of the arms and shoulders, such as that to which some classes of laborers are subjected, produces emphysema through increase in the expiratory pressure; but *Hertz* regards this explanation as incorrect, and remarks that in cases of this kind there are probably primary nutritive changes in the lung tissue which act as predisposing causes, though their existence has not as yet been proved.

Hertz expresses the opinion, furthermore, in the second edition *v. Ziemssen's Encyclopædia*, p. 456, that the inspiratory as well as the expiratory act plays a part in the production of emphysema; the former in the diffuse form of the disease, the latter in those cases in which it is localized chiefly in the upper portions of the lungs. In the diffuse form, both acts may, indeed, contribute to the result; in chronic bronchitis, for instance, increase in the force of inspiration tends to produce general dilatation of the alveoli, while the upper lobes bear the brunt of the heightened expiratory pressure incident to the attacks of cough.

Whether asthma plays the part of cause or of effect may, in individual cases, be very difficult to determine. There is no doubt that asthmatic attacks intensify pre-existent emphysema, and that, vice versa, emphysema and the circulatory disturbance which it involves, favor the occurrence of asthma, the two having a very close relation to one another. The pneumotometer shows deficient expiratory power in cases of asthma, without previous emphysema, precisely as in emphysema itself.

This latter fact speaks in favor of the views of *Berkart*, who most vigorously and ably maintains that asthma is not a disease at all, but "only one link in a chain of quasi-independent affections, which commences with changes of the pulmonary tissue, and terminates with emphysema or bronchiectasis"—in fact, a symptom, indicating always structural modifications of the lung tissue (see a review of *Berkart*, *Boston Med. and Surg. Journ.*, Feb. 12th, 1880).

PROGNOSIS.

The experience of the last few years in the treatment of emphysema shows that some cases may be even cured which were formerly supposed to be incapable of improvement, though this remark holds true only of

cases in which there is some impairment of the elasticity, but no extensive rarefaction of the lung.

It has been shown of late that the pneumatometer is of great service in prognosis, affording us information, not only as to the degree of existent deficient ins- or expiratory power, but also as to the value and effect of our therapeutic measures. Increase in the pneumatometric measurements and simultaneous improvement in the condition and symptoms of the patient are of favorable prognostic import, while non-increase or diminution are correspondingly unfavorable. The spirometer is also used by *Waldenburg* for purposes of prognosis; he finds that it is a rather unfavorable sign when the capacity of the lungs is diminished as much as fifty per cent—in men to 1,500–2,000 cc., in women to 1,000–1,500; but absolutely unfavorable if it be as low as 1,000–1,400 in men, and 700–1,000 in women. It is, however, to be borne in mind that patients differ greatly in the skill with which they use the spirometer, and we should never, therefore, be content with the results of one trial, but repeat it several times on different days before drawing our conclusions.

Assistance in prognosis may also be derived from the use of the pneumatic apparatus with a view to the treatment of emphysema. It is of good import, showing that the thorax is distensible, and the lung still retractile, if an amount of air can be drawn out of the lung equal to the normal vital capacity; whereas with less amounts the contrary is true. We can always, hence, be sure that there are textural changes in and atrophy of the pulmonary tissue, for the repair of which there are, at present, no means in our power, when the spirometer shows small vital capacity, the pneumatometer low measurements, and at the same time the amount of air extracted by the pneumatic apparatus is relatively deficient. The worst cases are in persons advanced in years with ossified and fixed thorax.

DIAGNOSIS.

These same instruments are also of service in diagnosis.

The spirometer indicates, as in various other affections of the respiratory organs, the degree of diminution in the vital capacity; but does not enable us to distinguish between these affections. The pneumatometer, on the other hand, shows that in emphysema and bronchiolitis the expiratory force is diminished, while in phthisis the loss is in inspiration, and we are enabled to detect commencing emphysema with the aid of this instrument in people who appear quite well, complain of nothing, and are only slightly short of breath on exertion. *Waldenburg's* careful investigations show also that we can determine the degree of the affection. In slight cases, in which dyspnoea is present only after unusual effort, and there is no modification of the percussion note, it is found that the expiratory pressure is somewhat less than the inspiratory, instead of being decidedly greater, as it is under normal conditions. In a later stage of the disease, when slight exertion suffices to induce dyspnoea and percussion reveals unquestionable pulmonary dilatation, it is found that the expiratory is one-third or one-half less than the inspiratory pressure; the

latter remaining usually normal in amount, though it may be increased in order to compensate for the deficiency of the former. In the worst cases, finally, with bronchitis of years' standing, severe dyspnoea and asthma, cyanosis, œdema, and rigid thorax, the inspiratory pressure is found to be diminished also, though it still remains greater than the expiratory.

The stethograph also affords valuable information, *Riegel's* observations showing that expiratory insufficiency is indicated by very characteristic curves which deviate from the normal standard in proportion with the emphysematous changes in the lungs. The normal curve is represented during inspiration by a gentle wavy rise with gradually increasing rapidity, and then gradual descent; during the transition from in- to expiration, by a line curved in the form of a bow which then descends with uniform rapidity until the respiratory pause. The curve of emphysema, however, has a much less gradual and an unduly rapid ascent during inspiration, and falls away at an acute angle during expiration, which latter is further characterized by increased duration and a rapidity which is at first normal, gradually decreases, and in the last third becomes very much less than it should be.

The strikingly short in- and prolonged expiration, as contrasted with the nearly equal duration of the two acts in a healthy person, is very characteristic of emphysema, and *Riegel* holds that the change in their relations is exactly proportional to the loss of pulmonary elasticity. The lung which is already distended cannot take in much more air, but does its best with the aid of the accessory muscles of respiration. The enlargement of the chest is not gradual as in healthy persons, but inspiration is rapid and brief, as is indicated by the steep rise in the curve, and the first portion of expiration is rendered relatively rapid by what elasticity is still retained by the lung, the pressure of the abdominal organs, and the tendency of the ribs to return to a position of rest. The second portion of expiration is more slow; and the last portion the slowest of all, for the reason that all save the accessory forces of the act have been exhausted during the first period, and these latter work feebly and at a disadvantage against the resistance of the chest-walls.

TREATMENT.

According to *Berkart*, the nutritive changes in the pulmonary tissue which are in the course of time followed by emphysema and asthma, are in the great majority of cases traceable to chronic bronchitis, and catarrhal pneumonia complicating whooping cough, measles, and typhoid fever; it may hence be in our power by careful treatment of these affections to save persons from much future misery. Whether this view be correct or not time will show; but, if we err at all, we shall certainly err on the safe side in attempting to keep under and cut short as far as possible those affections in which inflammation of the bronchi has a tendency to spread to the parenchyma of the lung. Nor is this all; careful attention to hygienic measures should also be enforced after the symptoms of these af-

fections have subsided, that the general nutrition may be raised to the highest possible point, and the lung tissue thus restored to a perfectly healthy condition. Cases in which an hereditary tendency to emphysema and asthma is discovered should, of course, engage our most earnest attention. Asthma having been generally considered hitherto as dependent on derangement of the central nervous system, treatment has been directed almost exclusively to the palliation of the dyspnoeal paroxysm, and the underlying condition has been greatly neglected. It should be our object to arrest the progress of existing pathological lesions and to maintain the healthy portion of the lung in a state of greatest efficiency; the proper way to attain this object being to improve the nutrition of the body in general, and indirectly that of the lungs, and to restore the normal function of the bronchial surface.

Fresh air, sunlight, warm clothing, cleanliness, suitable exercise, and careful attention to the gastric and intestinal digestion, are the most important points. Proper ventilation of the sleeping room is of prime moment.

There are certain patients who are so afraid of fresh air that its effect on them is almost like that of alcohol. The chemical changes of the body which have been hitherto at the lowest ebb are roused by a free supply of oxygen to an energy previously unknown, at times even so great as to produce an almost febrile condition. Moreover, by prolonged confinement in impure air, the bronchial mucous membrane is apt to be anæsthetized by the narcotic influence of the carbonic acid; then, on exposure to a pure atmosphere, the membrane recovers part of its sensibility, and cough is readily induced. But this return of bronchial sensibility is not regarded by these patients as a favorable sign, rather as a "fresh cold" and they refuse to continue the treatment, returning to narcotics in order to suppress the cough. Hence, the longer they have breathed in a vitiated atmosphere, the more gradually are their habits to be changed; otherwise the neglect of this precaution would deprive the sufferers of the benefit of the treatment, and cause the practitioner the annoyance of seeing his best efforts frustrated (*Berkart*). Sufferers from hay asthma or autumnal catarrh cannot, of course, afford to fight out their annual attack, but must, if it be possible, take refuge in some spot which gives them immunity from their enemy. [Reference is made in the bibliography at the beginning of this article to the most important recent monographs on this subject.]

The medical literature of the pneumatic treatment since the publication of the first edition of *v. Ziemssen's* Cyclopædia is enormously copious, but there is not much which is really new. *Waldenburg's* apparatus has been modified by *Schnitzler* and others, but the underlying principles remain the same. *Schnitzler* has, for instance, constructed an apparatus—it is called portable—consisting of twin cylinders; one of these contains compressed, the other rarefied, air; and the patient can thus change readily from one to the other, economizing his own time as well as that of the physician.

In the second edition of *v. Ziemssen's Encyclopædia*, *Hertz* has greatly modified and enlarged his remarks on the pneumatic treatment as contained in the first edition; and as it is not likely that any further change of consequence would be made if a third edition were to appear now, I shall simply translate a short portion of his exposition.

The favorable results which have been obtained by the use of the pneumatic apparatus these last five years ('72-'77) show that in it we have a valuable means of alleviating and curing emphysema. According to *Waldenburg*, expiration into rarefied and inspiration of compressed air are indicated in all cases of obstinate bronchitis, in which the pneumatometer indicates expiratory insufficiency, whether there be any other sign of emphysema or no. In case the pneumatometric measurements do not increase at all after several weeks' use of the apparatus, or if the thorax be rigid and we are satisfied that there is already extensive atrophy of the parenchyma of the lung, the treatment is to be discontinued, as it only serves unnecessarily to fatigue the patient. The pneumatic treatment is, moreover, contra-indicated if there be secondary degeneration of the heart.

The effects of the pneumatic apparatus in emphysema are then briefly as follows:

By *expiration into rarefied air*: 1. An increased amount of residual air and carbonic acid are sucked out of the lung, and consequently more oxygen can be absorbed and pulmonary ventilation is furthered. 2. The lung is diminished in size more than after an ordinary expiration. 3. This diminution becomes gradually permanent, as is evidenced by percussion and direct measurement; and 4. Simultaneously with the gain in elasticity of the lung and the diminution in the residual air, the vital capacity is increased.

Inspiration of compressed air undoubtedly leads in time to dilatation of the lungs, and thus acts directly contrary to the above treatment unless it be practised with the greatest caution; with this proviso, however, it is unquestionably of service in emphysema, inasmuch as it tends to counteract hyperæmia of the bronchial mucous membrane, whether this hyperæmia be already present and intensified, or called forth by the use of the rarefied air. Compressed air also increases the force of the cardiac contraction and heightens the pressure in the systemic circulation, as is shown by the pulse becoming harder, and thus relieves the pulmonary circulation; it may, furthermore, act as an expectorant in bronchitis, the aerial current dislodging mucus impacted in the finer tubes. In the treatment of emphysema, consequently, a subordinate and symptomatic position alone can be accorded to the inspiration of the compressed air, whereas expiration into rarefied air is to be regarded as directly curative.

As for medicinal treatment, *Germain Sée* (*Gazette Méd. de Paris*, 1878, p. 69) uses iodide of ethyl and iodide of potassium in asthma. The former is given by inhalation during the paroxysm, in a dose of five to ten drops and, it is said, with very satisfactory results. The potash is

given in the intervals between the attacks to ward off their occurrence. He gives twenty to forty-five grains per diem and is not afraid of iodism which he combats by increasing the dose of the drug. In twenty-four cases treated in this way, which have been under observation for several years, the results are very satisfactory.

Dr. J. P. Oliver, of Boston, has also used large doses of iodide of potash in asthma of late with surprising success (*Boston Med. and Surg. Jour.*, Feb. 19th and March 4th, 1880). He increases the dose gradually up to fifty or sixty grains per diem and continues it for a long time, warning the patient not to expect relief too soon and that six weeks may elapse before any change can be noticed. Some of his patients were unable to take the iodide, even in small doses, and he then substitutes hydriodic acid. The syrup of hydriodic acid prepared by Robert Gardner, of New York, he considers the best form of administration, it being agreeable to the taste and not very likely to be affected by exposure to air and light. He begins with small doses, twenty or thirty drops well diluted with water, and taken half an hour to an hour before meals; if taken after meals it may disturb the stomach. The dose is gradually increased, but should not exceed a tablespoonful. In cases of chronic bronchial catarrh, and in fact in all cases where iodine is indicated, he has found this syrup of great value. The above is taken from a mere preliminary notice of the method of treatment, a more detailed account of which, with a large number of cases, is to appear in the *Boston Medical and Surgical Journal* shortly.

Westbrook (*Proceedings Med. Soc. Kings Co., N. Y.*, 1879, IV., p. 7) reports ten cases of asthma with bronchitis and emphysema, all of which were greatly relieved by iodide of potash which he usually gives in seven and a half grain doses four times a day.

It should be mentioned that iodide of potassium is contra-indicated when the bronchial mucous membrane is acutely inflamed; the iodine in contact with the atmosphere being disengaged from its combination with the albumen of the blood, and when thus set free being apt to irritate the surface of the air passages.

Penzoldt (*Berlin klin. Wochenschrift*, No. 19, 1879) first called attention to the value of quebracho bark—from a Brazilian tree—as a remedy for dyspnoea, whatever its cause apparently. It is said that South American physicians attribute antifebrile qualities to the remedy, similar to those of quinine. *Penzoldt* could see no effects from the drug when used as an antipyretic, but found that the alcoholic extract of the bark dissolved in water had a marked effect on dyspnoea, decreasing the frequency of and greatly facilitating respiration. He gave the drug to hospital patients with emphysema (both simple and complicated by bronchitis), phthisis, chronic pneumonic processes associated with periodic attacks of an asthmatic nature, pleurisy, etc., and concludes that “we possess in quebracho bark a remedy which affords more or less complete relief for hours from the various forms of dyspnoea incident to diseases of the organs of respiration and circulation; without, at the same time,

producing any sort of disturbance. Its action is manifested by decrease in the frequency, and often in the depth, of respiration, diminution of the cyanosis, and, above all, improvement in the subjective condition of the patient."

Berthold and *Picot* (*Berl. klin. Wochenschrift*, No. 52, 1879) also report on the drug. The former found relief from it in only two out of six cases of phthisis. The latter administered it in dyspnoea from catarrhal pneumonia, asthma, and valvular disease of the heart—of each one case—with decidedly beneficial effect. He then took it himself while on a vacation tour in the mountains and was satisfied that the drug enabled him to walk up hill with much less fatigue and shortness of breath.

This is, of course, far too slender a basis of facts to enable us to decide on the merits of the remedy, and it is more than possible that further investigation will consign *quebracho* to the place occupied by so many of the drugs of the pharmacopœia, but no harm can apparently come from giving it a fair trial. The writer is informed by a competent authority that the bark is not at present to be had in this country, but that it will be on hand before this volume appears in print.

Since the above was written, a new report has come in from *Laquer* (*Wiener med. Presse*, Jan. 25th, 1880). He administered the remedy according to the following formula:

℞ Ext. corticis <i>quebracho</i>,	. . . . .	12.
Mucilag. gum. <i>acac.</i>,	. . . . .	40.
Aquæ,	. . . . .	200. M.

to twelve patients with emphysema and severe bronchitis. In some cases decided relief followed a dose of one to two teaspoonfuls, but in others no effect was observed. He tried it also in one case of valvular disease of the heart, but it seemed to aggravate the sufferings of the patient, and he did not feel encouraged to give it to other cases of the kind.

With a view of ascertaining whether the remedy produced permanent or only temporary relief, it was then administered in doses of one to two teaspoonfuls thrice daily in nine cases of emphysema, one of chronic bronchitis, and one of right pleurisy. The results were not unsatisfactory, though not as good as had been hoped for. In some of the cases the drug caused, after a few days, headache with a sensation of heat and confusion in the head and giddiness, these symptoms increasing so that the patients begged to be let off.

Conclusions.—1. The drug appears to be a useful palliative in many cases of dyspnoea in emphysema and chronic bronchitis; but in other cases, especially in old people, is of no service.

2. After prolonged administration, various disagreeable effects may appear, rendering it necessary to omit the medicine.

3. The frequency of respiration is diminished with a certainty proportional to its previous increase above the normal standard. The remedy has no constant effect on the pulse.

GANGRENE OF THE LUNG.

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ETIOLOGY.

In the second edition of *v. Ziemssen's* Encyclopædia, *Hertz* adds that diseases or conditions which involve very great prostration with degeneration of the heart and sluggish circulation may result in thrombosis in the systemic veins, infarction, and gangrene of the lungs. *Steffen* suggests the possibility of thrombosis of the vessels of the lung in consequence of feeble and superficial respiration. Some English writers have supposed the existence of what they call "gangræmia"—a special condition of the blood favorable to the occurrence of gangrene—but *Hertz* knows of no case which does not admit of some more satisfactory explanation. He cites five cases in which blows and falls on the chest or shoulders have been followed by gangrene—traumatic—and a case is reported by *Wahl* (*Schmidt's Jahrb.*, 1878, Bd. 178, p. 32) of a man who received a violent blow on the head, laying bare, though apparently not fracturing the skull. The patient kept his bed for five days without an unfavorable symptom, but then, his wound being healed, he rose contrary to advice and began to work. Almost immediately he had a chill followed by pain in the region of the right nipple, gangrene of the lung, and death.

Magrath (*Lancet*, 1880, I., p. 89) reports a case of the passage of a head of grass into a bronchus with death after twelve weeks. The grass was found in the lower right lobe, about one-third of which was gangrenous. The diaphragm was perforated, the upper surface of the liver showed commencing softening, and the right side of the bodies of two dorsal vertebræ were excavated and carious. There are a number of similar cases on record, but it is on the whole surprising how large a proportion of the foreign bodies which get into the lungs are sooner or later expelled with final recovery on the part of the patient.

Hertz states, but without quoting his authority, that gangrene of the lung has been noted with special frequency during epidemics of diphtheria. Nothing is definitely known as to the relations of the two diseases, but the idea is suggested that, in those cases especially in which they are co-existent, the gangrene is really to be regarded as pulmonary diphtheria caused by low organisms.

Lancereaux has found bacteria in the gangrenous fluid and in the blood after death; he inoculated a rabbit with a very small quantity of the latter, causing death in twenty-four hours, and found precisely similar organisms in the animal's blood.

DIAGNOSIS AND PROGNOSIS.

Traube and *Leyden* consider the absence of elastic fibres in the sputum as very characteristic of gangrene as contrasted with other affections which involve destruction of the pulmonary tissue.

Fillehne thinks that the statements of the above-named authors are too strong, though he allows that the elastic fibres are often absent, or present in far less numbers than one would naturally expect. He was led to experiment with a view to explaining this fact, and his results seem to show that gangrenous sputum or pulmonary fluid contains some ferment which has the property of dissolving albumen and elastic tissue, while it does not attack fibrous tissue.

Bucquoy thinks that by observance of the following points a diagnosis may be often made before the sputum becomes offensive. As was first remarked by *Stokes*, the pain in the side is far more obstinate and severe than in any pleurisy or pneumonia; the temperature and pulse rate are not increased in proportion to the general phenomena of the disease, while dyspnoea and prostration of the system are very extreme. It is conceivable, of course, that the diagnosis should be reached from these symptoms alone, especially if the gangrene be diffuse, but we know that when it is circumscribed the disease may be far removed from the surface of the lung, and that the symptoms may not be very marked at first. On the other hand, the fever may be very intense in either form.

Huntington has collected thirty-two cases from the records of the Massachusetts General Hospital, being all the cases of the kind admitted from 1857 to 1875 inclusive. The results being brief and decidedly more favorable than leading authorities would allow us to expect, they are given in full. Seven cases were discharged well; six much relieved (these with proper care and favorable circumstances doubtless proceeded to ultimate recovery); three cases were temporarily relieved; five were not relieved, two of which were in the hospital but a brief period and were not treated; eleven cases terminated fatally.

COMPLICATIONS.

Cases with complication,	10
Cases without complication,	22
Phthisis as a complication occurred in	8

Emphysema as a complication occurred in	1
Cancer of the œsophagus as a complication occurred in	1

In seven of the cases without complication gangrene followed pneumonia, and was diffuse. Leaving them out of the discussion, the following statement can be made. Of the fifteen cases without complication, five were well, six much relieved, one was relieved temporarily, three not relieved, none died. In other words, among the cases of *circumscribed gangrene* there were eleven favorable and four unfavorable terminations. On the other hand, of the complicated cases, four died, two were not relieved, two were temporarily relieved, and two were cured of gangrene. That is, two terminated favorably as far as the disease under consideration is concerned, and eight terminated unfavorably.

Summary of results and complications.

CASES WITHOUT COMPLICATIONS.

Terminated favorably,	73.3 + per cent.
“ unfavorably,	26.6 + “ “

CASES WITH COMPLICATIONS.

Terminated favorably,	20 per cent.
“ unfavorably,	80 “ “

TREATMENT.

Bucquoy recommends highly the tincture of *Eucalyptus globulus* in two-gramme doses, finding that the drug has a very marked effect on the fetor of the breath and sputum, and also alleviates the cough.

Draper (*Boston Med. and Surg. Journ.*, 1876, II., p. 595) reports the successful use of salicylic acid in ten-grain doses, thrice daily.

Wys has used creasote by inhalation with benefit, a few drops being poured on flannel, and prefers it to turpentine, as being less disagreeable and irritating.

Curschmann has employed since 1871, in private and hospital practice, a mask which covers the mouth and nose and resembles in appearance the mouth-piece of *Waldenburg's* pneumatic apparatus. A compartment in the mask or respirator is filled with sponge to receive the remedy—turpentine, carbolic acid, thymol, creasote—and the apparatus is recommended in all pulmonary affections characterized by fetid breath and expectoration. His experience with gangrene seems to be very slight, the cases being chiefly of putrid bronchitis and bronchiectasis. Carbolic acid was used in very strong alcoholic solution and also *pure* after having been liquefied by heat, giving rise to no unpleasant symptoms even when the respirator was worn for days; thymol was always used in alcoholic solution. The solution of either remedy has the advantage that the drug is thus more volatile, but the disadvantage, on the other hand, of being more irritating, and hence more likely to excite cough. The fetor was sometimes greatly diminished within twenty-four hours, though usually a somewhat longer period was required, and in many

instances was entirely relieved; fever dependent on decomposition in the secretion ceased, and the bodily weight came up. Turpentine and creasote were used in the pure state, and the latter is preferred in cases with a tendency to hæmoptysis. It would seem worth while to try this method of treatment in some cases of circumscribed gangrene.

Two cases have been reported recently in England in which gangrene of the lung was treated by incision. Both were very severe and terminated fatally, though the operation afforded marked relief. The first of these cases is reported by *Cayley* (*Lancet*, 1879, I., p. 440). A man of forty entered the Middlesex Hospital; having been ill five weeks, and had fetid cough and expectoration two weeks. Prostration and emaciation were extreme, and small quantities of brownish, horribly offensive mucus were raised with great difficulty. The signs pointed to consolidation at the right base, but it was inferred that there was a full cavity at the spot, and an exploratory puncture was made with an aspirator needle. A few drops of fetid pus coming out, an incision three inches long was made in the ninth interspace, on a line with the lower angle of the scapula. About five ounces of frightfully offensive pus and several bits of gangrenous lung-tissue escaped; a drainage tube was inserted, and the cavity was washed out twice daily. The patient experienced great relief, ceased to cough and raise fetid mucus, the bad smell disappeared, and the temperature, which had been very high, fell to the normal point. He died of prostration five days after the operation. At the autopsy it was found that the right lower lobe was consolidated by pneumonia and firmly adherent to the chest-wall. The point where the cavity was most superficial was more than an inch from the surface of the lung.

In the second case, *Smith* (*Lancet*, 1880, I., p. 86), gangrene supervened on right pneumonia in a man of over sixty years of age. His condition became most critical and a cavity was detected in the right middle lobe. On consultation, it was decided that the only chance for life lay in opening the cavity and evacuating the contents, especially as the discharge was not free through the bronchial tubes. An aspirator needle was introduced to the depth of three or four inches near the angle of the scapula; no fluid escaped, but there was a gush of very foul air, and, on holding a candle near the open canula, the flame was blown to and fro with respiration. The canula was then used as a director; a knife was passed in between the ribs, and by its side a pair of dressing forceps, by opening which the wound was dilated sufficiently to allow of the introduction of a drainage-tube. Through this a little carbolic lotion was injected, which seemed to excite a coughing-fit and the forcible expulsion of half a pint of fetid pus. For the first week after the operation the improvement was very decided, but a change for the worse then set in and the patient gradually sank. There was no autopsy. Mr. *Smith's* conclusions are: "(1) When the opening through the bronchi seems to be insufficient as an exit for the fluid, or the passage of the gangrenous ichor seems to be setting up irritation in the bronchial mucous

membrane; (2) the patient appears to be sinking rather than rallying; and (3) auscultation shows the presence of a cavity, an incision with a view to drainage is justifiable."

NEW GROWTHS IN THE LUNGS.

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HÄRTING AND HESSE: *Der Lungenkrebs—die Bergkrankheit in den Schneeberger Gruben*. Vierteljahrschrift für Gerichtliche Medicin, 1879, Apr., July, Oct.—SCHMIDT'S JAHRBÜCHER: 1879, II., p. 81 et seq.—FINLAYSON: Primary Epithelioma of the Lung. Medico-Chirurg. Trans., Vol. LX., p. 313.

Finlayson adds three cases—one of his own—to the short list of observations of primary epithelioma of the lung, and many cases of the more common varieties of new growths in the lungs have been reported since 1874. The only article which requires especial reference is, however, that the title of which heads the above bibliography.

At Schneeberg, in south-western Saxony, there is a large cobalt mine, affording employment in 1877 to five hundred and eighty-four persons in all, and it has been known for some time that the workmen at this mine were especially liable to a peculiar thoracic affection, the nature of which the painstaking investigations of our authors go far to explain. Until seventeen years ago, the disease was regarded simply as consumption. The arrangement of the article is so involved and lacking in clearness that it is a difficult matter to extract from it a clear statement of the disease. I will, therefore, begin by stating their conclusions, and then enlarge upon them somewhat.

1. The disease endemic in the Schneeberg mines is pulmonary cancer and is the cause of about seventy-five per cent of all the deaths among the employees.

2. The disease assumes the form of lymphosarcoma, though in rare cases of endothelial carcinoma; both forms are, however, intimately connected, and originate invariably in the bronchial glands.

3. All of the miners who do not die from some accident incident to their calling or from some intercurrent affection, as it were, finally fall victims to cancer of the lung.

4. The disease never appears earlier than twenty and rarely later than fifty years after the occupation was embraced. The miners, especially those who are continuously employed in the drifts, are affected sooner than the masons and timber cutters, who do not pass their whole time underground, and are occasionally furloughed.

5. A low condition of the general nutrition and previous affections of the lung or pleura, and emphysema, are all predisposing causes.

6. The immediate cause of the disease is arsenic, which in this mine is found uncombined with sulphur in the regulus of cobalt; is inspired; passes into the lymphatic current; is arrested in the bronchial glands, and there sets up an irritation which eventuates in sarcoma.

In most arsenic-bearing mines that metal is combined with sulphur, and the sulphide, being insoluble, is vastly less poisonous. The workmen in the mines of Sweden, Hungary, and Tyrol are said to be free from any disease of this nature, and there is little doubt that the depth of the mine and the difficulties in the way of ventilating it are not without a certain influence.

The anatomical appearances are shown by twenty autopsies to be briefly as follows:

The cutaneous veins of the neck, chest, and arms, especially on the affected side, are generally unduly prominent. The mucous membranes are pale, often livid, and the nails are almost always incurved. The intercostal spaces are broad, but the affected side of the thorax is rarely notably enlarged. The pleura of the side which contains the tumor is distended by a moderate effusion, which is sometimes blood-stained, and adhesions are always found at the root of the lung. The affected lung is diminished in size, sometimes very markedly, and the tumor is generally unilateral, yellowish-white in color, in some cases confined to the root of the lung, in others involving one or even both lungs, the pleura, mediastinum, pericardium, etc., and of large size. The disease may extend to the ribs or sternum, and secondary nodules of larger or smaller size are often found in the liver. No constant changes are found in any of the other organs which can be connected with the affection under consideration. The nodules are found only in the lungs in some cases, and when present in other organs are always more recent; tubercles have never been observed. The disease starting as a growing tumor at the root of the lung, the symptoms are usually very ill-defined at the commencement, and in some cases never assume any prominence. Later they vary of course according to the direction taken by the growth and the parts compressed by it, though a general cachexia is well marked. The duration of the disease, dating from the time when medical aid is first invoked, varies usually between six and eighteen months, though in one case three years elapsed; and at the autopsy a fattily degenerated tumor the size of a hen's egg was found at the root of the lung.

Treatment has hitherto proved practically of no avail.

Out of an average total of 650 employees, the disease has proved fatal as follows:

1869-1871,	. . . . .	63 cases.
1872-1874,	. . . . .	47 "
1875-1877,	. . . . .	40 "

The authors claim only approximate accuracy for these figures and attribute the diminution in the number of cases of late to the adoption of hygienic measures, especially to improved ventilation of the mine.

PULMONARY CONSUMPTION.

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For the sake of clearness and convenience, it is proposed to treat under this head of phthisis from a clinical point of view chiefly, but little attempt being made to distinguish the tubercular from the inflammatory form. For references and remarks as to the artificial production of phthisis and allied diseases, the reader is referred to the article on tuberculosis.

The question as to the communicability and the means of communication of phthisis from one individual to another has been brought into renewed prominence recently. In evidence of the view that the disease is not so communicated, *Cotton* brings forward the fact that out of the large number of clinical assistants and attendants connected with the Brompton Consumptive Hospital between the years 1846 and 1867, very few indeed have ever contracted the malady. The chaplain has been at the institution seventeen, the matron sixteen years. This fact speaks well for the hygienic arrangement of the hospital, and the care with which the nurses are selected, but nothing more. As *Webb* very justly observes, there is a great difference between the nursing of the phthisical in hospitals and in private practice. In the former, there is one skilled nurse to a dozen patients or so, and the nurse occupies her own apartments after being on duty for a portion of the twenty-four hours, more or less careful precautions being observed as to ventilation and the like. In the latter, the nurse is generally some member of the family or a friend, unskilled, and the circumstances under which the office of nursing is performed are apt to be such as to increase the risk of contagion.

Walshe in 1860 was not prepared to admit that the evidence of contagion was by any means conclusive, but said in 1871, "My belief in the reality of such transmissibility has of late years strengthened. I have now met with so many examples of the kind that *coincidence* becomes itself an explanation difficult of acceptance." The evidence adduced by *Weber*, *Webb*, *Holden*, *Wernich*, and others is overwhelming. *Weber* has collected the histories of twenty-nine marriages of phthisical women to healthy men, and fifty-one marriages of healthy women to phthisical men. But one of the healthy men contracted the disease, while eighteen of the healthy women fell victims. *Weber* thinks that these facts indicate

transmission through the semen, but this explanation seems rather far-fetched. It is very rarely that the male is so constantly exposed to the emanations from a consumptive partner as is the female when the conditions are reversed; and the reasons are obvious. One of *Weber's* phthisical males sacrificed four wives, another three, and four two each. *Holden* thinks that the Brompton experience negatives the possibility of infection through the atmosphere where ventilation is observed, and believes "that consumption is communicable in its later stages by means of soluble excrementitious matter thrown off by the skin and deposited on the bedding or underclothing, or in any other manner brought into contact with the naked surface of a healthy body; and that, although in some instances this may be thrown off without development into new disease, it is yet very liable to be so developed, and more liable when the healthy person is by heredity or depression in a favorable state for its reception." The proviso, *where ventilation is observed*, is a very important one, especially in connection with the experiments of *Tappeiner*, *Schweninger*, and *Lippl*, and the clinical observations of *Reich* (see Tuberculosis).

According to the most trustworthy authorities, hereditary predisposition to phthisis can be traced only in twenty-five to thirty-five per cent of all cases of the disease, and it would seem not improbable that contagion is responsible for a share in the large proportion which remains. *MacCormac* is a strong opponent of the influence of contagion, asserting that the disease is no more communicated thus than is a fractured limb. But he holds that propagation takes place through pre-breathed air, and thus, as *Webb* shrewdly observes, inadvertently becomes one of the strongest advocates of contagion. If the exhalations from healthy lungs can produce consumption, is it not rational to suppose that such exhalations plus gases and floating particles from disintegrating lungs will have that effect in a still higher degree?

In this connection the articles of *Müller* and *Thomson* are of great interest. The former analyzes with minute care 988 cases of phthisis which came under his observation at Weissenburg, a Swiss sanitary resort. He found that heredity was traceable in thirty-five per cent of the cases from the country, while in those from cities it was so traceable in only nineteen per cent. In other words, more cases are acquired in cities, where large numbers of human beings are congregated.

The latter shows that the mortality from phthisis in Australasia has been and is steadily increasing with the increase in population, and that it is now nearly as great as in England. In fact we are learning the true relation between climate and phthisis, a disease which is eminently social. The climatic conditions are more favorable in some places than in others for the development of the disease, as will be touched on more at length under the head of treatment, but no climate can claim complete immunity from consumption.

As for contagion, the practical deductions to be drawn from a consideration of the question are plain. A physician should never sanction

the sharing of the bed of a consumptive by any other person, and should enjoin upon those who must necessarily be much with such patients careful attention to ventilation, and an interval of daily exercise in the fresh air.

A recent paper of *Senator* (*Berliner Wochenschrift*, 1879, Nos. 4, 5, and 6) calls attention to the connection between phthisis and brain disease, and shows that *Ruehle's* statement (*Cyclopædia*, Vol. V., p. 561) of the safety with which we can infer cerebral tuberculosis whenever phthisical patients present decided brain symptoms must be somewhat modified. *Senator* reports a case admitted to hospital with phthisis of the upper portion of the right lung, the patient being up and in pretty fair general condition. Five days after entrance weakness of the right hand was noticed; this was soon followed by complete motor paralysis of the right forearm, right unilateral epileptiform convulsions, paralysis of motion in the face and right leg, high fever, aphasia, coma, and death on the twentieth day after entrance. A large abscess was found at the autopsy in the left hemisphere. The possible dependence of cerebral abscess on lung disease was first pointed out by *Sir W. Gull*, in 1858, and has since been insisted on by *Biermer*, *Huguenin*, and *R. Meyer*.

The latter collected and published, in 1867, eighty-nine cases of abscess of the brain, eleven of which were complicated by suppuration in the lungs. The pulmonary affection has often been mentioned casually, as if it could have no bearing on the abscesses, and it is to be hoped that in the future this point will be carefully investigated. *Senator* reports a second case of phthisis, in which the invasion and localization of the paralysis was very similar to that in the first, but without convulsions, aphasia, or coma; at the autopsy no localized disease could be found in the brain. In both cases the general sensibility and control of the rectal and vesical sphincters were unimpaired.

DIAGNOSIS.

Peter has made a careful study of local temperatures in phthisis and other diseases. He uses the ordinary clinical thermometer, placing the bulb on the surface of corresponding intercostal spaces on the two sides of the chest, and finds that the temperature of the affected side is always $\frac{3}{10}$ -1° C. higher than that on the other. The application of this sign in doubtful cases with obscure signs is obvious. *Peter's* results are substantiated by *Vidal* (*Bulletin de l'Acad. de Méd.*, VII., No. 38).

Charteris (*Lancet*, 1876, May 13th) and *McAldowie* (*Times and Gazette*, 1878, II., 269) report on axillary temperatures in phthisis. The former found that the temperature on the affected, or more-affected, side was always higher; whereas the latter, basing his conclusions on 880 observations on 42 patients, finds that there is no law of the kind regulating the temperature. Of 359 observations in cases of unilateral and well-marked lesion, higher registrations were obtained on the healthy side 162 times, on the affected side 162 times, and 35 times the registrations were equal. Everything depends in such observations as these on

minute pains and precautions, but the probability is that *Peter* is correct. *Broca's* experiments on localized cerebral temperatures are well known, and *Peter* has found local elevation in various inflammatory conditions.

The same author reports (*La France Médicale*, '78, Oct. 12th and 16th) four cases of phthisis in which venous pulsation synchronous with the systole of the heart was noted on the back of the hand. The phenomenon is attributed to paralysis of the muscular walls of the arterioles from asphyxia, and indicates that death is near at hand.

Heitler (*Wiener Wochenschrift*, 1877, Nos. 49 and 50) reports on the diagnostic value of epithelium in sputa, and denies that there are any cells the presence of which is characteristic of phthisis. All the epithelial forms which are found in this disease occur also in other pulmonary affections which do not lead to destruction of tissue.

PROGNOSIS.

Dr. *Flint* maintains the view that phthisis is, in some cases at least, a self-limited disease. He has preserved notes of and analyzed 670 cases from among those which have come under his observation in thirty-four years, the list embracing a few cases of acute tuberculosis and interstitial pneumonia, and of these 44 ended in recovery, 31 ceased to progress. Of those which recovered there was no medicinal treatment to which the arrest of the disease could be attributed in 23; and of those which ceased to progress in 15. With respect to hygienic treatment, in some cases of both groups there was no change whatever in habits of life. In other cases there were changes involving more favorable circumstances pertaining to hygiene; but a considerable portion of these changes were not of such a character that a potential influence could be attributed thereto. It is probably correct to say that the changes may have favored recovery or non-progression, but were inadequate to cause an arrest of the disease. Without wishing in any way to decry medicinal and climatic treatment, *Flint* expresses his conviction that some of the cases, the cure of which has been attributed to these measures, really got well by self-limitation. He briefly relates an instance from his own practice of recovery in New York City, without any important medication, the cavity gradually disappearing and leaving a permanent, circumscribed depression of the chest wall to mark its site.

The writer has a patient whose case is interesting in two respects. A young man, of vigorous New England stock, married soon after twenty a lady with commencing phthisis, took her to Europe and up the Nile, and was most assiduous in his devotions to her till she died of consumption, about a year after her marriage. Very soon after he began to cough, hemoptysis appeared and recurred frequently, cough and expectoration persisted. He did not care much whether he recovered or not, was reckless at times, but made several changes of climate, passing a large part of one winter in *North Germany*, and after various ups and downs during a period of six or seven years, finally recovered completely and is now a very hard-working professional man. A sufficiently long period has now

elapsed—at least five years—since the cessation of all symptoms to justify the use of the term recovery. He undoubtedly contracted the disease from his devotion to his wife, but digestion remained good throughout, loss of weight, though decided, was never excessive, and I am satisfied that self-limitation played a larger part in the production of the favorable result than whiskey with cod-liver oil and change of climate.

It is, of course, an excessively difficult matter to estimate in any given case beforehand how far we can rely on this element of self-limitation, but we are not entirely without a basis for drawing conclusions as to this point. Toleration of the disease affords grounds for encouragement; the chief indication of toleration being the maintenance of the normal, or nearly the normal, pulse rate and temperature, and the retention of the power of digestion and assimilation. Again, other things being equal, the smaller the amount and extent of the lesions the better the chance of recovery through self-limitation. *Flint* states that he has been led to believe that phthisis not very infrequently ends by self-limitation before it has made sufficient progress to develop well-marked physical signs; in other words, that there are abortive cases of this as well as of other diseases, and remarks on the frequency with which the traces of small, old phthisical affection are found in bodies of those dead with various diseases.

When there are cavities resulting from the involvement of a considerable portion of pulmonary tissue, the absence of signs denoting progressive extension or general diffusion is the most reliable of the points on which to found a relatively hopeful prognosis. But *Dr. Flint's* whole article is deserving of thoughtful perusal.

Prof. McCall Anderson, of Glasgow, reports three cases of entire recovery from galloping consumption or acute tuberculosis, according to his diagnosis. The treatment was antipyretic and highly supporting, and the cases are very interesting and suggestive, even if one is not fully prepared to accept the diagnosis without question. No attempt is made in the published report to eliminate typhoid fever, whatever may have been done at the bed-side, and *Anderson* is led to found his belief in the curability of tuberculosis in general largely on a case of *Spencer Wells* (*Diseases of the Ovaries*, London, 1872, p. 135). A lady of twenty-two had abdominal enlargement which it was supposed might be due to a thin, non-adherent, unilocular ovarian cyst, and a small incision was made below the umbilicus. "A large quantity of opalescent fluid escaped, and then the whole peritoneum was seen to be studded with myriads of tubercles. Some coils of small intestine were floating, but the great mass was bound down with the colon and omentum, all nodulated by tubercle, towards the free and upper part of the abdomen. The uterus and ovaries were felt to be of normal size, but their peritoneal coat was very rough." The patient made a good recovery and has since married. Now the writer inclines strongly to the belief that limited tubercle certainly, and extensive perhaps, is not so necessarily fatal as has been generally supposed, but *Mr. Wells* is not a pathologist, and every pathologist

knows that small bodies are occasionally found in great numbers in the peritoneum and elsewhere which are not tubercles, but can be distinguished from them only by very careful examination—much more careful than is possible after a small opening has been made in the abdomen of a living human being, and it has been ascertained that the condition present is not that which was sought for.

TREATMENT.

It is proposed to refer first to the chief recent contributions to our knowledge as to the alleviation of the prominent symptoms of the disease and then to the treatment in general.

HÆMOPTYSIS.—The subcutaneous injection of ergotine suspended in water with or without glycerine has come more into vogue, and certainly seems to have a marked influence in some cases. It may be given in doses of five to ten grains, and repeated as often as seems necessary. Pain at the point of injection is often sufficiently prominent, but abscess is not apt to occur, and both pain and reaction are said by *Kobert* (*Schmidt's Jahrb.*, 1879, III., 241) to be much less than when sclerotic acid is thus injected. He has also found the latter decidedly less efficacious in checking the bleeding, though *Nikitin* (*Schmidt*, 1879, I., 19) seems to have obtained more favorable results.

Pasley (*Brit. Med. Journ.*, 1880, I., 53) reports that in Trinidad at least eighty per cent of hospital cases of phthisis originate in catarrhal pneumonia and prove fatal in six to twelve weeks. At the lowest estimate, ten per cent of the cases which die in hospital terminate in profuse hæmoptysis, the patient expiring in the very act of bringing up blood.

Williamson (*Lancet*, Sept. 2d, '76) publishes his observations of one hundred and twenty cases of hæmoptysis with reference to barometric pressure and the theory that active hemorrhage takes place with increased, passive with diminished pressure. He does not find the theory borne out.

DIARRHŒA.—*Frohnmüller* (*Schmidt*, 1879, II., 230), among others, reports on the use of coto bark and its derivatives—cotoin and paracotoin—in diarrhœa from various causes, including that incident to phthisis. During the last six years, he has administered the drug in ninety-two cases of diarrhœa, mostly of a colliquative character, in the course of typhoid fever and phthisis, other remedies having generally been tried without success. The preparation most commonly used was the tincture of the bark. In fifty cases the diarrhœa was checked, in twenty-six it was diminished, and in nine the drug failed altogether. As a rule, the looseness reappeared after several days and again yielded to the remedy, but in some cases no repetition was required. The drug is well borne and the appetite usually improves under its use. The writer has ordered the fluid extract prepared by *Metcalf*, of Boston, in some half a dozen cases without obtaining any apparent effect on the condition.

NIGHT-SWEATS.—*Lauder Brunton* (*Bartholomew's Hosp. Reports*, 1879) contributed an interesting paper on the pathology and treatment

of this symptom. He thinks that sweating in phthisis is due to exhaustion of the respiratory centre by the reflex irritation from the lung, constant cough, and consequent accumulation of carbonic acid in the blood, which stimulates the sweating centres. The venosity of the blood and imperfect tissue change, not, as was formerly supposed, the mere loss of fluid, are the causes of prostration observed after night-sweats. It thus occurred to him that simply by stimulating the respiratory centre the symptom might be prevented from appearing, and putting his theory into practice he administered strychnia and nux vomica to a number of patients. The night-sweats were checked, though the drug seemed to lose its effect after a time, and, in one case, a very troublesome cough appeared to be aggravated. In cases where cough is prominent, atropia is better, this drug acting not only on the peripheral terminations of the sweat nerves, but also lessening the irritability of the sensory nerves in the lung and stimulating the respiratory centre.

Dover's powder, by diminishing the irritation from cough, tends to prevent the exhaustion of the respiratory centre, which is also powerfully stimulated by the ipecac. The favorable action of picrotoxine, reported on by *Murrell* (*Brit. Med. Journ.*, Jan. 17th, 1880), is also probably due to its stimulating qualities. Picrotoxine is the active principle of *Cocculus indicus*, a plant first known in Europe as a poison for taking fish, which it first throws into violent, irregular motion, and then stupefies. It had fallen into disuse as a medicinal agent till very recently. *Murrell* employs a solution in water, 1 part to 240, giving one to four minims thrice daily, the last dose at bed-time or just before the time at which the perspiration usually commences. The drug failed in only one case in which it was tried, is best given alone, and does not parch the skin, as atropia is liable to do.

There is no doubt that night-sweats are sometimes due in part to the stimulus of increased temperature on the sweat nerves, and in such cases quinine is indicated. Oxide of zinc and sulphate of copper act as astringents.

Fothergill attaches a far more direct weakening effect to night-sweats than does *Brunton* and employs largely a pill containing one-fourth of a grain of the hydrochlorate of morphia, a fortieth of a grain of atropia, with a grain of capsicum and three of aloes and myrrh. He has never seen this combination followed by any toxic effects of atropia, which is sometimes given in doses as high as a twenty-fifth of a grain. The practitioner must not go away with the impression that atropia has failed in any case until he has pushed the dose to a decided dryness of the throat and impairment of vision, flinging aside any effect upon the pupil as a fallacious test not to be trusted. Dr. *Sayre*, of New York, reports that an irregular practitioner gained a great reputation in that city many years ago in the treatment of phthisis by sponging the patient with hot vinegar containing a considerable quantity of powdered capsicum. He was very successful in arresting night-sweats, and when these are checked

the appetite returns, and food is relished and digested. *Fothergill* has found these spongings useful in obstinate cases.

COUGH.—The last-named author is no friend of sedative cough mixtures or of chloral, and recommends as a pleasant and effective remedy for cough, which is at once harassing and useless, hydrobromic acid with spirits of chloroform three or four times a day. His article is a very valuable one; and it may be observed in general that German literature is not the place to which one turns for useful hints in therapeutics.

Daremberg (*Lyon Médicale*, Nov. 12th, '76) advocates the administration of creasote from *beech-tar* for the purpose of diminishing the expectoration, which is sometimes a serious drain on the patient. The purity of the remedy is of the utmost importance, and creasote from *beech-tar* may be distinguished from that derived from *coal-tar* by its behavior with collodion. Fifteen parts of *coal-tar* creasote and ten of collodion give a gelatinous mass when mixed, while *beech-tar* creasote gives a clear solution. The remedy may be administered in doses of one to three grains.

DYSPNŒA.—For remarks on the use of *quebracho* as a remedy for dyspnœa the reader is referred to the article on *emphysema*.

TAPPING A CAVITY.—*Williams* (*Brit. Med. Journ.*, 1878, I., 101) reports the case of a man of twenty-eight with a phthisical cavity in the right lung, which was tapped with a moderately large trocar, about two litres of offensive pus being evacuated; the expectoration immediately diminished in quantity and lost its fetid character, the pulse and temperature fell, and the general condition of the patient was greatly improved. The cavity was washed out several times with disinfectants.

GENERAL TREATMENT.

I. MEDICINAL.—Dr. *Andrew H. Smith*, chairman of the Committee on Restoratives of the New York Therapeutical Society, reports (*New York Med. Journ.*, April 20th, 1879) on the use of ether with cod-liver oil in ninety-four cases, as suggested by Dr. *Foster*, of London. The conclusions of the committee are as follows:

1. The addition of ether to cod-liver oil in about the proportion of fifteen minims to each half-ounce (or an equivalent amount of the compound spirit of ether) will succeed, in the vast majority of cases, in enabling the patient to take the oil, even though it previously disagreed.

2. In some cases in which the oil still disagrees after the addition of the ether, the difficulty may be overcome by giving the ether separately, from fifteen minutes to half an hour after the oil is taken.

No facts have been laid before the Committee having a bearing on the question as to whether the etherized oil is superior to the plain oil in its ultimate effect on nutrition, supposing them to be equally well tolerated by the stomach.

The same Committee reported on defibrinated blood for rectal alimentation, and, though this treatment can scarcely be classed as "medicinal," a brief notice comes in here better than elsewhere. Thirty-eight out of the sixty-three cases were of phthisis in every stage, some with large

cavities, and several within a few days of death. Eight could not tolerate the injections, either because of irritability of the rectum or on account of severe and persistent colic, even when the dose was reduced to two ounces and laudanum was added. This leaves thirty cases in which the treatment had a more or less thorough trial, and of these ten showed no effect which could fairly be attributed to the injections. Some were improving before the treatment was begun, and continued improving at about the same rate during its continuance. Others were losing ground, and their downward tendency seemed not to be checked in any appreciable degree. These cases were, therefore, regarded as not affected either way by the treatment. In the other twenty cases, positive benefit seemed to have attended the use of the blood; the improvement being in some cases slight, in others very decided.

The conclusions of the committee are as follows:

1. That defibrinated blood is admirably adapted for use for rectal alimentation.
2. That in doses of two to six ounces it is usually retained without any inconvenience, and is frequently so completely absorbed that very little trace of it can be discovered in the dejections.
3. That, administered in this way once or twice a day, it produces in about one-third of the cases for the first few days more or less constipation.
4. That in a small proportion of cases the constipation persists, and even becomes more decided the longer the enemata are continued.
5. That in a very small proportion of cases irritability of the bowels attends its protracted use.
6. That it is a valuable aid to the stomach whenever the latter is inadequate to a complete nutrition of the system.
7. That its use is indicated in all cases not involving the large intestine, and requiring a tonic influence which cannot be readily attained by remedies employed in the usual way.
8. That in favorable cases it is capable of giving an impulse to nutrition which is rarely, if ever, obtained from the employment of other remedies.
9. That its use is wholly unattended with danger.

Schnitzler (*Wiener Presse*, 1876, No. 32) has employed subcutaneous injections of carbolic acid in phthisis, being encouraged to do so by success in a severe case of diphtheria which had resisted other remedies. During June and July, he treated more than one hundred cases, injecting one or two syringefuls of a one to two per cent solution once daily—though in a few cases twice—into the back or front of the chest. The result, in a large majority of cases, was diminution of the fever, marked improvement in the general condition, and in a few cases alleviation of the cough and expectoration. The injections were kept up for several weeks, and no injurious effect was observed. The patients experienced no more pain than from morphia injections, though the local burning sometimes continued a little longer. Slight, but never serious, inflammation was occasionally observed.

Experiment having indicated that phthisis may be an infectious disease, the idea was naturally suggested that an antiseptic treatment might produce favorable results—hence the employment of carbolic acid subcutaneously and by inhalation. The latest development of this idea has excited such interest in Germany that it is worthy of notice, although the brilliant success with which benzoate of soda inhalations were heralded to the profession does not stand the test of extended experience. In June, 1877, Prof. *Klebs* communicated to a scientific meeting in Munich the opinion, founded on experimental and microscopical observations, that tuberculosis is an infectious disease of parasitic nature; that it is induced by certain micro-organisms which invade the body and multiply in it, and that the expectation might be entertained of curing it by the employment of means which annihilate these organisms. One of these means is the inhalation of benzoate of soda solutions. *Rokitansky*, of Innsbruck, then took up the idea and employed a five-per-cent watery solution of the substance which was pulverized and inhaled, and his assistant, *Krocak*, communicated to the *Wiener medicinische Presse* for Sept. 14th, 1879, "results exceeding all expectations," in fifteen cases so treated. Persons, so to speak, moribund upon entrance to the hospital were sent out cured apparently, after about three weeks of the treatment. The matter was taken up by the lay press, great excitement was caused, and the drug was forthwith tested in many of the German hospitals. Sufficient reports are now in to show that the inhalations are not only useless, but indeed harmful in some cases; causing nausea and vomiting and irritation of the air passages. Those who are curious on the subject are referred for details to articles in the *British Medical Journal* for Jan. 3d, 1880, and *Wiener Presse*, 1879, No. 51, and 1880, No. 1. Among the observers who report on the uselessness of the drug are *Guttmann*, *Senator*, *Fränkel*, and *Wolff*.

Klebs (*Allgemeine Wiener Centralzeitung*, 1880, Nos. 1, 9, 10 et seq.), however, does not give up the ship; but maintains now that the formation of miliary tubercles can be stopped, and those already formed made to vanish, by the internal administration of the benzoates, especially magnesium benzoate. And in infiltration of the apex of moderate standing, attended with high septic fever and preceded by hæmoptysis, under the inhalation or insufflation of about ten grammes of sodium benzoate, two or three times daily, and the injection of twenty to thirty grammes of magnesium benzoate daily, permanent defervescence, disappearance of catarrhal symptoms, and notable increase in weight have been observed.

II. CLIMATIC TREATMENT.—It will clear the way if we here make a brief classification of phthisis, a term which represents a group of pathological conditions. This group consists, according to modern pathology, of three members, tubercle, pneumonic infiltration or exudation, and interstitial growth. It is true that in the majority of cases we find two or all three of the members of the group co-existent and intimately associated with each other; but we do, on the other hand, meet with cases in which some one of the members is alone, or almost alone represented, as in

acute miliary tuberculosis, acute inflammatory phthisis, and cirrhosis of the lung—fibrous or fibroid phthisis. We are not infrequently able to determine clinically which member of the group is present or predominant in a given case, and the attempt should always be made, inasmuch as the decision has a most important bearing on the advisability of change of climate.

“Within the past few years, in this country and in foreign lands, monographs have been published with carefully prepared tables in regard to the temperature range of different health-resorts, the amount of rainfall, the degree of atmospheric pressure, the prevailing winds, the altitude, etc. Some localities are mentioned as especially desirable for phthisical invalids on account of their equability of temperature, other places are recommended on account of their luxuriant vegetation or the peculiarity of their soil. Some are thought desirable on account of their dryness of atmosphere, others on account of the humidity of their atmosphere.”

“Vague and uncertain are the statements in the literature of the subject, and widely different conclusions have been arrived at by various observers. Places which at one time were the favorite resorts of consumptives have been abandoned as unhealthful and dangerous. Directly opposite views are held in regard to the therapeutic value of the same resort. An educated physician, who was in the last stage of the disease, and who had vainly tried all climates, expressed what I mean when he said to me: ‘In attempting to follow the instructions of my New York medical adviser, and also those of my Philadelphia medical adviser, the one recommending a cold, the other a warm climate, I have made the result a failure.’”

“Fifteen years ago, the belief prevailed that the essential climatic element for the arrest or cure of phthisis was a warm, dry atmosphere. More recent observations and investigations have settled the fact that phthisis is not necessarily hastened in its development by a low temperature, and is not prevented or cured by a high temperature. Again, it has been claimed that the higher the altitude, the fewer were the cases of phthisis, until at a certain elevation it entirely disappeared, and that this diminution in the number of cases was due to diminished atmospheric pressure. More extended observation has demonstrated that the altitude at which this supposed immunity exists varies with the latitude; that the nearer the approach to the equator the higher must be the altitude to accomplish the desired result. This fact seems to prove that the development of phthisis does not depend upon atmospheric pressure, for the laws governing atmospheric pressure are ever the same at a given altitude.”

“*Elevation* was also regarded as the cause of this immunity from phthisis. This theory was disproved by the fact that, whenever the inhabitants of elevated regions engaged in manufacturing pursuits which confined them in unwholesome air, phthisis was very frequently developed. Nevertheless, this theory so rapidly grew in favor that a large number of phthisical patients were sent to the mountains; these more markedly

improved than those who were sent to the milder regions of the southern lowlands. A new series of investigations established the fact that this immunity from phthisis was not due to altitude, but to the absence of organic matter in these high elevations. In the presence or absence of these organic substances we have a very important element of difference between the air of the lowlands and the air of the mountains. That atmospheric germs are also more abundant in cities and towns has been plainly shown. Dr. *Schreiber*, in his lecture on Climatology, states that "ozone and rain have the power of purifying the atmosphere, that is, of freeing it from organic substances; that the purifying power of ozone depends on its oxidizing power; that while oxygen requires a considerable degree of heat before it will combine with other substances, ozone will do so at an ordinary temperature. Ozone destroys the products of decomposition by chemically combining with them. The air of a locality may not necessarily be unwholesome because no ozone is present, as the ozone may already have been expended in oxidizing the organic substances in the surrounding atmosphere. Yet the presence of ozone in the atmosphere is presumptive evidence that it contains no organic substances."

"The air of the ocean and high mountains is richer in ozone than that of the plains, and this substance promotes nutrition and blood changes by supplying to the respiratory organs a most active form of oxygen. Therefore, when choosing a health resort for phthisical invalids, we should give the preference to a locality in which there is constantly an excess of ozone in the air, for experience has established the fact that there the climate is especially salubrious. Experience has also shown that the direct inhalation of ozone has little if any power in preventing or arresting phthisical development, and we must, therefore, conclude that it acts simply as a purifier." (The above is quoted precisely from *Loomis*: further points will be borrowed from his paper without the use of quotation marks.) Damp warm as well as damp cold climates are unfavorable for phthisis, but the worst form of dampness is that dependent on a clayey, ill-drained soil; and this matter of soil-moisture is of the utmost importance.

Temperature has always been regarded as of very great importance in the treatment of phthisis, and a warm, sedative climate was long regarded as best for the purpose; more recently it has been claimed that a cold climate is the favorable one, and that phthisical mortality decreases as we go northward. Both views are correct to some extent. It is not the warm temperature of a locality which is so important as the absence of sudden and frequent changes, such as those to which the eastern seaboard of the greater part of this country is subject. Whether a cold or warm climate is indicated in any given case, can be determined only by the experience of the individual prior to the phthisical development. Some are greatly depressed by a cold and exhilarated by a warm climate; with others the contrary holds true. There is no evidence that temperature is directly curative.

As proof that altitude alone is too highly regarded by some, *Loomis*

states that there is no place where patients do worse in all stages of the disease than among the Catskill Mountains, as he has found by experience, and he finds similar testimony given by others in regard to other mountain regions.

Sea and mountain air do not differ as widely as has been supposed by many. The latter is less dense, of lower temperature, and less humid; but they are alike in containing an excess of ozone, in freedom from organic substances and impurities, and in being cooler, and less subject to frequent variations in temperature than is the air of inland plains.

I. Individuals in whom the processes of tissue change do not require hastening are better in the mountains than on or by the sea.

II. Persons past middle life in whom phthisis has been developed do better in sea than in mountain air.

III. Phthisical invalids should not go to the mountains unless they are capable of considerable muscular activity.

IV. As a rule, phthisical subjects with an exhausted nervous system, with an overtaxed brain from excessive mental labor, or an all-absorbing occupation, yet who still retain considerable latent muscular power, will improve in the mountains, while those whose processes of tissue change require hastening or stimulating, they being in too feeble a condition to take active muscular exercise, should go to the sea.

The above conclusions are drawn under the provisional acceptance of the correctness of *Beneke's* experiments, which go to show that tissue changes take place more rapidly on or by the sea than in the mountains.

Loomis' conclusions from his own experience are as follows:

1. We can expect permanent improvement in cases of developed phthisis only after prolonged residence in the locality which experience has proved best suited to each individual case. Permanent favorable results cannot be obtained from an annual change of climate.

2. Cases of *tubercular* phthisis, in any stage of the disease, grow steadily and rapidly worse in all localities. Such cases do best in the quiet, well ventilated apartments of their own homes, where they can be surrounded by all those influences and circumstances which tend to make a feeble invalid comfortable.

3. Cases of *fibrous phthisis* in every stage, whether the fibrous process commenced in the pleura or bronchial tubes, even after retraction of the chest-walls, especially in the infra-clavicular region, is well marked, and the bronchial dilatations which accompany it give the physical signs of extensive cavities, improve and often reach a condition of comparative health when they take up their residence in regions having very high altitude, such as are found in Colorado and the Rocky Mountain ranges, where patients with asthma and emphysema derive very marked benefit.

4. Experience has led me to be very cautious in recommending these regions of high altitude to invalids with catarrhal phthisis. In the advanced stage of this form, I have never seen good results from a residence in such regions, and it is quite doubtful whether any one in the first stage has received benefit.

C. Theodore Williams (*Lancet*, Aug. 16th, 1879) says that the influence of high altitudes is intensely stimulating to respiration, circulation, and digestion; the cases in which it is indicated being those without pyrexia and with limited consolidation at one apex, limited cavity, and hemorrhagic phthisis. He is speaking largely with reference to Davos am Platz in the Swiss Alps, 5,200 feet above the sea, and so situated in a valley that the sunshine is unobstructed, while there is great protection from cold winds. The season at Davos extends from November to March, and during that time the average temperature is 23.5° F. above zero. The air is, however, so dry that patients can pass much time out of doors, and they are encouraged to sit in the fresh air and exercise as much as possible. Four hundred invalids are said to have sought this resort in 1874, from all parts of Europe, and its reputation has increased steadily since then. Clifford Albutt gives very favorable reports of the influence of the place on suitable cases in the *Lancet* (1877, II., Oct. 20th and 27th, 1878, I., 824).

Loomis has seen only a very limited number of cases of catarrhal (this class is apparently the same as that called by other authorities 'pneumonic') phthisis improved permanently by long sea voyages or residence in a warm climate. A large number in the early stage of the disease, going from a northern to a southern winter, are temporarily improved; after the first apparently beneficial effects are passed, the degenerative inflammatory processes go on more rapidly than before. The invalids whom he has found most markedly benefited by a sojourn during the winter months in a southern climate are those convalescing from some acute pulmonary affection, in whom the delayed convalescence raises the fear of possible phthisical development, and those in whom acquired or hereditary phthisical tendencies exist, yet in whom there may be no positive physical signs of disease of the lungs. For such cases, Aiken, S. C., Palatka, Enterprise, and Gainesville, in Florida, and Thomasville, in Georgia, are of great service.

In cases of consolidation, his best results have been obtained in those who have made a prolonged stay—one to three years—in regions of a medium elevation, 1,500 to 2,000 feet, such as Asheville, North Carolina, and the Adirondack region; a number of cases are cited by the author in illustration of the benefits derived from the latter region, and he strongly urges the further establishment of sanitariums under the charge of well educated, careful, and intelligent physicians.

Now for a few words as to some of the leading American resorts for consumptives. The climate of Florida is moist and warm, the changes in temperature between day and night being often marked, and fires being frequently needed in the evening. At Jacksonville, Palatka, Magnolia, and some other places, many comforts are attainable, and an improvement is taking place in this respect every year. With the development of railroads and the growing use of Pullman cars, the region is becoming easier of access for those who wish to avoid a sea voyage. Patients can also work gradually northward in the spring, when the

heat in Florida begins to be excessive and debilitating. Thomasville is in southwestern Georgia, not elevated, but with a porous sandy soil, and large pine forests in the vicinity. It was, I believe, discovered, so to speak, by Prof. *Metcalf*, of New York, and has one or more good hotels. Aiken, South Carolina, is also low, with a dry, bracing atmosphere and sandy soil; it is the winter home of Dr. *Geddings*. At Asheville, North Carolina, Dr. *Gleitsmann* has established a home for consumptives, at an elevation of 2,250 feet, the sunny hills of this region offering facilities for outdoor life and active exercise. In East Tennessee is Walden's Ridge ("A people without consumption," Dr. *Wight*, Chattanooga), part of the Cumberland table-land, at an elevation of 2,000 feet, but there is no provision for feeble invalids as yet in the region. The Adirondacks are too well known in this part of the country to require further mention here. In parts of Minnesota we have a dry, cold climate with medium elevation, while in San Diego and Santa Barbara, California, and Nassau, in the Bahamas, a moist sea atmosphere and very great equability of temperature are combined. Within a few years, Colorado and the foot-hills of the Rocky Mountains have attracted great attention, though they will doubtless attract still more as the life becomes less rough, and the region better supplied with those luxuries which to many of the inhabitants of the older States have become necessities. Dr. *Denison*, of Denver, gives full details as to the benefits of this region in his recent book.

In recommending any particular health resort, careful attention should always be given to the personal peculiarities and preferences of the patient. It is not only important that the atmosphere should be pure and the climatic conditions such that the utmost possible amount of time should be passed in the fresh air, but due regard must also be had to the opportunities offered by the resort under consideration toward the mental occupation and amusement of each patient. There is, as a rule, but little use in sending the patient who abhors the simplicity of country life to a quiet village, and for this reason, during many years to come, we shall continue to send certain patients to Europe; the greater luxury of a certain kind, novelty, and distractions of which certainly more than counterbalance its inferiority from a strictly climatic point of view. In short, the mind of the patient as well as his lungs must receive our earnest consideration, and a step which often involves uprooting a whole family is not one to be entered on lightly.

Dr. *Harry Leach* (*Practitioner*, 1878) writes of his personal experience of South Africa, and the reckless way in which English practitioners have sent patients thither without knowing anything about the special localities recommended, the means of reaching them, with the necessary expense involved, and their accommodations and special resources. South Africa is not the only resort to which his remarks are applicable, nor are English physicians the only ones who have sinned in the way he describes.

The congregation of large numbers of invalids at health resorts also exercises a most depressing influence on some people, and it would not

be a bad thing if it were part of the education of physicians to spend three months in one of these places, as it was the fortune of the writer to do in Nassau, a number of years ago. The less many patients think about their own symptoms and cases the better. There is in this country opportunity for the fulfilment of every climatic indication, and we have entered on a great era of progress in the "home treatment" of consumption.

TUBERCULOSIS.

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The nature of tuberculosis and its relations to scrofula and phthisis are still questions which engage some of the best minds in the profession, and towards the ultimate solution of which important contributions have been made during the last six years, though its solution may be, and probably is, still far off. At the time of the publication of the second edition of the Encyclopædia, the giant cell was regarded by many as the characteristic anatomical element of tubercle and tubercular products, but it has more recently been shown that these cells are found in other and widely different formations. In fact, suffice it to say, we are acquainted to-day with no anatomical criterion of any kind which stamps

a formation as indisputably tubercular. From a theoretical point of view, this admission is very discouraging and unsatisfactory, but the practical results are not so serious as might be supposed, inasmuch as any reasonable doubt can be removed, in the great majority of cases, by consideration of the circumstances and origin of the formation, its localization, distribution, symptoms, and termination.

Aufrecht says that miliary tubercle is not the anatomical basis of tuberculosis, a term which has merely an etiologico-clinical meaning, the granulation being the result of various causes, and never the primary change in that condition which has so long been known under the name tuberculosis. In perfect analogy with the term scrofulosis, the term tuberculosis means simply this—a tendency, generally hereditary, to weakness of certain organs, in consequence of which weakness they become readily the seat of inflammatory processes and resulting cheesy degeneration of the tissue. Pulmonary consumption is the most common localization and manifestation of tuberculosis. Scrofula and tuberculosis are brothers, as they generally appear in the same families. If some members of a large family have died of scrofulous affections, some of the survivors are pretty sure to have tuberculosis later in life. Moreover, individuals who in childhood suffered from the former, are more likely than other people to develop the latter as they grow older. Finally, tuberculosis in the parent is eminently a cause of scrofula, and eventually tuberculosis, in the children. This view is directly opposed to that of those who believe tuberculosis to be an infectious disease like syphilis, whether low organisms play a part in it or not. If it is an infectious disease, how can so many people recover from it, and how can we expect to combat a chronic, infectious disease by simple hygiene? This is not the way in which we cure syphilis. [It is not obvious why people should not recover from an infectious disease, and the best authorities are unanimous in insisting on the very great importance, and even curative influence, of hygiene in syphilis.]

In view of the fact that the theory of the infectious nature of tuberculosis has necessarily been based on experiments on the lower animals, great interest is attached to the observations of *Reich*, which indicate the transmission of the disease from a phthisical midwife to a number of children. The village of Neuenburg is healthily situated on the Rhine, counts 1,300 inhabitants, and gave occupation to two midwives. One of these was healthy, the other began to suffer from a pulmonary affection in the winter of '74-'75, and when examined by *Reich* in July, 1875, had several cavities in the right lung, with profuse purulent expectoration. She nevertheless pursued her occupation almost uninterruptedly up to the time of her death, July, 1876. Of ninety-two children who died during their first year in Neuenburg, between 1866 and 1874, tubercular meningitis was the cause of death in but two cases; of twelve who died in 1877 in but one case, and in that there was hereditary predisposition. Now, between July 11th, 1875, and September 29th, 1876, tubercular meningitis caused the death of *ten* children who were born between April

4th, 1875, and May 10th, 1876, of healthy parentage. All of these ten cases occurred among the clients of the consumptive midwife, and not a single case of the kind among the clients of the healthy midwife. The disease began with bronchial catarrh, which was followed by well-marked symptoms of tubercular meningitis, though in no case does an autopsy seem to have been made, and it was found that the midwife was accustomed to suck the mucus out of the mouths of new-born children under her care, to blow into their mouths if there was any asphyxia, and to subject them in general to an unusual degree of kissing and fondling.

The important bearings of the above report are too obvious to require comment, and in this connection the experiments of *Tappeiner* are of great interest. He caused, namely, dogs to inhale the spray of human phthical sputa rubbed up and diluted with water, dogs being chosen on account of their great relative immunity from tubercular disease. Eleven animals were subjected to the treatment, some for longer, others for shorter periods, during four to eight weeks, and though only two of these showed any signs of sickness, all were found to present marked evidences of disease when they were killed. In all but one miliary tubercles were found, especially in the lungs, but often also in other organs, and that one had extensive degenerative pneumonia. The amount of sputum used seems to have been very small, and the earliest period at which the nodules appeared was during the third week of the inhalation. In order to determine whether the transmission of the disease took place really through the air-passages, or through the digestive tract, the particles of sputum which lodged in the mouth and pharynx being swallowed, *Tappeiner* fed some dogs with portions of the same sputum which was used in the other experiments. He thus produced miliary tubercles, but not with the same constancy as under the other method. *Schottelius* was led by these experiments to see what effect follows the inhalation of powdered cinnabar, brain, cheese, and bronchitic sputum, likewise rubbed up and diluted with water. Miliary nodules were found in the lungs in all cases, in equal quantity with both phthical and bronchitic sputum. Cheese produced a smaller quantity, brain still less, and cinnabar least of all, namely, a few whitish nodules with pigmented centres. He consequently concludes that powdered mineral substances give rise to little irritation, but that powdered organic matter, especially sputum, sets up broncho-pneumonia, which may appear in small foci, and bear a great resemblance to miliary tubercles. Bronchitic sputum gives rise to precisely the same lesions, and the cause is not specific, but simply the irritation of an organic matter, which is in a state of fine subdivision, and prone to decay. This view is shared by *Ziegler*, who considers true miliary tubercle as the indication of a general infection. *Weigert*, however, considers the nodules produced by *Tappeiner* as genuine tubercles, while agreeing that those of *Schottelius* were simply inflammatory; and this for the reason that in the experiments by the former the nodules were found in other organs as well as the lungs, while in those of the latter they were not.

Chauveau was the first to experiment on the transmission of tuberculosis through the intestinal canal, and very recently the subject has been taken up by *Bollinger*, *Orth*, *Virchow*, and others. The two former hold that the pearl disease of cattle and human tuberculosis are one and the same disease, but the latter is more cautious, and his lecture is well worth a detailed abstract, showing as it does, not only the present state of our knowledge on the relation of these affections, but also the difficulties which are involved in investigations of the kind.

For four years *Virchow* has been experimenting in the Royal Veterinary School in Berlin, at the instance of the Minister for Agriculture, to ascertain how far the secretions and flesh of animals, especially cattle, with the pearl disease are prejudicial to man, what bad effects may be produced, and what sanitary measures should be adopted by law for their prevention. He is apparently led to make known his results thus far by the unduly positive statement of the first-named authors and *Klebs*, who thinks that he has discovered a special germ or parasite, the common cause and carrier of tubercle and the pearl disease.

In the first place, confusion has been introduced into the question by those who fail to recognize due distinction between the characteristic products of the pearl disease and those of chronic peribronchitis and pneumonia. Both affections are common in cattle, and are sometimes co-existent but their products differ greatly as regards their life-history. The pearl disease is characterized, namely, by the presence of hard tumors which increase in size with age, scarcely ever become cheesy, and consequently do not lead to ulceration, but have a marked tendency to cretification. These are important points of distinction, and in the present state of our knowledge we shall do well not to interchange the terms pearl nodules, inflammatory products, and tubercles.

It is a cause of difficulty that our common domestic animals are not well suited to experiment on the subject, all being subject to diseases which are more or less similar to the tubercular, or may induce tuberculosis itself. Dogs are completely exempt from tuberculosis by ingestion—they can eat what they choose; and in rabbits, guinea-pigs, cats, pigs, goats, and sheep it is first necessary to study the exact pathology of the nodules and cheesy or calcified masses to which they are subject. Echinococcus disease is very common in pigs' livers, but here we also frequently meet with nodules which, when they first appear, are no larger than miliary tubercles, but increase in size without ever becoming cheesy, and have a great resemblance to those of cancer. Time will enable us to distinguish between these various conditions and tuberculosis, but then a new difficulty arises: it is, namely, not to be directly concluded that the changes found are the result of our experiments. Suppose we take a young and apparently healthy pig, and feed him daily for five or six weeks with pearl-disease products, the question arises whether the various changes are due to the food. From extreme antiquity the pig has been notoriously subject to swellings of the lymphatic glands, especially the submaxillary and jugular; the very term *scrofula* has this origin,

and signifies a condition in man similar to that which occurs in pigs. These glands are by no means easy to feel, far less the mesenteric and bronchial glands, and it may well happen that we pronounce a pig healthy when, in fact, his glands are more or less enlarged.

Again, not a single experimenter in this field pretends that his results are constant and invariable. Analogous changes are found in animals which have not been fed with pearl-disease products; as to the frequency of these changes, we have no statistics at our disposal, but *Virchow's* experience satisfies him that they are certainly common in the pig and coincide in their course with what are called scrofulous glands in the human subject. The process begins with cellular hyperplasia, which then becomes cheesy and very often calcified, but is not followed by the development of nodules—tubercles. In the majority of cases, as in the human subject, the cervical glands are chiefly affected, but in some cases the mesenteric, in others the thoracic, present the most marked changes. It is not, however, unusual for one of these three groups to be alone affected, and genuine tubercular affections are very rare, provided that the name tubercle is not applied where it does not belong. Much more weight is to be attached to small nodules or tubercles within the different organs than to the glandular swellings: the more common the lesion the greater the allowance which must be made for accident.

Pregnant sows have been bought and cared for until after the birth of their young; the litters have been preserved, and when they have reached a certain size, fed with meat or milk from cattle with the pearl disease, some animals from each litter being kept under natural conditions for purposes of comparison. In some litters the submaxillary and cervical, in others the mesenteric glands were chiefly affected; but the latter not so frequently as we would naturally expect, the supposed poisonous material being introduced into the digestive tract; the intestine itself remained invariably free from changes. It is difficult to understand how the submaxillary glands should be the seat of changes under these circumstances, while the mesenteric are unaffected, and *Bollinger's* explanation is more ingenious than satisfactory. He supposes that in these cases the virus is completely absorbed in the mouth, but this is utterly inconceivable. But there is still another difficulty. If a young pig eats daily a material which is always poisonous, one would naturally expect the changes thus induced to present a constant and steadily progressive character: it is true that this does happen, but only very exceptionally. In the great majority of cases, the lesions which are found after four to six weeks' feeding are already relatively old, instead of being in various stages of development. One fact is, however, unquestionable, and all experimenters are agreed upon it. More animals, namely, become diseased among those thus fed than among those kept for comparison and leading the ordinary life of domestication.

During the series of experiments, a most instructive mistake was made. A cow was purchased, after being pronounced by the best veteri-

nary authorities as the subject of the pearl disease, and a number of animals of various kinds were fed upon her milk. After a time the cow was killed, and no trace of the pearl disease was found, but the lung-tissue was almost entirely replaced by echinococci! The animals fed on her milk were killed before the cow; a calf which had been thus fed during a period of three months presented no recent lesions, but partially cheesy masses were found in the lungs and various glands, which latter looked exactly like those found in the subjects of the pearl disease. Others of the animals presented various changes, even some of those fed with the milk after it had been boiled, and others were unaffected. If the cow had not been killed, the results would have been considered brilliant, though it must be confessed that a larger number of animals of this series escaped disease than of another, in which the milch cow proved really to have the pearl disease.

Virchow does not feel warranted in going further at present than to suspect that pearl-disease products are injurious. The lesions of the disease are never found in the muscular tissue which is used for human food, and we are scarcely warranted as yet in taking legal measures to prevent the consumption of those parts. No human being has ever yet got a pearl tumor from eating the flesh of an animal with that disease. Some experiments have also been made with the meat of horses and beef more or less in decay, but the results do not as yet show much, one way or the other. In regard to milk, it appears probable that a distinction must be drawn between the milk of cows with local manifestations of the pearl disease in the udders, and those free from this complication. In a case of the former kind, large numbers of micrococci were found in the milk, but whether they were the peculiar cocci of this disease is not known at present.

Epstein's experience leads him to think that children at the breast acquire tuberculosis chiefly through the nurse's milk. He has seen large numbers of children of tubercular parentage, and observed that most of them did well when given to healthy nurses, and kept away from contact with tuberculous people; some died of chronic catarrhal processes in the lungs, but in no one of these instances were tubercles found at the autopsy. On the other hand, children suckled by tubercular mothers became tuberculous very soon after the appearance or the exacerbation of the pulmonary affection of the mother. In one of his cases, the tubercular changes were chiefly marked in the mesenteric glands and intestinal canal. In other words, nurslings generally ingest the disease, while older children inhale it.

Metzquer holds that the ingestion of tuberculous food is never a means of the inoculation of phthisis. After a certain time, irritation and inflammation of those parts of the intestinal canal with which the material remains longest in contact ensues, giving rise to diarrhoea and loss of weight. Hyperæmia and interference with the circulation result in intestinal thrombosis, and the inflammation may result in ulceration; in the latter event, and in that event only, is the way opened for infection.

A remarkable pamphlet has come from the pen of *Cohnheim* within a very few months, bringing forward fresh evidence that tuberculosis may be propagated by a specific process of infection, and propounding an exact and complete theory of the origin of the disease in the human subject. The original paper has not as yet come to hand, and the following summary is taken, with but few changes, from the *British Medical Journal* for May 8th, 1880, it being expressly stated that the exposition is, as far as possible, almost literally in the words of *Cohnheim* himself.

In the theory which was originated by *Virchow*, long adopted in Germany, and now largely taught in this country, it is held that a fundamental difference exists between miliary tubercle—tubercle properly so called—and the inflammatory products found in scrofulous diseases of the lymphatic glands, and in the form of phthisis called by the Germans caseous pneumonia. The latter processes are regarded by *Virchow* as purely inflammatory in their nature, and as differing from other such processes only in that there is neither absorption nor further development. This theory is based on certain anatomical facts, and may be conveniently termed the anatomical theory. One of *Cohnheim's* objects is to show that, since *Villemin* has proved that tubercle can be transmitted by inoculation, this anatomical theory has been completely shattered. The test for tubercle no longer consists in anatomical elements or arrangement of elements, but in the capacity of a morbid product, when introduced into the body of a rabbit or guinea-pig, to produce tuberculosis in the animal. What produces tuberculosis is tubercle; what fails to produce tuberculosis is not tubercle. Judged by this criterion, caseous pneumonia and miliary tubercle are manifestations of one virus, and the doctrine of *Laennec*, which for a time had been in the shade, has now received ample confirmation. Further, the scrofulous lymphatic gland is found to contain the same poison. Other simple tissues, such as that of lupus, are found not to be inoculable.

For the application of this test all animals are not equally reliable. Dogs, for example, show little susceptibility, while rabbits and guinea-pigs have it in a remarkable degree. The way in which the tuberculous substance is introduced into the animal is almost a matter of indifference; the common and most convenient method of procedure is inoculation by a small incision, either into the subcutaneous tissue, the pleural and peritoneal cavities, or the anterior chamber of the eye. Whether there is much or little tubercular substance employed, whether it is used alone or mixed with other tissues—as, for example, pieces of lung containing tuberculous nodules—is of little importance; of far greater consequence, on the other hand, is it that the substance used should be fresh and free from decomposition. The fresher it is, the less likely is the experiment to be affected by septic and similar influences, and infection is the more certain. How the infection takes place is best seen in animals when the tubercular matter has been introduced into the anterior chamber of the eye. In this case, if the substance be absolutely fresh, the irritation produced by the introduction soon passes away, the small portion introduced

becomes gradually smaller and smaller, and may even completely disappear. Then, for a time, the eye is perfectly clear and intact, until suddenly a larger or smaller number of minute gray nodules appear on the iris, grow to a certain size, and then caseate, exactly as happens with human tubercle. In the rabbit *Salomonsen* and *Cohnheim* observed the eruption usually about the twenty-first day after inoculation; in guinea-pigs, as a rule, a week earlier. In the rabbit, also, the period of incubation is sometimes shortened to fourteen days.

It is this test that, applied to human tubercle on the one hand, or caseating scrofulous products on the other, shows that they are both caused by the same virus. All these morbid products are effective, and in the same degree. If a piece of tubercular peritoneum or cerebral membrane be introduced into the peritoneal cavity of a rabbit, typical tuberculosis, beginning in the abdominal organs, is the result. But inoculation with a piece of lung affected with caseating pneumonia, or of a caseating testicle, produces exactly the same effect, and nothing succeeds better than a freshly excised scrofulous lymphatic gland from the neck.

Those who are convinced that all contagious virus is due to a parasite, will, of course, not hesitate to believe that the tubercular poison is corpuscular, and that, in a not very distant future, this corpuscle will be demonstrated in tubercle and in scrofulous products. Until, however, this goal has been reached, there remains no other test for tubercle than that of infection. The leading principle here, as in all infecting maladies which produce local changes, is that a tubercular or scrofulous product is generated wherever the tubercular virus is present and remains for a certain time. The chief factor, therefore, in determining the localization of the disease, is the mode of introduction into the system. Once introduced, its further extension is influenced by the conditions of the structure of the part, and takes the direction of the natural roads of the part. Consequently, whilst, on the one hand, the course which the disease takes is very different in different cases, the eventual entrance of the virus into the circulation affords the conditions for the development of tubercle in distant organs. The influence of the point of introduction is strikingly exemplified by inoculation experiments. Where a small piece of tubercle is introduced into the peritoneal cavity, there constantly follows, in the first instance, tuberculosis of the peritoneum, liver, and spleen; after inoculation into the anterior chamber of the eye, the iris is first affected; after feeding with tubercular matter, the intestine and the mesenteric glands; after the inhalation of pulverized sputa, the lungs and bronchial glands; and, when the material has been introduced into the subcutaneous connective tissue, it is the nearest lymphatic glands in which the disease first develops.

That the lungs are affected with tubercular disease in a far larger ratio than other organs shows, in Professor *Cohnheim's* opinion, that the poison is introduced into the human economy most frequently with the inspired air. This conception finds support, he believes, in the frequency with which the bronchial and tracheal lymphatic glands are affected in a very

early stage of the disease—so much so, that an extensive tubercular pleurisy, and still more frequently advanced caseation of the glands, is found whilst in the lungs there are only a few nodules or a very scant amount of caseous infiltration. An analogous condition is found in the certainty and rapidity with which inhaled carbonaceous particles reach the pleura and bronchial glands. The conditions which determine whether the inhaled virus shall produce disseminated tubercles or caseous pneumonia are still unknown.

Whilst the pleura and bronchial glands become diseased immediately after or simultaneously with the lungs, the anatomical relations of the air-passages with each other and the digestive canal, furnish the means for further development of the disease. So soon as the tubercular products break down and ulceration takes place, a certain amount of tubercular, that is to say, of infecting matter, must leave the lungs. This reaches the trachea and larynx, and, if it take root there, tubercle and tubercular ulceration are the consequence. Then come the pharynx, the soft palate, the root of the tongue, and the tonsillar region, which are all exposed to the same influence. A certain proportion of the matter is swallowed, but the passage through the œsophagus is too rapid, and undoubtedly the acid reaction of the gastric juice too adverse to the local inoculation and further development of the organized tubercle poison, to favor the disease in the stomach and gullet, where tuberculosis is exceedingly rare. When, in consequence of the swallowing of large quantities of tubercular matter, catarrh of the stomach has been produced, the chief obstacle to the transmission of the virus into the intestine is overcome. In the bowel, infection will most likely follow at points where the intestinal contents are longest detained; that is to say, in the neighborhood of the ileo-cœcal valve, the lower portion of the ileum, the cœcum and ascending colon. The upper and lower extremities of the tube are less exposed. It is easily ascertainable in what parts of the intestinal wall the tubercle is most likely to fix itself—on those points, namely, where all absorbed substances are first retained; that is to say, in the lymphatic structures, the isolated and grouped lymph-follicles. These are, in fact, as is well known, the seat of caseating and tubercular ulcers of the intestines. Simultaneously with or immediately following the development of the virus in the follicles comes the development in the mesenteric glands; whilst, on the other hand, the tubercular ulcers admit the poison into the branches of the portal vein, and the liver is then endangered. How frequent tuberculosis of the liver is, every one knows who has taken the trouble to examine this organ with sufficient care in all cases of chronic tuberculosis. With this combination, consumptive disease of the lungs and intestines frequently ends, but further developments sometimes take place. The disease may enter the ductus choledochus and produce tuberculosis of the bile ducts. More frequent and more important is transmission to the peritoneum from deep ulcers of the intestines. And the virus inhaled with the atmospheric air may take root directly in the larynx and trachea, producing the so-called primary tuberculosis of the larynx.

Whilst the tubercular disease of the digestive tube which has been described in the foregoing sketch is secondary to the affection of the lungs, there are cases in which the intestinal canal admits the virus into the system for the first time. Amongst this class of cases, *Cohnheim* reckons advanced tubercular disease of the mesenteric glands and peritoneum, without disease or with only very slight disease in the lungs—a form of the affection rare in adults, but unfortunately very common in young children. The reason why young children are specially exposed to this danger may, perhaps, be found in the experiments of *Gerlach*, *Klebs*, *Orth*, and others, who have shown how close is the connection between the virus of the consumptive disease of cattle and that of human tuberculosis, and have further proved that the virus from the diseased cows is contained in their milk. Whether the milk of tubercular women contains the virus does not seem yet to have been investigated [see the observations of *Epstein* referred to above]; but, with the well-known prevalence of tuberculosis among cattle on the one hand, and with the prevalence of the habit of bringing up children on cow's milk on the other, an explanation of the frequency of primary consumptive disease of the intestines is ready to our hand. Perhaps the influence of food in producing tubercular disease has even a wider extent. The question may at least be entertained whether all the so-called scrofulous inflammations of the lips, mouth, and pharynx, and especially the caseating swellings of the lymphatic glands of the neck, are not due to the direct inoculation of the tubercular virus contained in food, and more especially here, also, in infected milk.

Cohnheim's remarks on uro-genital tuberculosis are very suggestive. Direct infection from one sex to the other, as by syphilis, although not impossible, is scarcely to be expected. If the virus from tuberculosis of the uterus ever is transmitted *in coitu* to the male urethra, or perhaps, what is not so unlikely, if a man with tuberculosis of the lung or other organ can transmit the virus to the genital mucous membrane of a woman, such cases must still be very exceptional. As a rule, uro-genital tuberculosis is a disease of excretion. The virus, from whatever source it has entered the blood, is excreted by the kidneys, and doubtless, like cinnabar particles, oil-drops, milk-globules, and bacteria, through the glomeruli. It by this means gets access to the urinary passages, and, on whatever point it gets a hold, tuberculosis develops. Most frequently, this takes place in the open canaliculi of the pyramids; but the disease may develop also in the pelvis of the kidney, in the ureter, and the bladder, and even in the prostatic portion of the urethra tuberculosis may occur. It may cross in the bladder to the other ureter, and ascend to the other kidney; more frequently, however, it is the urethra that is attacked. In the male the virus attacks the prostate, thence passes by the *ductus ejaculatorii* to the seminal vesicles, and onwards to the vas deferens, the epididymis, and testicle, but it can also pass directly where the ureter and the vas deferens cross. In the female, the anatomical arrangement of parts renders the route by the urinary passages very improbable. In the great majority of cases, the parts affected are the Fallopian tubes and the uterine mucous

membrane, the virus entering the former from the peritoneum, which is scarcely ever found free in genital tuberculosis in the female.

Although analysis shows that uro-genital tuberculosis is scarcely ever the primary outbreak, this cannot be said of all the parts where tubercle is localized. In meningeal tuberculosis, there are cases, especially in children, in which the usual deposits in the lungs and glands are not to be found. How, in such cases, and even in those in which the deposits in other organs are present, is the transmission of the virus to the membranes of the brain to be explained? *Cohnheim* is in such instances disposed to accept *Weigert's* explanation, who has suggested that the poison gets access to the membranes of the brain from the nose, passing through the foramina of the ethmoid bone.

Still more difficult of explanation are cases of tubercular disease of bone and fungating tubercular disease of joints, occurring in individuals in whose other organs no tubercular deposit is to be discovered. Although in most such cases the development of the local disease is traced to an injury, yet it is not to be supposed that an injury can beget the tubercular poison. *Cohnheim* conceives it to be possible that, in such persons, the virus is already circulating in the blood, and that, with the exudation which follows the injury, the poison leaves the blood and engrafts itself in the tissues. As a rule, tubercular poison is not spread through the medium of the circulation, though in favorable instances this occurs; and metastatic tubercle, comparable to the most developed forms of metastatic inflammations and tumors, is sometimes found.

When we add to this mode of infection the direct transmission from the peritoneum to the spleen, through the lymphatics of the diaphragm to the pleura, from the pleura to the pericardium, etc., we need not wonder at the number of organs that are sometimes found affected with tuberculosis.

In explanation of the instances of acute miliary tuberculosis come the cases described by *Ponfick*, in which, as a cause of the contamination of the blood with large quantities of the poison, tuberculosis and infiltration of the thoracic duct were found. A more frequent cause, however, of this rapid form of the disease is tuberculosis of the blood-vessels of the lungs, instances of which are recorded by *Weigert*. A local tuberculosis of the pleura, bronchial glands, or mediastinum has extended into the wall of a pulmonary vein, and a large surface of caseating tubercular substance has projected into the lumen of the vessel. In the light of these discoveries, acute miliary tuberculosis loses much of its mystery.

When the chronic nature of scrofulous affection of the lymphatic glands, and the immunity to the general health that often follows it and scrofulous diseases of the joints, are compared with the rapid and deadly course of acute tuberculosis, it may seem extraordinary that they are all attributable to the same poison; but inoculation of rabbits shows that they all produce the same disease—a pure tuberculosis. In endeavoring to account for the comparative innocence of some classes of cases, it must not be forgotten that the human organism may entirely overcome the

poison. Tuberculosis can heal. Pathological anatomy has long known cretification and cicatrization after tubercular deposit and ulceration. *Cohnheim*, assuming the error of the dualistic theory of syphilis, compares the localization of tubercular affections with cases of syphilitic infection in which there is no manifestation of the disease beyond the nearest lymphatic glands. Individual differences in the behavior of the organism which has been infected by tubercle are seen even in inoculated rabbits. When equally large pieces of the same caseating lymphatic gland are introduced into the peritoneal cavity and the anterior chamber of the eye of a number of guinea-pigs or rabbits, the first outbreak of tuberculosis takes place at about the same time and in the same manner in all of them, but the further progress shows the greatest imaginable diversities. One animal succumbs after five weeks, and, on examining the body, nodules and caseation are found in almost every organ—the peritoneum, liver, spleen, lymphatic glands, the lungs, vascular walls, etc. A second lives over two months; a third, three months or more; in another, the respiratory organs are almost entirely free, while the abdominal organs are extensively affected; in another, the eye is completely destroyed by caseous panophthalmitis, whilst the animal is otherwise perfectly healthy, is not emaciated, eats well, and is strong and lively; and when, finally, after many months, it is killed, tubercle is found nowhere except in the eye.

Cohnheim will not have it that the different powers possessed by individuals of resisting the tubercular poison are due to the presence or absence of a phthisical or consumptive habit of body. The so-called consumptive habit has nothing to do, he believes, with a facility for receiving the virus, but is a product of the disease. Individuals with this phthisical habit of body are not specially disposed to tubercle, they are already tubercular. In their case, the disease has been either acquired in early life or has been inherited. That tuberculosis is hereditary is too well known to require to be more than stated; but, translated into other language, that means nothing more or less than that the virus can be transmitted in the semen and in the ovum; whether it can, like the virus of small-pox, be transmitted to the fetus through the placental circulation remains yet to be learned. The only difference, in this respect, between it and the syphilitic poison is that, while the latter manifests itself in the offspring before or soon after birth, in the case of the tubercle poison, development takes place at a later period.

Thus, in the whole history of tubercle, everything is due to the special nature of the poison and its effects. According to the present manner of looking at the subject, every man is tubercular in whose body the tubercular poison has taken root. There is, accordingly, no predisposition for tubercle any more than for syphilis, although some persons are more easily infected than others. Nor is there any constitutional predisposition that causes hyperplastic or inflammatory products to caseate like tubercle instead of being absorbed or changed into connective tissue, but only those pathological products undergo the specific change which are already the product of the tubercular virus. Other than this, there is

nothing in the whole course of tuberculosis wherein there is a difference in principle between it and other diseases arising from local infection. Not even the fever is pathognomonic.

This brilliant generalization is to be submitted to the test of time and criticism; but the source from which it emanates commands respectful attention, as does the vast practical and theoretical importance of the subject.

The whole question of tuberculosis is in such an unsettled state that the purpose of this article has been merely to indicate the drift and results of recent investigation, without attempting criticism.

