

merous on a plate the counting can be carried out best under a microscope. Ehrlich stops are placed in the eyepiece or the special Ehrlich ocular may be used. The size of the opening in the ocular must be determined by means of a stage micrometer. The average number of colonies for a given sized opening is determined, and from this the total number on the plate is calculated.

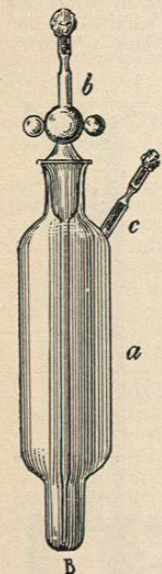


FIG. 5114.—Wurtz's Apparatus for Air Analysis.

the former is tested for by means of the Smith fermentation tube (Fig. 5117); 1 c.c. of the water is added to

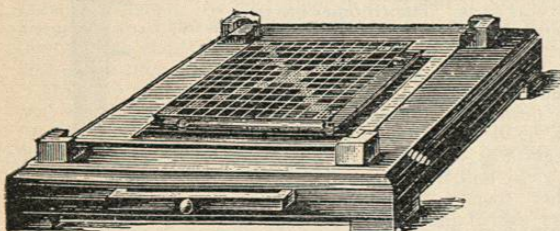


FIG. 5115.—Wolffhügel's Colony Counter.

glucose bouillon in the fermentation tube, which is then set aside at 37° C. The formation of gas indicates the

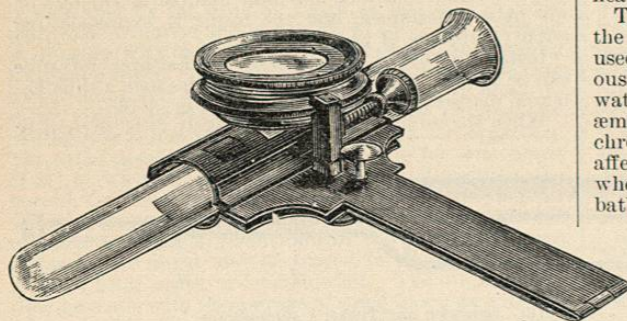


FIG. 5116.—Counter for Esmarch's Roll-Tube Cultures.

probable presence of the colon bacillus, while the non-production of gas points to the absence of this organism. Further tests are necessary for identification.

Litmus lactose agar plates should be made directly from the water and also from the fermentation tube when gas production is present. The formation of red colonies is indicative of the colon bacillus, since this organism ferments lactose, whereas typhoid-like bacteria do not. For the same purpose lactose bouillon is sometimes employed in the fermentation tube.

Another procedure is to plant the water in carbolic bouillon, or in Parietti's solution, in order to eliminate many of the more common bacteria.

Neutral red bouillon and agar is also used for cultivating the suspected colon bacillus. The water may be planted direct, or the red colonies which form on the plate may be used for inoculation. The coagulation of milk and the production of the indol reaction are additional tests of identification.

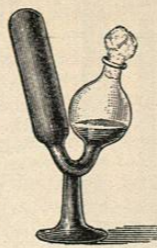


FIG. 5117.—Smith's Fermentation Tube.

F. G. Novy.

BADEN-BADEN AND THE BLACK FOREST, GERMANY.—The region of the Black Forest (Schwarzwald) lying to the east of the Rhine, between Karlsruhe and Basel (Switzerland), is a thickly wooded mountain range of great beauty and picturesqueness, containing many climatic and mineral-water health resorts. The most of these resorts have only a summer season extending from about the middle of May to the end of September; but the open-air cures for pulmonary tuberculosis remain open the whole year, and the winter season is just as efficacious in the treatment of this disease as are the milder seasons of the year. The climate in general is that of Central Europe, with the addition of the peculiar influence of the mountains and the thick fir forests. The elevations of the climatic resorts are from one to two thousand feet. In this country comparable resorts are such places as Rutland, Mass., Saranac in the Adirondacks, and Liberty, N. Y.

Baden-Baden (650 feet) lies at the entrance of the Black Forest from the north, six miles from the Rhine, and is beautifully situated; it is surrounded by hills thickly wooded with the dark fir. It is one of the most popular spas of Europe, and, besides its permanent population of 15,000, it is visited in the summer by about 60,000 people. Moreover, the environs of Baden are most charming, and one can either begin or end a tour of the Black Forest at this point.

The average temperature of the year is 48.3° F., and for the summer as follows: May, 53.9° F.; June, 60.2° F.; July, 62.9° F.; August, 62.2° F.; September, 56.6° F. For the autumn, 47.6° F.; winter, 34.3° F. The yearly rainfall is quite large. The surrounding hills afford shelter from the cold winds in winter, but in mid-summer they prevent the cool breezes from mitigating the heat which, for some persons, is too great for comfort.

The waters contain sixteen grains of common salt to the pint, at a temperature of 110° to 154° F. They are used for drinking, but chiefly for bathing, and in various forms of douches. The maladies for which such waters are recommended are rheumatism, gout, lithæmia, gastric catarrh, catarrh of the bladder, scrofula, chronic metal poisoning, obesity, and chronic catarrhal affections of the respiratory tract. The effect of the waters when drunk is diaphoretic, diuretic, and laxative. The bath establishments are extensive and well appointed, some of them luxuriously so, and include hot-air, vapor, pine, electric, and mud baths, and swimming pools. There is also an inhalation establishment, and a section for Swedish massage and mechanical gymnastics. There is an elaborate and extensive *Conversations-Haus* with pleasant grounds, and near at hand is a *Drink-halle*, most frequented in the early morning, when the waters are drunk to the accompaniment of music, the usual custom in European spas. There are also several private sanatoria under competent direction. The

sanitary condition of the city is satisfactory, and the water supply for domestic purposes comes from mountain wells. The accommodations are abundant, excellent, and of varying price. The baths are open all the year, although they are most frequented during the season (May to October). There are also milk, herb, and grape cures. The situation of Baden with its hills affords opportunity for the "Terrain-Cur." One can also make an "after-cure" here after a course of more active mineral waters.

East of Baden-Baden, in the northeastern part of the Black Forest, is Wildbad (1,410 feet), a much-frequented spa, containing indifferent thermal waters, of a temperature of 91.3° to 104.5° F., used very largely for bathing, although they are also used for drinking and gargling. The town, of about 3,000 inhabitants, lies in the narrow wild valley of the Enz, surrounded by hills covered with pines, and possesses an agreeable climate and excellent drinking-water. The mean yearly temperature is 46.5° F., and the mean monthly temperatures for the season are: May, 53.7° F.; June, 60.8° F.; July, 63.1° F.; August, 62.6° F.; September, 55.9° F. The waters are beneficial for the class of cases for which simple hot baths are appropriate, such as chronic rheumatism, gout, chronic joint pains, metal poisoning, scrofula, functional nervous affections, catarrh of the respiratory organs, nervous dyspepsia, convalescence from acute and chronic diseases, certain gynecological affections, and chronic skin eruptions. The bracing mountain air found here also enhances the value of a visit to this resort. The application of the waters is chiefly in bathing, and they are conducted from the wells in a continual stream at their natural temperature. There are also electric, steam, and hot-air baths; massage and gymnastics. There are several bath establishments, the property of the Government, two excellent ones, the Great Bathhouse and the König Karls Bad, and others for the poor or those of slender means. There are a variety of outdoor amusements, such as fishing, shooting, and tennis; and, as in almost all these resorts so largely visited by English and Americans, an English church.

Not far from Wildbad is Schömburg (2,130), where is situated a sanatorium for pulmonary tuberculosis conducted by a physician formerly attached to the Falkenstein Sanatorium, and in a similar manner.

St. Blasien (2,530 feet), in the southeastern part of the Black Forest, has an excellent climate and situation, affording mountain and forest air, and is resorted to both in summer and in winter. There are pleasant walks among the forests in the neighborhood, and the paths are arranged for the "Terrain-Cur." There is a well-known sanatorium here, open the whole year for the open-air treatment of pulmonary tuberculosis.

At Nordrach (1,470 feet), near the centre of the Black Forest, is Dr. Walther's celebrated "Nordrach-Colonie," in a protected position, looking toward the south. The success of Dr. Walther in the treatment of pulmonary tuberculosis has given this place and name a world-wide fame; with the English, especially, this sanatorium is very popular, and the sanatoria, now so frequently being established in England, follow Dr. Walther's methods, and sometimes take the name "Nordrach."

The climate at all these open-air resorts in the Black Forest is practically the same: the air is fresh and pure, fairly dry and equable, and although cold in winter (mean winter temperature, 29.6° F.) it is sunny and there is protection from the wind. The mountain influence is also apparent, and the thickly wooded character of the country is not without value.

Badenweiler (1,450 feet), in the lower part of the Black Forest, is a popular summer resort and spa, and possesses great beauty of situation and an excellent climate, pure air with a moderate humidity of seventy per cent., and an equable, mild temperature. The mean average monthly temperatures are: May, 53.8° F.; June, 61.5° F.; July, 64.6° F.; August, 62.8° F.; September, 57.4° F. The yearly rainfall is about forty inches. Badenweiler is used much more for a climatic health resort than for its

waters, which are indifferent thermal (of 84° F.). They are used in drinking, in gargling, and in baths; and for various maladies—gout, rheumatism, neurasthenia, chronic neuralgia, diseases of the skin, catarrh of the respiratory passages, dyspepsia, dysmenorrhœa, etc. There are two public bathing pools, the "beautiful marble bath," an open swimming pool, and bath-rooms in a number of hotels. The baths are sometimes artificially heated, and common salt is added to render them more stimulating. The milk and whey cures can also be taken here. The sanitary conditions of the town and the water supply are good. There is also a steam disinfecting apparatus. The accommodations are good in hotels and pensions. In the vicinity of Badenweiler are various resorts of different elevations which offer favorable climatic conditions.

Rippoldsau (1,856 feet) is situated in about the centre of the Black Forest near the Kniebis Mountains, in a thickly wooded valley, with typical forest scenery, rocky precipices, cascades, and the ever-present fir trees. The waters are gaseous chalybeate, containing bicarbonate of iron, sulphate of sodium, carbonate of calcium, and free carbonic acid gas. The waters are taken internally in anemia, chlorosis, debility, dyspepsia, catarrhal conditions of the stomach and bowels, etc. Iron baths are also used from two springs containing a small amount of iron and rich in carbonic acid gas. Mud baths are used extensively here, and are said to be effective in chronic rheumatic swellings, various sexual disturbances such as amenorrhœa, spermatorrhœa, and impotence. There are also pine-needle, electric, and sand baths, with massage and gymnastics. The baths are heated by Schwarz's method, which consists of the introduction of steam into the double bottoms of the separate baths. There are two well-appointed bathhouses containing twenty-five bath-rooms. The yearly average is about thirty-five hundred baths. The water from some of the springs, viz., Josef's, Leopold's, and Wenzel's, are bottled and largely exported, as is also the salt (Rippoldsau salts). The accommodations are good. The rural simplicity of the place remains, many of the old-time costumes being still worn by the natives.

There are numerous other small spas and climatic resorts in the Black Forest, all attractively situated and affording opportunities for hydrotherapeutic treatment or open-air life in a fresh invigorating atmosphere. Indeed, a walking, bicycle, or automobile tour through this most picturesque region may well be considered a cure in itself for tired nerves and the mentally overworked; and the writer, from personal experience, can bear witness to the charm and restfulness of such an excursion: the air is so fresh and invigorating, the food so good, the country scenery so attractive, and the singing of the skylarks so sweet and seductive.

Edward O. Otis.

BRONCHIECTASIS.—Dilatations of the bronchi, either diffuse or circumscribed, are known as bronchiectases. They are of common occurrence and arise from a great variety of causes. In all cases, however, the essential cause of bronchial dilatation is to be found in a weakness of the bronchial wall or an increase of pressure within the bronchus, or in a combination of both these factors. Bronchiectases appear both clinically and pathologically in such a variety of forms that their classification is difficult. According to their etiology they may be divided into the following forms:

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|-----------------|---|-------------------|
| Bronchiectasis. | { | 1. Congenital. |
| | | 2. Atelectatic. |
| | | 3. Vicarious. |
| | | 4. Emphysematous. |
| | | 5. Inflammatory. |

GENERAL MORBID ANATOMY.—The condition of bronchial dilatation may be single or multiple, one or more of the bronchi being affected. In some cases the entire bronchial tree is dilated (*universal bronchiectasis*). When but one bronchus is dilated the condition is usually found

in the upper lobes; when many are dilated the lower lobes are affected. Usually the bronchial branches of the third or fourth order are the ones involved; they not infrequently become wider than the main bronchi, and may

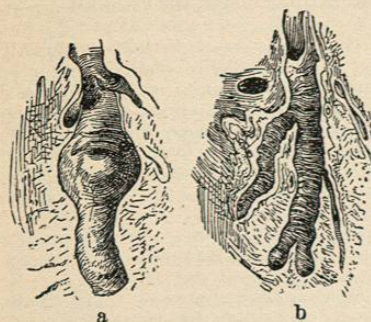


Fig. 5118.—Saccular and Cylindrical Forms of Bronchiectasis. (After Orth.) a, Saccular form; b, cylindrical form.

often be followed out to the pleura, where they end generally in a sac-like terminal dilatation of somewhat greater width, as is seen in Fig. 5118, b). In other cases the terminations may be of normal width, or they may become narrowed. The smaller bronchi may at times alone be dilated, the lung

on section resembling a very porous cheese.

The dilatation may be more or less uniform (*cylindrical, fusiform, or spindle-shaped bronchiectasis*), or it may be localized, the dilatation being much greater at one point than elsewhere, or involving but a small portion of the bronchus (*saccular bronchiectasis*). In other cases a succession of dilated portions may be separated from each other by portions of the bronchus which are of normal width or are constricted (*varicose or rosary bronchiectasis*). The different forms may be found in the same lung. Closure of the central end of the dilated portion and the accumulation of secretions may give the dilatation the character of a cyst (*bronchiectatic cyst, cystic bronchiectasis*). Suppuration of the wall of the dilated bronchus gives rise to the conditions known as *ulcerative bronchiectasis and bronchiectatic abscess*. Enlargement of the bronchiectasis at the expense of the surrounding lung tissue leads to the formation of bronchiectatic cavities (*cavernous bronchiectasis*). Infection of the dilated bronchus with putrefactive organisms causes a *gangrenous bronchiectasis*. In this case also the destruction of the wall of the dilatation and the encroachment upon the surrounding tissue give rise to the formation of cavities. In some cases the larger bronchi may be chiefly affected, in which event the distended portions project from the main bronchus like the dilated fingers of a glove.

The walls of the dilated portion may appear to be normal, or they may show marked pathological changes. The inner lining may be smooth or roughened. The smooth-walled dilatations often contain no fluid. As a rule the bronchial mucosa presents the appearances of a chronic purulent catarrh. The cylindrical epithelium is usually replaced by one of a cubical or squamous type. In the large saccular bronchiectases and in some of the cylindrical forms due to retained secretions the lining membrane may be ulcerated. Polypoid outgrowths are not infrequently seen. The contents of the cavity may be thin and watery, or thick or even caseous. In some of the larger bronchiectases, and particularly in the case of secondary gangrene, the contents are horribly fetid. Microscopically the fluid consists of mucus, pus corpuscles, fatty acid crystals, and occasionally blood and hæmatoidin crystals. In the case of ulcerative or gangrenous conditions of the walls elastic fibres may also be present. The outer portions of

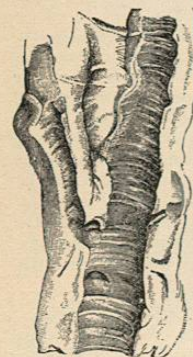


Fig. 5119.—Atrophic Cylindrical Bronchiectasis with ribbed transverse markings. (After Ziegler.)

the wall of the dilated portion may be markedly atrophic; even the cartilage plates may entirely disappear. The elastic tissue is stretched and separated; and the muscle, if it has not entirely disappeared, is much stretched and atrophied. The mucous glands may also entirely disappear, or may show extreme mucous degeneration. In other cases a secondary thickening of the wall, due to a new formation of connective tissue and elastic fibres, may occur. This is true particularly of the inflammatory cases. Small-celled infiltration of the wall is usually present. According to the condition of the bronchial wall bronchiectases may be divided into the *atrophic* and the *hypertrophic* forms. Such a classification has, however, but little practical importance, inasmuch as both forms may be found in the same lung. In general, the condition of the wall is dependent essentially upon the cause of the dilatation.

The *atrophic form* occurs in association with emphysema, and as a sequela of old chronic inflammatory processes which lessen the elasticity and resisting power of the bronchial wall, so that it gives way to the air pressure. Prolonged and difficult expiration favors its occurrence. Such dilatations are usually cylindrical and occur chiefly in the bronchi of the lower lobes. Very often the stretching of the bronchial wall is not uniform, and the inner surface shows circular or oblique ribbed elevations corresponding to circular bands of muscle fibres and elastic tissue which are still preserved, the connective tissue between them being pushed outward. All the elements of the wall are more or less atrophic, even the cartilage, which may be replaced by connective tissue containing newly formed blood-vessels. The openings of the mucous glands are dilated and funnel-shaped. The epithelium may be well preserved, or it may be changed to a cubical or flattened variety, or may be desquamated.

The *hypertrophic form* occurs as a frequent sequela of indurations and contractions of the lung parenchyma. In these cases the greater part of the lung is usually impermeable to air, and the cause of the dilatation is less a result of the weakening of the bronchial wall, but is essentially dependent upon an increase of intrabronchial pressure, which is due to the fact that the air entering the bronchi no longer passes normally into the ramifications of the air passages. In the case of retraction of

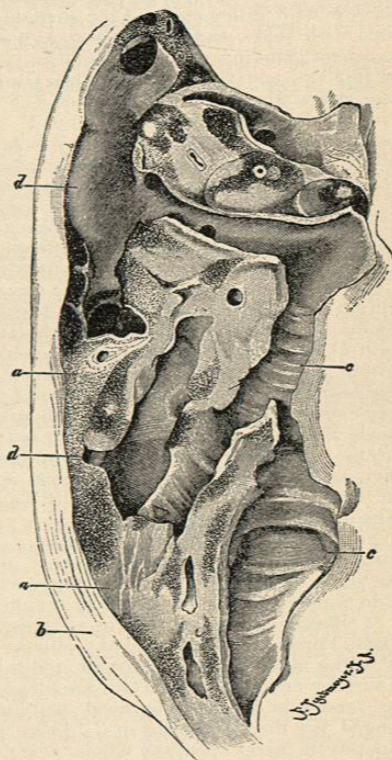


Fig. 5120.—Hypertrophic bronchiectasis and bronchiectatic caverns in fibroid induration of lung. (After Ziegler.) a, Indurated lung tissue; b, thickened pleura; c, dilated bronchus; d, cavity communicating with a dilated bronchus.

the lung tissue with pleural adhesions the outward pull upon the bronchial walls is also an important factor in causing a dilatation of the bronchial lumen. In both cases the dilatation is favored by any inflammatory process which weakens the wall. The mucous membrane of the dilated bronchus in the hypertrophic mass may resemble that found in the atrophic forms, or papillary or polypoid proliferations may be present. A lattice-like marking of the lining membrane is often seen. These markings correspond to small thickenings or elevations of the mucosa corresponding to the formation of a very cellular granulation tissue about the longitudinal and transverse bundles of elastic tissue. The connective tissue of the wall and of the peribronchial region is more or less thickened and connective tissue may take the place of the mucous glands and cartilages. The capillaries of the wall are greatly dilated and present thickened walls. The hyperæmia of the wall may be so marked that the appearance of the mucosa suggests a hemorrhagic condition. Tuberculous and gangrenous processes may cause various modifications of these appearances.

The *saccular bronchiectases* usually develop at the cost of the lung parenchyma. The bronchus may show at some point in its course a dilatation varying in size from that of a mustard seed to that of a hen's egg, or the bronchus may terminate in a sac. The central end of the dilatation may become obliterated and the dilatation thus come to resemble a cyst. Through the accumulation of secretions the cyst may attain great dimensions. All the bronchi of one lung may be similarly affected, the lung tissue between becoming atrophic and compressed, so that the organ finally comes to resemble a multilocular cyst. In other cases the saccular dilatation may involve only a portion of the circumference of the wall, so that it appears as a diverticulum which is connected with the lumen of the bronchus by a narrow opening only (*dilatation ampullaire latérale* of Cruveilhier). In the majority of cases the saccular dilatations involve the smaller bronchi, more rarely are the main branches affected. They are usually associated with bronchial stenoses, and are most often found near the periphery of the lung. According to Gairdner all the saccular dilatations are the result of ulcerative excavations of the lung tissue. This is true, however, of only a part of the cases.

Biermer divides bronchiectases, according to the character of their walls, into the following forms: (1) Dilatations with catarrhal swelling and relaxation of the bronchial wall. These are acute and occur chiefly in the lungs of children affected with chronic bronchitis. After the bronchitis has been cured the bronchial wall regains its old tone and elasticity, and the dilatation disappears. (2) Dilatations with hypertrophic walls. These affect the larger bronchi and are usually spindle-shaped. (3) Dilatations with thin walls. These are usually saccular. (4) Dilatations with trabecular degeneration. The walls are uneven, thickened, and there is a peribronchial increase of connective tissue.

Ulcerative processes are of common occurrence in the mucosa of the saccular bronchiectases. Complete destruction of the elements of the wall may take place, giving rise to a bronchial abscess. Infection with putrefactive bacteria leads to a secondary gangrene. Such changes are due to the lessened resistance of the bronchial walls, the changes in the secretions, and the entrance of bacteria. In these cases elastic tissue may be found in the sputum. Deposits of lime salts may occur in the bronchial walls, and as the result of the formation of granulating surfaces adhesions of the walls or the development of connective-tissue bridges may take place. In some cases a complete obliteration of the lumen results, and the bronchus is converted at the point of dilatation into a fibrous cord.

The changes in the lung tissue in the neighborhood of the bronchiectasis are usually primary, with the exception of ulcerative and gangrenous processes, which are secondary to the dilatation. The bronchi which are not dilated show catarrh and a putrid decomposition of the secretions. They are often wholly obliterated. In

bronchiectases due to syphilitic affections of the air passages the dilatation of the smaller bronchi is usually secondary to a stenosis of the trachea or large bronchus. The portions of the lungs not affected by the condition causing the bronchiectasis may present a compensatory emphysema, and in the later stages foci of bronchopneumonia, due to the aspiration of secretions from the dilated bronchi, may be found. The right ventricle may become hypertrophied and dilated as the result of the stasis in the pulmonary circulation. The bronchial glands are usually swollen.

Metastasis may take place from bronchiectases. Biermer observed metastatic brain abscesses in four cases of bronchiectasis; and Gerhardt and Bardenheuer noted the occurrence of rheumatic joint affections in patients with bronchiectases. Chiari has reported a case of suppurative myelitis following bronchiectasis. In the pus and vessels of the cord a branching filamentous fungus was found which showed threads breaking up into coccoid bodies and staining with Gram's mixture. Of eight cases of hæmatogenous myelitis collected from the literature three were secondary to bronchiectasis. In one case of actinomycotic abscesses occurring in the brain of a man with numerous bronchiectatic cavities, many clusters of the fungus were found in the walls and contents of the latter.

Bronchiectasis.
Bronchiectasis.

LOCATION.—Statistics as to the location of bronchiectases are of doubtful value. This is particularly true with regard to the relative frequency of involvement of the right and left sides and the upper and lower lobes. The statements generally made in regard to these points are to the effect that bronchiectases usually occur in one lung, and more frequently on the left than on the right side, and more often in the upper lobe than in the lower, and that in double-sided bronchiectasis both upper lobes are more often affected than the lower ones. But little importance can at present be attached to such statements, the number of observations upon which they are based being too small. The dilatations occurring with tuberculosis and chronic inflammatory processes are more often seen in the upper lobes; in the case of pleuritic exudations, in the compressed lower lobes; in those occurring as sequelæ of croupous and catarrhal pneumonia, hypostatic and atelectatic conditions are found in the lower and posterior portions. In the case of pleural adhesions the dilatations are sometimes found in the bronchi of the upper lobe, sometimes in those of the lower lobe.

Congenital Bronchiectasis.—Under this head there is included a number of conditions in the lungs of the newborn which have been regarded as due to congenital syphilis. One lung is usually affected; it may contain numerous cysts filled with a serous fluid. The lung tissue between the cysts may be indurated or atelectatic. Heller, Herzheimer, Grawitz, and others have described cases which, according to Grawitz, are to be ascribed to a hydroptic dilatation of the bronchi. Heller regards them as representing the bronchi of undeveloped portions of the lung, the dilatation occurring in later life partly as the result of the growth of the thorax and the consequent pull upon the bronchus, and partly as the result of the growth of the bronchus itself and the pressure of retained secretions.

Atelectatic Bronchiectasis.—The congenital bronchiectasis of Heller is to be placed in this class. In a number of cases observed bronchial dilatations have been found in adults, the lung tissue being free from pigment and showing no evidences of inflammatory changes. The condition is therefore very probably the result of a congenital atelectasis. An acquired bronchiectasis, due to atelectasis, may take place in later life as the result of deformities of the thorax, tumors, aneurism, etc.

Vicarious Bronchiectasis.—If the entrance of air into any portion of the lung be hindered and the volume of that part reduced, the inspiratory pull upon the sound portions of the lung is increased. As the result of this increased pull both the alveoli and the bronchi become dilated, and there arise a vicarious emphysema and a vicarious bronchiectasis. Pneumonic foci, infarcts, local

atelectasis, local tuberculous nodules and infiltrations, contracting scar tissue, etc., are the causal factors of such bronchial dilatations. The bronchial wall and mucosa become stretched and thinned like a serous membrane. The essential characteristic of the change is that no inflammatory processes take part in the direct production of the dilatation. It is to be regarded as a vicarious emphysema of the bronchi. The clinical significance of the condition is not great. The dilatations are relatively small and circumscribed. Inflammatory changes may follow, and an ulcerative or inflammatory bronchiectasis develop.

Emphysematous Bronchiectasis.—An emphysema of the bronchi occurs also in simple atrophic emphysema of the lungs not due to a compensation for portions of the lung the function of which is lost or diminished. It is to be regarded as idiopathic rather than vicarious or compensating. The dilatation is not great, but the walls of the bronchi are greatly thinned. The smaller branches, particularly those of the lower lobes, are chiefly affected. The symptoms cannot be separated from those of alveolar emphysema.

Inflammatory Bronchiectasis.—This is by far the most common and important form. All authorities are agreed that for the production of a bronchiectasis of clinical importance an inflammatory weakening of the bronchial wall is necessary. In general there are no severe inflammatory conditions of the lungs or pleura in which bronchiectases may not develop. Capillary bronchitis, chronic bronchitis, catarrhal pneumonia, croupous pneumonia, particularly when running a subacute or chronic course, tuberculosis, obliteration of the bronchioles due to indurations, peribronchitis, typhoid hypostasis, stenosis of the large bronchi, pleuritis, pleural adhesions, etc., are the causal and predisposing factors. General anæmia, marasmus, alcoholism, excessive or forced respiratory movements, singing, screaming, coughing, etc., play a secondary part. In the case of bronchial stenoses the bronchus is usually dilated both above and below the point of stenosis. It is probable that the dilatation which lies below the stenosis is due to the fact that the air which passes through the stenosis into the portion of the bronchus below it is held there by the blocking of the stenosis with mucus during expiration, and as the result of the expiratory increase of pressure this portion of the bronchus becomes stretched. In the case of foreign bodies the bronchial dilatation is found not only around the body, but involving other bronchial branches as well. The causes of such dilatations are complicated, but the essential factor is the production of a peribronchitis. Tuberculosis and syphilis may give rise to bronchiectases which are primarily dependent upon stenoses caused by the contraction of scar tissue, or are due to infiltrations. Chronic pneumonia, whether following the acute pneumonias, or due to syphilis, pleuritis, foreign bodies, etc., or primary of unknown origin, is of especial importance in the etiology of bronchiectasis.

SYMPTOMS.—**Cough.**—This is the rule. It occurs in paroxysms, usually at long intervals, almost always on the patient's awakening in the morning, the paroxysm being repeated once or several times during the day. The patient may be awakened by the first paroxysm, or it may come on after arising. Usually the patients know the time when the attacks may be expected. A paroxysm may also be precipitated by the patient's lying upon the affected side and then turning suddenly into another position. The attacks are often very violent and convulsive, at times completely depriving the patient of breath. The frequency and severity of the cough are dependent upon the position and the character of the opening of the dilatation. As long as the secretions are retained within the cavity there is no coughing, but when these escape into the neighboring bronchi and alveoli paroxysms are excited. When the bronchiectasis is located in the apex the secretions may pass continuously into a vertical bronchus and thus give rise to almost constant coughing.

Dyspnoea.—This may be slight or entirely absent; it

usually increases in degree toward the later stages of the affection and may become very marked. Ordinarily it is noticed only at the time of coughing, or after vigorous exercise. It is increased in the event of acute catarrhs of the respiratory tract, and in the case of the collection of mucus in the smaller bronchi. Persistent dyspnoea is due to some complication on the part of the heart or lungs.

Expectoration.—The attacks of coughing are attended by expectoration. This may resemble that of any ordinary bronchitis, but in the majority of cases the expectoration is very characteristic and of diagnostic importance. With the coughing paroxysm there is a gush of sputum so great as to fill the patient's mouth. Within a few minutes an ordinary sputum cup may be entirely filled. The total amount of sputum may be so great as to suggest the possibility of the perforation of an empyema into the bronchus or lung. Five to seven hundred cubic centimetres may be expectorated within the twenty-four hours. With the evacuation of the dilatation the coughing usually ceases, to begin again as soon as the bronchiectasis fills up. Usually the sputum is raised easily, without much effort or coughing, but in the case of such complications as pleuritis, emphysema, tracheal or bronchial stenosis, etc., the expectoration may be very difficult. The position of the patient is of great importance; when he lies upon one side there may be neither cough nor expectoration, but as soon as he turns upon the other side the bronchiectasis begins to empty itself and the cough and expectoration are excited. Sensations of pressure, fulness, and pain are sometimes felt before the expectoration takes place, particularly in the case of children. Occasionally these symptoms may be very marked, lasting half an hour or so before the expectoration occurs. The large amounts of sputum and the long periods between the attacks of expectoration may be explained as due to a lessened irritability on the part of the bronchial mucosa, a larger quantity of sputum being necessary to excite coughing. The amount of sputum raised is always greater during the morning hours. Toward the end of the affection the total amount decreases as the patient becomes weaker.

Sputum.—The sputum is usually purulent in character, but may be fetid or gangrenous. When purulent it is yellowish and contains more or less mucus. If fetid in character the odor may be extremely disagreeable and penetrating, so that the patient's breath may be perceived some distance away. The patient himself shows a remarkable tolerance of the odor; nausea is rarely produced. In the gangrenous cases the sputum is grayish-yellow or greenish in color. When the complication of gangrene is not present the sputum may have no putrid odor, but commonly possesses a disagreeable, nauseating, acid or sweetish smell (pseudogangrene). When collected in a glass or cylinder the sputum separates into two distinct layers: an upper, thin, slightly cloudy, almost serous layer; and a lower, thick, purulent layer containing caseous masses. The latter appear as dirty yellow plugs varying in size from a mustard seed to a bean (plugs of Dittrich). If the sputum be put into a tall cylinder which is half filled with water, four distinct layers may be seen. The uppermost is foamy; the one beneath this consists of muco-purulent masses, which hang down in the form of shreds into the third layer, consisting of cloudy water. The lowest layer of water has a grayish-green appearance.

Microscopically the sputum is made up of pus corpuscles which may be well preserved or contain fat droplets. In the case of putrid decomposition bacteria, crystals of fatty acids, margaric, tyrosin, leucin, and triple phosphates may be present. Blood-pigment may also be found. In the case of gangrene elastic fibres may be present. The caseous plugs stain a brownish-yellow, blue, or violet with dilute iodine solutions. The mucin content of the sputum varies greatly. Blood cells are not infrequently present.

Hemorrhage.—The presence of blood in the sputum of bronchiectasis is not rare. The amount is usually small,

but the hemorrhage may be so large or so frequently repeated that severe symptoms or even death may ensue. The sputum in such cases may appear to be chiefly blood; it is rarely bright-red, but is more or less discolored by the mixture with the other elements of the sputum. The smaller hemorrhages are chiefly of capillary origin; the large ones come from the erosion of large vessels in the wall of the dilatation. In ulcerative conditions of the wall the hemorrhages may be very severe, persist for a long time, and finally lead to death.

General Symptoms.—When secondary changes in the heart, kidneys, etc., are not present, the general condition of the patient may be quite good or fair. Fever and sweating are signs of complications. Occasionally fever may be caused by the absorption of products of decomposition from the cavity. In such cases the fever does not present any distinct type.

Physical Signs—Inspection.—The color of the skin is usually unchanged. When it is very pale the underlying disease is most likely to be tuberculosis; when it is cyanotic there is usually emphysema present. Many of the patients lie upon their backs; others sit bending forward, claiming that this prevents the swallowing of the sputum. When the bronchiectasis is confined to one side, the patients usually lie upon the affected side, coughing and profuse expectoration being caused by turning upon the sound side. Deformities of the thorax are rare, occurring only in the case of retraction of the lung, or when extensive pleuritic adhesions are associated with the bronchiectasis. Diffuse or localized retraction of the thoracic wall and curvature of the spine may result from these conditions. When emphysema is present the thorax may present the characteristic barrel form. Occasionally differences of movement may be made out between the two sides. In the case of extensive bronchiectases of the lower lobe of one side there may be seen during deep inspiration a wave-like retraction of the intercostal spaces proceeding from above downward. On the affected side such a movement is not visible. A compensatory emphysema of the sound lung is always found in such cases. Very rarely it may be seen that the respiratory movements on the affected side lessen, and at last wholly cease as the bronchiectasis fills up, but return after the expectoration has emptied the bronchus.

Among the most common and important of the physical signs of bronchiectasis are the changes which take place in the distal phalanges of the hands and feet (drumstick fingers). The clubbing of the fingers is due to a hypertrophy of the terminal portions of the bones (osteoarthropathie hypertrophique pneumique), so that the joints of the phalanges, the carpal joints, and even the wrist joint may be greatly thickened. These changes take place in association with chronic cyanosis and appear to be dependent upon the latter. They are also found in other conditions than bronchiectasis, particularly in the congenital heart lesions; but Bamberger has attempted to show that the change in bronchiectasis is characteristic of this affection, in that it is a painful hypertrophy of the epiphyses.

Percussion.—The percussion phenomena of bronchiectasis vary greatly, being dependent upon the size of the dilatation, the quantity of fluid present in it, its distance from the chest wall, and the character of the changes in the surrounding lung tissue. Dulness or a tympanitic tone may be obtained, or both alternately, according as the cavity contains fluid or air. A tympanitic tone with change of pitch on opening and closing the mouth may be noted, as well as change of tone on change of position, the cracked-pot sound, metallic tones, etc., according to the conditions present. About the areas showing such signs of cavity the tone may be resonant; in the case of tuberculous cavities it is always dull. The dislocation of the neighboring organs, pleuritic thickenings, adhesion, etc., may also be shown by percussion.

Auscultation.—The vesicular murmur is weakened or absent, being replaced by a bronchial blowing. The cylindrical dilatations give a soft bronchial sound, and when containing fluid they yield also moist, coarse bub-

bling râles. The saccular dilatations give both the percussion and auscultation signs of a cavity, particularly large, moist, bubbling râles.

COMPLICATIONS.—The most frequent and dangerous complication is the putrid or gangrenous decomposition of the contents of the dilatation. Pleuritis, peribronchitis, bronchopneumonia, chronic pneumonia, chronic bronchitis, lobar pneumonia, emphysema, chronic laryngitis, renal and cardiac affections, dropsy, albuminuria, cirrhosis of the liver, etc., may be associated with bronchiectasis or appear as sequela. Metastatic abscesses may occur in the brain, spinal cord, etc.; there may also be rheumatic joint affections. There arises in these cases a suspicion of the occurrence of a general pyæmic infection. Perforation of the dilatation into the pleural cavity leads to the development of a pyopneumothorax. In old chronic cases of long duration amyloid degeneration of liver, spleen, and kidneys may be found. Tuberculosis is a fairly common complication. The heart is usually affected, hypertrophy and dilatation of the right ventricle occurring in the majority of cases. The cardiac changes are due partly to disturbances in the pulmonary circulation, partly to the accompanying condition of chronic intoxication, partly to local changes in the thorax, and partly to coincident renal changes.

DURATION AND COURSE.—Bronchiectases may remain stationary for years, the only symptoms being those of a chronic bronchitis. As a rule the dilatation gradually increases during this time without an increase in the symptoms. With the advent of fresh catarrhs emphysema gradually develops, the shortness of breath becomes more marked, and the patient may become cyanotic. The right heart becomes hypertrophic and finally dilated. Putrid bronchitis and gangrene may occur; from these the patient may recover for a time, or death may take place. As a rule the condition runs for a long time; amyloid disease of the kidneys may finally result and the patient becomes dropsical. After alternating periods of improvement and exacerbation, extending over a long period, the disease is brought to an end by some one of the complications.

DIAGNOSIS.—The differential diagnosis of bronchiectasis from its complications is sometimes very difficult. The absence of the tubercle bacillus will distinguish it from tuberculosis. When the latter process is combined with bronchiectasis the character of the sputum, the age of the patient, position of the cavity, habitus, etc., are points to be considered in the differential diagnosis. The history of the case is of greatest importance. It may be taken as a guiding principle that tuberculosis may lead to a bronchiectasis, but that a bronchiectasis rarely becomes tuberculous. Actinomycotic cavities may be distinguished by the presence of the fungus in the sputum. The rare localization in the lung of hydatids may also be easily diagnosed by the findings in the sputum. From pulmonary gangrene, abscess, putrid bronchitis, interstitial pneumonia, pyopneumothorax, etc., the differentiation is often impossible. The physical signs of cavity are of the greatest importance in so far as the differentiation between processes with cavity formation and those without is concerned. Much was expected from the use of x-rays in the diagnosis of bronchiectasis, but these expectations have not been realized. Only in the case of extensive peribronchial thickenings may aid be looked for by the use of x-rays.

TREATMENT.—In very rare cases self-healing of the bronchiectasis may take place. In children this may follow the cure of catarrhal bronchitis and the restoration of normal conditions of pressure. In extremely rare cases the bronchial cavity may be obliterated by adhesion of the walls of the cavity or through the formation of granulation tissue. Since in the great majority of cases such healing is impossible, the prophylactic treatment becomes of prime importance. The conditions (pleuritis, pneumonia, etc.) which lead to bronchiectasis should be appropriately treated with a view to the prevention of such dilatations. After the development of bronchiectases the chief therapeutic indication is to keep

the contents of the dilatation—so far as lies in our power—aseptic. This can be perfectly accomplished only by residence in an atmosphere containing no bacteria. Removal of the patient to a suitable climate is the best means of avoiding the various complications of the affection. When this cannot be done the treatment becomes chiefly symptomatic and largely directed to antiseptic procedures. Inhalations of creosote, turpentine, menthol, eucalyptus, etc., and creosote vapor baths are recommended for this purpose. A number of writers speak favorably of the creosote vapor baths. These are, however, unpleasant and slow in operation, and do not always succeed in lessening the amount of the sputum. The crude creosote appears to be more effective than the various substitutes (vapo-cresoline, refined creosote, soluble cresol, etc.) which have been advised. Other writers have found success with guaiacol vapor baths after failing with creosote. The ordinary methods of giving such inhalations may, however, be a source of infection, as many of the forms of inhalation apparatus used are dirt traps.

Intralaryngeal injections of menthol, guaiacol, etc., have been advised by Rosenberg, Stewart, Campbell, and others, but are condemned by various writers because they give rise to constitutional disturbances, fever, and violent cough.

Subcutaneous injections of guaiacol (1 in 5) and creosote (1 in 5) in olive oil have also been recommended. They may give rise to inflammation and necrosis at the point of injection.

Intravenous injections of formalin (25–50 c.c. of a 1 in 2,000 solution of formalin in decinormal salt solution) have also been tried without success.

Injections of carbolic acid and menthol directly into the bronchiectatic cavity have also been suggested.

Murphy's method of filling the pleural cavity with air or nitrogen to such an extent as to cause a collapse of the bronchial cavity has been tried with some success. The air should of course be thoroughly sterilized. About 170 c.c. of air or nitrogen are injected every second or third day.

Inhalations of oxygen may aid in reducing the odor of the sputum. Symptomatic treatment with expectorants (apomorphine, senega, ipecacuanha, etc.) may at times give relief or temporary improvement. Hemorrhage should receive appropriate treatment.

Inasmuch as the medical treatment is usually without avail, much had been hoped from surgical intervention in the treatment of bronchiectasis. This has now been given a very extensive trial, with complete failure in the majority of cases, and only partial success in the others. These unsatisfactory results are easily understood when we consider the facts that the dilatations are often multiple and bilateral, and that the pulmonary tissue is usually extensively diseased. Dangerous hemorrhages may result, and anaesthesia is in itself attended with danger in these cases. The uncertainty of the physical signs also contributes to the unsatisfactory results. Puncture of the bronchiectatic cavity with a trocar and drainage, incision and drainage, cauterization of the cavity, etc., are among the operative procedures advised. From the cases thus treated which have been so far reported, it would seem that under favorable conditions of life the outlook for patients with bronchiectasis is more favorable without operation than with it. Improvement of the technique of operations upon the lung may lead to better results.

The *postural* treatment of bronchiectasis is strongly recommended by Ewart (*Lancet*, 1901). While not regarding it as curative in advanced cases, he holds that no other treatment is so simple, so rational, and so effective. In a case so treated the relief afforded the patient was striking; the persistent pyrexia stopped, and the gushing character of the expectoration ceased. Ewart advises a continuous elevation of the foot of the bed of from twelve to fourteen inches. For brief periods a greater elevation may be resorted to with benefit.

PROGNOSIS.—In so far as a cure is concerned the prog-

nosis in any well-established case of bronchiectasis is bad. Except in rare cases no method of treatment at present employed is of avail in effecting a cure. Some of the more acute cases in young persons may, however, be cured. In the chronic cases our present methods of treatment can only relieve the distress of the affection and prolong life.

Aldred Scott Warthin.

CAMPHOR, POISONING BY.—An unwarranted belief in the innocuousness of camphor prevails in the community, referable, probably, to the safety with which it is used as an external domestic remedy for minor ailments and to its agreeable odor. This should not, however, blind the physician to its real and serious dangers when taken internally; for it may act as a poison either when eaten frequently in small quantities, as for headaches or colds, or when swallowed accidentally or intentionally once or more in large amount. It is true that fatal cases are very rare, but the symptoms are often most alarming, even when recovered from. The lethal dose of camphor is difficult to determine. The smallest dose known to have produced violent symptoms in an adult is 1.3 gm.; the largest dose known to have been recovered from is 15 gm. (Kunkel, Blyth). Camphorated liniments swallowed by mistake have frequently been the cause of severe cases of poisoning, the fact of the drug being in alcoholic solution allowing it to be absorbed and disseminated through the system more rapidly and in larger quantity than when swallowed in the solid form. The histories which I shall presently cite illustrate further the usual sequence of symptoms, and such relations as the early or late supervention of convulsions to the occurrence or absence of vomiting, this depending upon whether any large proportion of what was swallowed remained long in the stomach in a comparatively insoluble condition, or was promptly taken into the circulation. Attention is also called to the statement that when camphor has been swallowed, what is absorbed undergoes such a transformation that the odor of it is not appreciable in the urine or feces (Kunkel); sometimes not even in the breath of the patient. Still, other authorities declare that the bodies of those dying smell strongly of the drug.

Full doses of camphor produce markedly exciting effects upon the brain and the medulla, especially when an alcoholic solution has been taken which favors rapid absorption. The earliest evidences of this stimulation are flushing of the face, a rapid succession of ideas, perhaps agreeable hallucinations, with a sense of lightness of motion and a desire to dance, in fact an intoxication. These manifestations are transient and may soon be followed by tonic cramps and epileptiform convulsions. To these may succeed sometimes paroxysmal tonic and clonic cramps with movements of rotation, followed by paralysis; or again deafness passing into sopor, coma, and death, the parts of the nervous system which are first excited being apparently finally paralyzed. The temperature is lowered, but the pulse and respiration vary (Brunton, Husemann). If the patient recovers, the memory is apt to be wanting for some hours. There are no characteristic lesions after death.

The following cases are fairly typical of poisoning by camphor: Davies reports being called at 3 A.M. to a child of two years and eight months, who had swallowed solid camphor. He found it pale, with blue lips, a rapid pulse, and suffering from severe convulsions. Vomiting was induced and the ejecta smelled strongly of camphor. The child soon recovered in part from its condition of collapse, but the convulsions continued, and in the intervals the patient was semicomatose. A stomach-pump was then used and the stomach washed out with warm water, procuring some relief. In five hours castor oil was given, also bromide of potassium, three grains every three hours. Still no improvement; the convulsions continued all night and the child died at 9 A.M. of the next day. The amount of camphor taken was probably half a drachm. From its being solid the stomach-pump could not act upon it effectively.

Craig reports that a man who was a hypochondriac ate

about three drachms of pure camphor. About half an hour after swallowing it he was seized with giddiness and nausea, staggered on rising and seemed likely to fall. Still he was unable to vomit, and was relieved by drinking some water. He was free from pain, and lay down with a drowsy ringing in the ears. In three-quarters of an hour the giddiness and nausea had gone, but he felt as if he had been taken from his feet and were being carried through the air. He sat down at the dinner table, but became suddenly unconscious. He had general convulsions, which soon ceased, and the reporter says there was no deviation of the eyeballs, pupils equal and small and not reacting to light, knee-jerks exaggerated; breathing rapid, cyanosis followed by pallor. He was not unconscious for over five minutes. There was no odor of camphor in the breath. About two hours and a half after taking the camphor he vomited copiously, and brought up no blood and some camphor. There was no retention of urine. His memory was affected for an hour after other symptoms had disappeared.

Honman reports the case of a girl of eighteen, to whom he was called at 11 A.M. She was in the habit of eating camphor. He found her unconscious and irritable, with dilated pupils, cold extremities, pale face, epigastrium sensitive to pressure, pulse thready and uncountable, and the breath smelling distinctly of camphor. The stomach was washed out after an unsuccessful attempt to produce vomiting by sulphate of zinc. Ether was given subcutaneously with immediate improvement. It was learned that she had had camphor in her hand, and had offered it to her roommate at bedtime. She had vomited during the night and had taken brandy and water about 8 A.M. Convulsive movements now began and extended from the lower extremities to the body and upper limbs. The temperature rose to 100.3° F., and the pupils were dilated. She died at about 3 A.M. the next day. At the autopsy the only finding attributed to camphor poisoning was a high degree of congestion of the vessels of the dura mater and surfaces of the brain. The government analyst reported a small quantity of camphor in the stomach, but it is observed that none of the ejecta or dejecta had been saved prior to the doctor's arrival at 11 A.M.

In regard to the treatment of poisoning by camphor, the most important precept laid down is the earliest possible emptying of the stomach by tube, stomach-pump, or emetic. Hypodermic injections of brandy or ether may be used, with perhaps the alternate hot and cold douche.

J. Haven Emerson.

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CANTHARIDES, POISONING BY.—The poisonous action of this drug is ascribed chiefly to the proximate principle *cantharidin*, which is from twenty-five to thirty times as active as the powder. As the unassayed powder or the tincture is the form in which it is most apt to have been taken, it is difficult to determine the fatal dose of cantharidin. Blyth states that a young woman died from twenty-five grains of the powder, probably equal to one grain of cantharidin, while the smallest dose of the tincture known to be fatal (Taylor) is an ounce, equivalent to gr. $\frac{3}{4}$ of the proximate principle. Poisonous effects may also follow from external applications of the drug, in which they result from absorption, especially in feeble persons and children. Blyth says that the popular idea of the influence of cantharides as an aphrodisiac holds good only as to the entire cantharides, and not as to cantharidin, and he considers it probable that cantharidin is not the only proximate principle in the insect. It is also stated that cantharides may be eaten with im-

punity by fowls, while the flesh of the latter may produce symptoms of poisoning if eaten by human beings. Ogier tells us that a fatal result may follow poisoning by this drug after as long an interval as twenty-four hours; also that proof of the cause of death may be found in the presence in the intestine of minute glistening particles of the insect. Fatal cases are rare.

The symptoms due to poisonous doses are given as follows by Husemann, Kunkel, and Blyth: They are shown in disturbances of respiration and in convulsions from involvement of the nervous system, often with headache, dizziness, stupor, and delirium. In the alimentary canal there appear at once burning in the mouth and throat followed by pain on swallowing, salivation, vomiting, and diarrhoea, while there develop intense irritation, pain, and a condition of inflammation of the kidneys and urinary passages, in consequence of which occur in the urine albumin, casts, pus, and blood, with catarrh and croupous deposits from the vesical mucous membrane. These are associated with strangury, dysuria, painful erections, and priapism. Sometimes pregnant women have aborted.

The following fatal case is reported by Lhôte and Vibert. A man of about sixty took a quantity of cantharidin, estimated at about 75 cgm. He died twelve to fourteen hours afterward, the symptoms presented not being accurately known. Autopsy four days post mortem. The lungs were much congested; there was a little froth in the bronchi. Stomach empty; mucosa actively congested. Kidneys large, turgid, and extremely congested; several large sanguineous effusions under the capsule; cortical and medullary substances gorged with blood and the mucosa of the calices and pelvis strongly injected. Bladder contained 4–5 c.c. of bloody urine; mucosa strongly congested and of an intense red; no ulcerations but many ecchymoses. Mucosa of the urethra likewise congested. On microscopic examination of the kidneys the glomeruli were found detached from their capsules, and separated from them by an exudate, in the midst of which were seen at certain points numerous round, nucleated cells. In the convoluted tubes the epithelial cells appeared glued together; they filled and distended the tubes. A material extracted from the viscera produced upon animals the effects of cantharidin, and its chemical reactions were characteristic of that substance.

The *treatment* of poisoning by cantharides must be symptomatic. The stomach should be evacuated, the stomach-pump or tube being used for the purpose if the mouth and throat are not inflamed; if they are inflamed, apomorphine should be injected hypodermically or an emetic should be given. Opium and hot sitz baths should be used to allay pain and strangury, and water and mucilaginous drinks given freely, but fats and oils are to be avoided.

J. Haven Emerson.

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CAROTID GLAND.—(Synonyms: Ganglion intercaroticum; Glandula carotica; Glomeruli arteriosi intercarotici; Nodus intercaroticus.)

This little-known organ lies in the bifurcation of the common carotid artery, generally near the posterior side of the internal carotid just as it comes off the main trunk. In size it is about 1–3 mm. in diameter, varying considerably. Because of its great vascularity the color is pink. For some time it was thought to be an epithelial organ developed similarly to the thyroid and thymus from the branchial clefts, but further study showed it to be of entirely different origin and nature. Its embryonal origin is later than the thyroid and thymus, and it is in no