cardamon and syrup of orange may be added. Another mixture that is recommended is an emulsion of bromoform with oil of sweet almonds, gum acacia, gum tragacanth, and syrup. All mixtures in which the drug is not dissolved are very uncertain, and require to be prepared with great care.

How the drug acts is uncertain; whether as a specific or on account of its germicidal properties, has not been determined. Dr. Stepp thinks bromine is excreted by the lungs after the drug has been decomposed in the system. The reports of others who have used it for this purpose corroborate the views of Dr. Stepp as to its efficacy in whooping-cough. *Beaumont Small.*

BROMOL.—(Tribromophenol.) This is formed by adding bromine water to a solution of phenol. It is deposited in white crystals; taste is sweet and astringent; odor resembles bromine; it is nearly insoluble in water, but is soluble in alcohol, ether, oils, and glycerin

It has been introduced as an antiseptic in the treatment of wounds, ulcers, etc. Applied in its pure state it has a slight caustic action and favors the removal of sloughs. As a dressing it is applied in solution in oil or as an ointment, one part in thirty. It has been used in diphtheria as a local application to disinfect the throat and remove the membrane.

When administered internally it is not acted on by the gastric secretions, and in the intestines is but slowly decomposed. Its action is therefore slow and prolonged. It is given in doses of gr. iij. to v. a day, and has proved of service as an intestinal antiseptic in cholera infantum and typhoid fever. For infants gr $\frac{1}{4}$ to $\frac{1}{2}$ may be given at each dose. *Beaumont Small.*

BRONCHI, MINUTE ANATOMY OF.—As a preface to the histology of the bronchi, a short résumé of the gross anatomy seems here desirable. The bronchi—more properly bronchia, $\beta\rho\acute{o}\gamma\chi\iota\alpha$, meaning swallow or throat—probably received the name through Plato, who taught that their function was to receive the liquids, the œsoph-

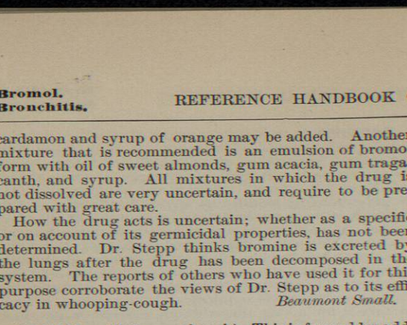

FIG. 1053.—Represents a Transverse Section of the Bronchial Wall at the Fifth Bifurcation in the Human Adult. *a*, Epithelial layer of mucous membrane; *b*, hyaline basement membrane, formed from *c*, internal elastic layer, showing its varying thickness: *d*, *d*, muscular layer; *e*, mucipurous crypts; *f*, cartilaginous lamina; *g*, external layer; *h*, branch of bronchial artery. (About 30 diameters.) (Drawn with camera by Dr. F. Cary.)

agus receiving the solids. Aristotle having supported this theory, the name remained so long in medical use as to become a fixture.

The bronchia, beginning at the tracheal bifurcation opposite the third dorsal vertebra (fourth in female), terminate in the pulmonary lobules. The primary tracheal branches, from their distribution, are named the right and left bronchus. The former is shorter, larger, and more horizontal than the latter, and the septum bronchiale separating them is placed to the left of the longitudinal (in the recumbent posture of the body) axis of the treachea. Hence bodies falling into the trachea lodge more frequently in the right bronchus. Hyrtl teaches that post-mortem examinations of the new-born, dying after a few respirations, show that the right lung respires before the left, and he explains the fact by the difference in size and location of the beginning of the right bronchus. The general rule of dichotomous subdivision obtains, but is not without exception; *e.g.*, the right bronchus subdividing into three branches, one for each lobe. Occasional small branches are given off by the main trunk. Having reached the diameter of 0.21 mm. ($\frac{1}{120}$ inch), they enter the apices of the pulmonary lobules. Here again branching at acute angles they dilate slightly, becoming funnel-shaped, whence the name "infundibula vesicæ." (See article *Lungs*.)

STRUCTURE.—The bronchia are hollow, cylindrical tubes, which retain in structure, throughout a large portion of their extent, the characteristics of the trachea. Like the latter, they consist of four distinct layers: an external fibrous, a muscular, an internal elastic, and a mucous layer.

The *External Fibrous Layer* consists of a dense meshwork of connective tissue, in which are to be found rings or laminæ of hyaline cartilage. In the primary bronchia these are disposed as in the trachea, *i.e.*, in broken rings like the letter **C**, held together by fibrous bands. The ring is made complete by small transverse bundles of unstriped muscular fibres attached by microscopic tendons to the ends of the rings. By their contraction they increase the curvature of the cartilage and so diminish the calibre of the tube. The right bronchus contains six to eight of these cartilages; the left ten to twelve. Further removed from the trachea the cartilages gradually lose their ring-like shape, and are disposed in irregular polygonal laminæ. Becoming smaller and less frequent, they finally disappear in tubes of less diameter than 0.23 mm. ($\frac{1}{110}$ inch), the fibrous layer still continuing to form the external coat.

The *Muscular Layer* lies within the fibrous layer just described. It consists of separate bundles of unstriped muscular fibres, disposed for the most part transversely to the tube. It is better developed in the intervals between the cartilages than just beneath them. As the cartilages disappear this muscular layer becomes better and better developed, until at last it completely surrounds the bronchioles, which, on section, but for the epithelial lining, might be mistaken for arterioles. The muscular layer can be traced to the final branching of the bronchiole to form the alveolar passages, where, according to Rindfleisch, it becomes again better developed into a sort of "sphincter" at the point of entrance to the alveolar passages. The function of the muscular layer is to narrow the calibre of the tubes. This is only manifested to any appreciable extent in the bronchioles. The cartilages prevent any decided narrowing where they exist. In the experiments of Dr. C. J. B. Williams with electrical stimulation on bronchioles of less than a line in diameter, they were seen to contract until they nearly obliterated their lumen. Dr. Gairdner suggested that the contractility of the minute bronchioles may serve to expel collections of mucus which have accumulated in them, and which neither ciliary action nor the ordinary expiratory efforts would dislodge.

The Internal Elastic Layer.—Within the muscular layer, and beneath the mucous membrane, lie longitudinal bundles of elastic tissue quite regularly disposed. They project, as it were, partly into the lumen of the tube, and so give, on transverse section, a wavy, corrugated appearance to the lining membrane; on longitudinal section, a grooved or furrowed one. Piercing this as well as the muscular layer, chiefly in the bronchial tubes containing cartilages, are to be seen the muciparous ducts, lined with epithelium, leading inward to open on the free surface of the mucous membrane. The mucous

crypts lie in the external fibrous layer, chiefly in the intervals between the cartilages.

The *Mucous Membrane* of the bronchia and bronchioles, forming the internal layer, possesses, throughout the greater portion of its extent, the characteristics of that of the tracheal mucous membrane. Like the latter, it consists of epithelial cells of the ciliated columnar variety,

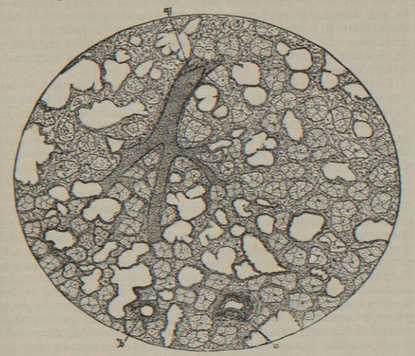

FIG. 1054.—*a*, A minute bronchiole splitting into the *ultimate* branches, which terminate in the alveolar passages; the epithelium has become of the simple pavement variety; on the left branch can be seen one of the so-called "saccular dilatations"; *b*, artery; *c*, medium-sized bronchiole having no cartilaginous lamina. The remainder of the field is normal lung tissue. (About 30 diameters.) (Drawn by Dr. F. Cary, from a microscopical section, with camera.)

superimposed upon a basement membrane, which latter is made by a condensation of the inner part of the internal elastic layer. When the tube has reached the diameter of 0.2 mm. ($\frac{1}{50}$ inch), these cells lose their cilia, become shorter, smaller, and rounded, in the ultimate tubules becoming the simple pavement cells. Here the membrane loses its character as a mucous membrane, and resembles that which lines the alveoli (see article *Lungs*). Here and there in the larger tubes are to be found the cup-shaped cells (*Becherzellen*) of Schulze, the function of which is yet unknown.

Vascular Supply.—From the thoracic aorta are given off the bronchial arteries, which, receiving occasionally branches from the first intercostal and internal mammary arteries, accompany closely the subdivisions of the bronchia, supplying their walls, the walls of the large pulmonary vessels, the lymphatic glands, and the connective tissue of the lungs, to terminate finally in capillaries which inosculate freely with the respiratory plexus. Injections thrown into these vessels will fill also the capillary plexus of the arteria pulmonalis. The corresponding bronchial veins empty in part into the vena azygos, in part into the vena pulmonalis; the venous radicles from the ultimate bronchioles emptying into the latter, those corresponding to the arterial branches to the bronchia and lymphatics, into the former.

Lymphatic Supply.—The lymphatics arise in the alveolar septa. Stomata open on the alveolar walls between the epithelial cells, communicating thus directly with the alveolar cavity. They form a plexus in the submucous tissues, accompany the branches of the bronchia, as well as the pulmonary veins and arteries, emptying finally into the bronchial glands at the roots of the lungs. Within the lungs they often possess a gray or black speckled appearance, from the absorption of pigment or foreign bodies.

Nerve Supply.—The nerve supply to the lungs is derived from the pulmonary plexuses formed from branches of the vagus and sympatheticus. The filaments from these plexuses—situated at the lung hilum—follow the ramifications of the bronchia, becoming lost finally on them, and in the parenchyma of the lungs. When carefully stained they are seen to possess, in parts of their course, the microscopic ganglia to which Remak and Schiff first called attention.

The sensibility of the bronchia must be very slight; at least this seems to be true of their smaller branches, because of the slight complaint made by consumptives in whom large portions of bronchial and lung structure are being destroyed. *Lewis L. McArthur.*

BRONCHITIS.—In no affection is the practical importance of the distinction between acute and chronic disease better illustrated than in bronchitis. A bronchitis of recent origin or of sudden development is hardly the same disease as a bronchitis of long standing, because, aside from the fact that they both involve the same locality, and that cough is a leading symptom in both, the essential features in the course of each are quite dissimilar. Moreover, in acute bronchitis itself the conditions vary to such an extent, according to the part of the bronchial tract affected, that it will be more advantageous to consider so-called capillary bronchitis separately. Hence we prefer, in beginning with acute bronchitis, to restrict the term to that common affection known as an acute catarrh of the larger and medium-sized bronchi.

1. ACUTE BRONCHITIS. — *Symptomatology.* — Nearly every one in our climate has experienced the first stage, at least, of an attack of this complaint. When a catarrh of the upper respiratory tract has been severe enough to pass beyond the larynx and trachea and become a veritable bronchitis, though yet only extending to the primary divisions, the symptoms are then readily distinguishable at sight from any other cough-producing affection. Pain is soon complained of and the patient's gesture in describing it is distinctive. Instead of applying his finger ends against one side, as he does to indicate the stitch or side stab of a pleurisy or a pneumonia, or holding his side as in pleurodynia, he lays his open hand on his breast as if taking an oath, and then passes it across the chest from side to side to indicate a suffocative sense of pain and tightness, which in severe cases feels as if the chest were transfixed with a disc of iron. Instead, also, of a carefully chosen and maintained decubitus, he changes frequently about, or else sits up and leans forward, a sure sign of a bilateral cause in dyspnœa, and one, therefore, which usually would exclude either a pneumonia or a pleurisy or phthisis. Although the patient may complain of difficult breathing, and although in active attacks he may breathe with both nostrils dilated, yet it will be noticed that, quite differently from what takes place in other febrile pulmonary affections, the respiration is but slightly accelerated; and, furthermore, the thermometer tells the same story in this as in inflammation of other mucous membranes, namely, that it rarely causes a greater rise than 100.5° to 101.5° F., unless some other element is entering into the course of the complaint. The other indications of a febrile complaint are usually present in a moderate degree also. The face is flushed, the eyes are watery, the voice is husky, the pulse somewhat faster than usual, the tongue furred, and along with a dry skin (not always) and headache there is also some chilliness, but not a distinct rigor, like that which ushers in a pneumonia.

The pain of bronchitis is an early symptom and often a sign that an acute catarrh, in its journey downward, has just entered the bronchi; for it is one of the peculiarities of the nervous supply of the respiratory tract that its sensitiveness differs markedly in different portions. The much greater irritability of the larynx over the trachea is well known, but it has been found by experiment that nearly the same proneness to cough on irritation is localized at the bifurcation of the bronchi. From this point onward, however, the irritability progressively diminishes until, as a result, serious accumulations of fluid may form in the smaller bronchi without occasion-

ing other symptoms than dyspnœa. This early inflammatory irritation will prove, on examination, to interfere with the breathing, mainly from spasmodic action of the bronchial muscles, conjoined with swelling of the mucous membrane itself, and consequent narrowing of the affected tubes, in much the same manner as the wide outlet of the nasal passage is closed in the beginning of a coryza. As soon, therefore, as a secretion bathes the irritated mucous surfaces, though the tubes be largely filled with it, the breathing becomes easier from relaxation of the spasm and reduction of the tumefaction, while the pain likewise is mitigated, except just after a fit of coughing.

Cough is a necessary element in bronchitis, and its sound indicates its character, so that a practised ear will distinguish it as bronchitic without difficulty. With reference to this subject of cough sound, it may be said that all coughs can be divided, according to their sound, into two classes, whose nature and import may be recognized by simply hearing, without necessarily seeing, the patient. The first, or the irritant cough, is the result of direct or reflex irritation alone, and it neither produces expectoration nor is caused by any need for expectoration. It is always composed of separate coughs or hacks, which, however frequent and prolonged, or even though they be severe enough to prevent all sleep, are yet each independent of the other, like the blows of a hammer. The second, or the expectorant cough, on the contrary, is like the running of a chain over a pulley, and though it may be deliberate and slow, yet each cough is connected with the preceding and the following cough, and when once begun it will not stop until some expectoration has occurred. The patient, and all within hearing, are aware that the cough cannot be arrested until something is brought up, though, as in a case of viscid chronic bronchitis, the pellet which is dislodged at last seems an insignificant product for such a strangling time as the sufferer has had of it. To the irritant class belongs the characteristic hack of acute and of chronic pleurisy, and, therefore, also the ominous slight cough of early phthisis. It becomes, however, very loud and barking in hysterical or uterine cough. One of the most violent coughs which I have ever heard was in a lady who proved to have a polypus extruding from the os uteri, and as soon as it was removed this cough, of several years' standing, ceased. Children often have such coughs at night, from intestinal irritation, and the cough of thoracic aneurism is another instance of the kind, and lastly, it is the cough of direct laryngeal irritation, as in croup. This irritant cough, if present at all, is found only in the very first stage of acute bronchitis, and soon gives place to an expectorant cough, which is comparatively slow if moist, and rapid if dry; its conclusion in expectoration being always announced by the last one or two coughs being more or less liquid, and following after a short or very prolonged antecedent series, according to the character of the secretion expectorated.

In acute bronchitis, as just remarked, all cough is in the beginning painful. As each paroxysm ceases, the patient presses his hand against the chest with an expression of distress, and in dread of the next return. After a while he experiences a good deal of soreness between the ribs, with some tenderness on pressure, which, however, must not be confounded with the same symptom in either pleurisy or pleurodynia, for in bronchitis it is located at the attachment of the diaphragm and of the other muscles engaged in the act of coughing, and is but the common result of unwonted muscular exertion.

Cough, therefore, is the chief cause of the patient's discomfort in acute bronchitis, and simply to allay it is the main indication in treatment. Hence the relief will correspond with the ease of expectoration, and this in turn depends upon the character of the secretion. As a rule, the secretion first formed is the most difficult of expectoration, owing to its viscidity. It is composed of a clear, tenacious mucus, much mixed with air from the protracted efforts of coughing, and contains also a few mucous corpuscles, and sometimes streaks of blood. After a time the secretion becomes either more liquid from greater watery admixture, or else more turbid and yellowish, according to the formation of a greater or less quantity of pus. This latter change, in acute bronchitis, is a sign pointing toward recovery, for as the expectoration becomes more purulent it rolls into rounded masses of increasing consistency, but of less frequent formation, until but one or two such accumulations are expectorated in the morning, and then they cease altogether. When that desired termination will occur is uncertain, for the duration of acute bronchitis, like that of other catarrhs, varies indefinitely, as it has no critical periods and ends irregularly.

Diagnosis.—Bronchitis is oftenest confounded with pneumonia, especially if the expectoration be bloody. From lobar (croupous) pneumonia we have already indicated some points of difference in the nature and bilateral extent of the pain, in the history usually of an antecedent naso-pharyngeal or laryngeal catarrh, in the absence of a distinct rigor at the beginning, in the moderate rise of temperature, and in the non acceleration of the respiration. Physical exploration of the chest now completes the demonstration. In acute bronchitis there is no dulness on percussion anywhere; if anything, the stroke note is increased in intensity all over the chest, and the vocal fremitus is diminished. In the early "dry" stage auscultation reveals sibilant asthmatic breathing in both lungs, varying constantly in intensity, and usually sufficiently marked to mask or extinguish the vesicular murmur. As soon as secretion commences, the whistling sounds give place to sonorous rhonchi produced in the larger tubes, mixed with the characteristic subcrepitant râle proceeding from the lesser bronchi. This râle is not as dry or sharp as the crepitant râle of pneumonia, and specifically differs from it in occurring during both inspiration and expiration, while the pneumonic râle is known by the wholly clear and high-pitched expiration which follows it. As the bronchial râle is itself often heard only at the end of inspiration, it should be watched for a number of respirations, and especially after coughing, when its true character will be revealed by its being heard also in expiration; or else it is greatly modified by the cough, while the pneumonic râle can neither be removed nor modified by any respiratory act. This distinction also separates the bronchial râle from a pleuritic friction sound, which it often closely resembles, for whereas the friction sound, like the subcrepitant râle, is heard during both inspiration and expiration, it cannot be modified by a deep inspiration or ever coughed away.

Etiology.—Bronchitis is sometimes an accompaniment of other acute diseases, like smallpox, but especially of measles and pertussis, and then it is apt not only to prolong convalescence, but also to cause permanent mischief by generating a proclivity to asthma. In typhoid fever, bronchitis is often an early symptom, and it then may be so pronounced as to mask the presence of that disease. The course of the temperature, however, will soon suggest the correct diagnosis, to be soon confirmed by the development of the proper signs of the infection. The bronchitis then usually subsides during the second week. The most significant fact, however, connected with its etiology is that bronchitis occurs only exceptionally as a direct result of excitation of the bronchial mucous membrane itself, by any irritant property or ingredient of the inspired air. The frequency of bronchitis among workers in dusty air, such as millers, rope-makers, etc., does not militate against this statement, for when every such instance is taken account of, it only shows that dusty air can cause bronchitis, as also measles does, but it does not explain why the great majority of cases of bronchitis have not been in dusty air at all. Recent researches also prove that bronchitis is not the result of any form of bacterial invasion through the air which enters the lungs. Its occurrence in phthisis can always be attributed to extrabronchial processes and not to primary infection of the mucous membrane, for no demonstration has been more conclusive than that the air in the whole bronchial tract is normally sterile, all germs having been filtered out of

it or destroyed during its transit through the nasal passages. This explains, as Lister pointed out, why pneumothorax caused by traumatic injuries of the lungs is not followed by suffocative pleurisy.

On the other hand the one great fact in the etiology of bronchitis, oftener illustrated by experience than any other, is its causation by some chilling of the skin. The peculiarity here is that this chill need be but very partial and often of cutaneous areas quite remote from the lungs. Sitting with wet feet in a cool room will induce a severe attack of the complaint much more commonly than the breathing of any kind of air, however cold or hot or dry or moist it be. So a cold draught upon the nape of the neck, especially if the skin be perspiring, always entails a risk, even in the healthiest persons, of an attack of bronchitis or of a catarrh of some other part of the respiratory tract. Such effects of surface chilling, however, are best illustrations of that most common disorder which is denominated "catching cold." Considering how frequent this derangement is, and how often it leads to severe or fatal internal derangements, it is strange that so little progress has been made in the investigation of the pathology of chill. It seems to me that we must look for its most probable explanation in the sudden local closing of the arterial circulation of an internal part by reflex vaso-motor irritation from the surface. Experiments on the kidney have shown that clamping the renal artery for only twenty minutes causes such damage to the renal secreting cells that albuminuria lasting two weeks may be set up by this brief arrest of the arterial flow. Now it is a general law of vaso-motor association that the cutaneous nerves are always in relation with the vascular nerves of the internal organs under that part of the skin, so that the same kind of vascular impression, whether stimulant or sedative, to the surface nerves is reflected to the nerves controlling the circulation of the deeper parts. It is in accordance with this law that cold suddenly applied to the abdomen will contract the internal arteries and check a post-partum hemorrhage, or a warm poultice to the chest soothe the pain of a pleurisy, etc. But besides this general law, there are many examples of special vaso-motor associations between distant parts. Thus the nerves of the feet are closely associated with the vaso-motor nerves controlling the circulation of the pelvic viscera, so that cold to the feet will check menstruation, and dry heat thus is one of the most reliable emmenogogues. Whoever has an irritable stricture of the urethra should not get his feet wet. The nerves of the nape of the neck also have wide relations of the same kind. Hence it seems reasonable to surmise that the process of "catching cold" is caused by the irritant surface impression of a chill reflected by some customary nervous association so as to shut off the arterial blood from some internal tract or viscus sufficient to inflict an injury there comparable to the injury to the kidney cells in the experiment above alluded to, and the subsequent inflammatory development is the expression of the local reaction to that injury.

Pathology.—Acute catarrh of the primary and medium-sized bronchi is rarely a dangerous complaint, and, if we consider its frequent occurrence, it is the least serious of any of the pectoral affections, particularly when compared either with laryngitis on the one side, or with catarrh of the smaller bronchi on the other. A post-mortem examination, if it could be had, of an adult who at the time of his death was suffering from a severe chest cold such as we are now considering, would reveal very little, if any, departure from health, owing to the removal of all traces of hyperæmia by the emptying action of the elastic fibres which line the tubes. We can best judge of the morbid changes by observing the traces of an incipient bronchitis in those who have died from other diseases. The first step is a hyperæmia of the vessels of the inner fibrous coat, which become swollen and softened and infiltrated with lymph cells, accompanied by œdema of the basement membrane, from which are detached numerous ciliated columnar epithelial cells, while new cells from the deeper layer of the epithelium are successively cast off mixed with leucocytes from the congested blood-vessels.

Treatment.—There is no disease in this country which so often brings patients for a prescription as this form of bronchitis. This is due not only to its own exceptional frequency, and the discomfort which it occasions, but also to the just dread which a visitation of cough causes among most persons. Ordinarily, of course, they are mistaken in supposing that phthisis means a neglected cough, and therefore that "it will never do to let a cough run"; but there is cause enough always for shortening every bronchial catarrh in order to prevent the formation of a habit of the kind, which is common to all inflammations of the mucous membranes. The aim, therefore, should always be to prevent an acute bronchitis from becoming chronic, either actually or potentially, and hence, in this complaint, the less trust in nature, or in spontaneous recovery, the better. When called to a patient who has not passed beyond the condition of hyperæmia and swelling (generally termed "the dry stage" of bronchitis), the physician's first duty should be to induce secretion as quickly as possible. If the patient be not too young, or too old, or too debilitated, much the most effectual proceeding to secure this end is to dissolve a grain of tartar emetic in a teacup of water, and tell him to take a teaspoonful of this every ten minutes. As soon as he begins to be slightly nauseated by it his pain rapidly subsides, owing to the anæsthetic effect of antimony; the spasm of the bronchial tubes relaxes, and soon a watery secretion flows and expectoration begins. It is not necessary to carry the administration of the antimonial to the point of producing emesis, for it cannot abort the inflammation, and we have much better remedies for the succeeding stages of the complaint.

As we have remarked before, cough is the one symptom to combat in acute bronchitis (not bronchiolitis), for it is apt to do a great deal more than produce expectoration. In acute (not chronic) inflammations the first indication is to secure quietude of the inflamed part, and every act of cough is an infringement of this rule. The severe pain which each paroxysm causes proves the mischief which it occasions, and hence, as some coughing must occur in order to remove the secretion formed, the purpose should be to render the secretion capable of removal by as few acts of coughing as possible, and then to suppress the superfluous remainder. Hence the more watery and the less adhesive the mucus can be made, and the less reflex irritation there be from the inflamed part, the sooner will the bronchitis subside. To fulfil the first indication, namely, that of inducing a watery flux, the most efficacious remedies are oils. To prove this, one need introduce only a few drops of sweet oil into his nose and note the flow which will speedily follow. The action of castor oil on the intestinal mucous membrane is another illustration of the action of oils, and we may mention in passing that castor oil on this principle is a dangerous cathartic to give to infants with bronchitis, from its tendency to fill their small tubes with too much secretion. Now certain oils have a particular affinity for the bronchial mucous membrane, and hence have a right to be classed among expectorants, and one oil, the oleum lini, or linseed oil, has this property to such a remarkable degree that it is one of the very best means at our disposal for painful bronchial coughs of every kind, including phthisical bronchitis. I was first led to use it from the fact that domestic experience had long shown the soothing effects of flaxseed tea in bronchitis, and I feel certain now that no other remedy is so effective as the oil itself in active inflammatory states of the bronchial mucous membrane. To insure a good emulsion it is better to make it in some quantity, thus: Irish moss, ʒ i., boil in water for an hour and strain, making ♁ ij., then add ol. lini ʒ xv., ol. gaultheriæ, ol. cassiæ, aā ʒ ij., glycerini ʒ v., syr. simpl. ʒ x., ac. hydrocyanici dil. ♏ clx. A six-ounce cough mixture of this emulsion may then be made by the addition of a grain of morphine and a drachm and a half of chloral, of which the dose for an adult is a tablespoonful taken an hour after meals. A firm in Dan-

bury, Conn., has made a proprietary article out of this emulsion, and I am told sells it widely under the name of Linolin.

When the bronchitis develops in the course of a descending catarrh from the pharynx and larynx, and especially in those with laryngeal pain, the action of full doses of aconite is very beneficial. A combination of tincture of aconite and camphorated tincture of opium with spirit of nitrous ether and syrup of senega may be employed for the same purpose as the linseed-oil emulsion, especially in patients who dislike all oily mixtures. Iodide of potassium, in doses of four grains, also comes under the head of liquefying expectorants, and to a less degree the carbonate of ammonia.

After a few days, in many persons the secretion often increases, especially in those who have had repeated attacks, until it becomes a very inconvenient and obstinate bronchial flux. Here the indication is for a combination which will start secretion and at the same time not allow it to become too viscid. Dr. C. J. B. Williams' favorite prescription for phthisical bronchitis, with abundant expectoration, is useful under these circumstances; it contains nitric acid, iodide of potassium, syrup of senega, and balsam of tolu. The addition of belladonna renders it still more certain in diminishing the flux.

The use of hot drinks on going to bed, especially those containing alcohol, for the purpose of getting up a perspiration, should be reprobated. Alcohol is uniformly mischievous in all catarrhs, acute or chronic, and the benefit of perspiration can be much better obtained by a Dover's powder and aconite taken while the patient wraps himself in an extra covering and sits with his feet to a fire without moving from it for some hours until he can go directly to bed. This, then, should not be too warm, for a nocturnal perspiration is always risky.

Counter-irritation is justly reputed among the laity as of much service in bronchitis. At the very start, a sinapism to the chest, especially if made large and applied for only a short time, may cut an attack short. After the second day it is rarely of any use, and furthermore it should never be applied in measles, as the action of mustard on the skin when inflamed by measles is apt to be very severe, and I have known of two fatal cases, in children, of gangrene of the surface of the chest from the ignorant use of mustard in this exanthem. Stimulating embrocations, however, such as the soap liniment, with turpentine and aqua ammoniæ, are useful both in the onset and decline of bronchitis, if only to lessen the cutaneous hyperæsthesia or sensitiveness to draughts, which accompanies all severe catarrhs of the respiratory mucous membrane.

2. Acute Bronchiolitis, or Capillary Bronchitis.—This formidable disease, with a mortality of from thirty-five to fifty per cent. of all attacked, is much more than a simple bronchitis, for the accompanying inflammation not only extends beyond the terminal bronchi into the alveoli, but also affects the peribronchial tissue, and may even involve the pleura. The affected tubes lie far within the substance of the lung, and, having lost all cartilage, they ramify as small thin membranous channels between textures rich in blood-vessels and in meshes of connective tissue. An inflammation reaching to them, therefore, may thus give rise, by involving the surrounding structures, to both acute and chronic changes of greater constitutional effect than in the case of any simple mucous catarrh. A pretty sure indication of this fact is found in the sudden rise of temperature which is observed whenever an acute bronchitis is passing into a bronchiolitis, for this proves that a profounder reaction has occurred than pertains to the course of a mucous-membrane inflammation. It is difficult, indeed, to draw a sufficiently marked distinction between the lesions which are apt to arise from the extension of a bronchiolitis and the phenomena of so-called catarrhal pneumonia. The term catarrhal has been objected to as applicable to a pneumonia, because the air cells cannot be said to contain mucous membrane, but the significance is obvious enough as indicating a pulmonary consolidation arising in a pneumonic process whose origin really comes from the bronchial tubes. While, therefore, capillary bronchitis as such is a frequent disease of early childhood, and often proceeds to a fatal termination without general implication of lung tissue, in adults pneumonia, consecutive to diffuse bronchitis, is a common affection, especially in the aged or feeble, or when supervening upon a chronic bronchitis. In these patients greater areas of consolidation are found in both lungs than is common in children; but it is difficult to demonstrate any specific difference in the morbid processes themselves, as the gradations between the two are of every degree, the smaller bronchi being almost exclusively affected in some adults, and pneumonic consolidation being the most pronounced lesion in many children.

The main reason for the gravity of capillary bronchitis is to be found in the comparative weakness of the bronchial muscles of patients affected with this disease. This cause pertains equally to the affection in children and in the aged. The muscular coat begins in the trachea and in the primary bronchi, where it joins together the free ends of the incomplete rings or **C**-shaped cartilages, and can thus on occasion contract the calibre of even these larger tubes. As the bronchi further divide, the muscular layer relatively increases, becoming more or less a circular coat, until it ends at the alveolar passages as a thick bundle of annular muscle fibre cells, forming a kind of sphincter (Rindfleisch). Upon the muscular layer lies the thick layer of longitudinal yellow elastic fibres which are continued on into the texture of the air vesicles themselves. Now, as the one function of muscle is to produce movement, it is plain that these muscles, acting upon the recoil of the elastic fibres at the moment when the external expiratory muscles are driving the air through the tubes in coughing, could, by a quick contraction upon the current of air, greatly assist the propulsion of fluids toward the larynx.

In children the bronchial muscles are not only relatively of much less development and power in proportion to their youth, but they are equally weak in the muscular apparatus of the throat and in the expiratory muscles of the chest, the latter having the further disadvantage of the yielding nature of the chest walls to which they are attached. Young children, therefore, cannot clear even their throats of mucus, but rather swallow that which is brought up, and in proportion to their debility, whether due to age or to imperfect development, will the danger increase of suffocative accumulation in their air tubes. In the aged, on the other hand, bronchial palsy, consecutive to chronic bronchitis, is the commonest condition which leads to a fatal complication.

Capillary bronchitis affects children more commonly in the first year of life; the frequency then diminishes progressively up to the third or fourth year; and, finally, the disease may develop from any of the common causes of acute catarrh of the respiratory tract. It is, therefore, of exceptional severity in whooping-cough, and ranks as the commonest cause of death in measles. It occurs also during the winter months, as one of the complications of dentition. At other times it develops upon an ordinary cold, which has begun with sneezing, and, after setting up a coryza, goes on to develop laryngo-tracheal symptoms for several days, until finally symptoms of a more pronounced constitutional kind begin to manifest themselves. The child becomes heavy and drowsy, with longer and more severe paroxysms of coughing, followed by dyspnœa, which is evidently due to paroxysmal spasmodic action in the bronchial tubes. After a time the nostrils begin to be permanently in action, a constant restlessness sets in, the respirations become accelerated, the head grows hot, and the face is deeply reddened during the attacks of coughing, which, though very hard, yet do not bring up much secretion. The cough has a peculiar whistling character, quite different from the brassy sound of croup, and a distinct wheeze is audible in many cases without applying the ear to the chest. The thermometer now shows that a rising fever is on hand, for a temperature from 102° to 103° F. in a child

with a cough should always cause solicitude. Percussion at this stage does not afford much information, but later on it may reveal localized areas of dulness, especially in the infrascapular and subaxillary spaces. Auscultation sometimes affords nothing but highly puerile respiration, but oftener a great number of high-pitched, fine, sibilant sounds are heard accompanying both inspiration and expiration. The presence of areas of consolidation is sometimes made out by localized exaggeration of both breathing and voice sounds, especially after a fit of coughing. It should be remembered that a child's chest, being so much smaller relatively than an adult's, is proportionately more resonant, and often transmits sounds of all kinds over to the side opposite to that on which they originated.

Meantime, with the progress of the case, both pulse and respiration grow more and more frequent. The child can nurse or drink only with a short, hurried effort, and, as the respiratory obstacle increases, its chest begins to show signs of disordered breathing which are very significant. The lower ribs and the epigastrium sink in during inspiration, indicating widespread obstacles to the ingress of air. On the other hand, the residual air in the lungs both increases and becomes rarefied, so that the supra- and infra-clavicular spaces become distended and the upper part of the chest seems scarcely to move with the breathing. As the case progresses the body temperature varies from 102° or 103° in the morning, to 104°, 105° F., or even more, in the evening. The pulse rises from 150 to 180 or 200, and the respirations to 50, 80, or 100 per minute, while the constant tossings of the patient and its expression of terror too plainly indicate the dread of approaching suffocation. As might be expected from the lack of air, its cry is low, plaintive, and short. If relief does not come, signs of exhaustion, from the excessive labor of the breathing, begin to appear; the lips first turn blue, the face and surface generally become cool, pale, and livid, the pulse grows thready, the cough ceases, and the stupor of carbonic-acid poisoning grows deeper until death closes the scene, with or without slight convulsions.

The duration of the disease is not very definite. In favorable cases it may last ten days and then occupy a week in recovery, with increased but more expectorant coughing at first, and with a plain increase of inspiratory power. In others who recover, the febrile stage may yet last for from three to four weeks. In a certain proportion of cases the disease passes into a fibroid alteration of extensive regions in one or in both lungs. As the inflammation then becomes chronic the peribronchial connective tissue greatly hypertophies, causing more or less obliteration of the air cells, and, finally, adhesions of the thickened pleura to the chest walls. Great bronchial dilatation is then apt to follow in the consolidated parts, surrounded by emphysematous lobules, and a constant secretion of muco-purulent sputa is thrown off. These symptoms, combined with the great emaciation of the patient, seem to leave nothing wanting for the diagnosis of tuberculous phthisis. Often, however, so much improvement of a permanent kind occurs, if the patient survives for a few years, that the prognosis need not be as hopeless as the same degree of wasting would imply in an adult.

The post-mortem appearances, after capillary bronchitis, vary according to the participation of the lungs in the inflammation. If the case has been chiefly bronchitic, the lungs do not collapse when the chest is opened, but may even bulge out as if they had been compressed by the ribs. This pseudo-emphysema is caused by the occlusion of the bronchi by mucus and other products of the inflammatory process. Commonly, however, the surface of the lungs is irregular from alternate collapsed and overdistended lobules, according as the valve-like action of the secretion in the tubules had allowed more air to pass during inspiration or more during expiration; the condition of overdistention being produced when less air could be forced past the obstacle during expiration than during inspiration, and a condition of collapse being produced when the reverse was true. The areas of pneumonic consolidation, on the other hand, present just the same appearances and changes that occur in cases in which a bronchus has been plugged by a foreign body. The inflammatory process then involves the whole parenchyma of the lobule, both of the air vesicles and interstitial tissue, so that instead of complete resolution following as in croupous pneumonia, fibrous or caseous changes are apt to remain. The bronchi, which are universally stuffed with mucus, pus, epithelial cells, etc., show very generally a reddish and swollen mucous membrane, this condition extending even to the primary bronchi, if not to the trachea; in which respect the appearances presented in this disease contrast strongly with those observed in simple bronchitis.

Treatment.—We scarcely need say that the treatment of capillary bronchitis should be prompt and decisive, and hence according to clearly defined purposes. As soon as the thermometric rise and the other symptoms indicate the threatening approach, the aim should be to shorten the acute stage of the inflammation as quickly as possible. For this purpose aconite is the best medicine, and should be given with the set determination to make the patient feel it. Every two hours doses of one, two, or three drops of the tincture of the root, in a solution of citrate of potash, should be given until the pulse falls in frequency and "excitement." Should the pulse grow weak or intermittent under this course, the use of stimulants will soon show that the acute inflammation is itself a guard against too great doses of aconite, for only a few teaspoonfuls of brandy will be enough soon to counteract the depression of aconite, which in a normal state, or in a chronic disease, would continue for hours. There is no remedy which can do as much as aconite just at this juncture; later on, it is mischievous, but at the beginning it is much the best antipyretic and antiphlogistic that can be employed, because of its specific effect in lessening the initial engorgement of the respiratory mucous membrane when acutely inflamed. We see this exemplified in tonsillitis, in which disease, when given in full dose, it often cuts short the otherwise tedious course of the affection toward suppuration; and a like power to prevent the congestion and the formation of muco-pus may be fairly attributable to it in bronchitis, while its anæsthetic effect is beneficial both to relieve the pain and to control the consequent asthmatic spasm of the bronchioles. We do not have the same reason to fear cardiac weakness in capillary bronchitis of children as in the aged, for the heart of the child is relatively stronger than that of the adult, at least as regards the right side, which has about the same thickness in early life as the left.

When sibilant râles begin, we should add, and continue systematically to give, the tincture of belladonna in full doses, combined with half a drachm to two drachms of the spirit of nitrous ether, in sweetened water or milk, every three or four hours. This combination is not to be omitted until convalescence begins; for while the aconite may be dropped as soon as signs of exhaustion appear, or if the temperature is relatively low, the belladonna and nitre should be faithfully persisted in as respiratory stimulants, to strengthen the function most imperilled, and also to lessen the complication of bronchial spasm.

Then when moist râles, a recurrent dyspnœa, and exciting hard cough come on, we have a plain indication to try to expel retained secretions. Here a single emetic, administered every twelve hours, is of true service. Some writers condemn emetics on the ground of failure, in their experience, to afford relief by their use. If wrongly administered, emetics are not remedial in bronchitis, but dangerous instead; still, that is no reason for neglecting the most efficient method of expelling mucus in children. Vomiting is both natural and easy to children, while expectoration is much the reverse, and no one who has witnessed the great relief following upon the effective action of the abdominal muscles after an emetic, in dislodging a quantity of mucus where the hardest coughing of children had failed to produce any effect, will doubt that emetics can do great good in the