

nerves of the stomach. When tartar emetic is given internally, the greater part is discharged with the vomit, and the part retained or absorbed is insufficient to cause emesis when injected into a vein.

There exist no special indications for the use of tartar emetic. Formerly, when it was supposed to exert a controlling influence over inflammatory affections, it was often given at first in emetic doses. But this practice is now obsolete. It should never be administered to very young children, to aged or weakly patients, on account of the profound collapse which it may induce.

The hyperemesis which sometimes results from tartar emetic may be allayed by giving small pieces of ice with a few drops of chloroform. The following remedies are also useful: strong coffee, tannic acid, ether, wine, alcohol, morphine, and tincture of opium.

The dose of tartar emetic for adults is from half a grain to one grain, repeated twice if necessary. It is usually combined with ipecacuanha: \mathcal{R} Antimonii et potassii tartratis, gr. ij.; pulv. ipecacuanhae, \mathfrak{z} i. M. Div. in partes aequales, iv. Sig.: One powder every ten minutes until vomiting takes place.

Zinci Sulphas.—This salt, in suitable doses, produces vomiting promptly, energetically, and with little nausea. In some instances it also causes colicky pain and liquid stools.

According to the observations of Toulmouche, vomiting rarely occurs after the administration of two grains, inconstantly after four grains, almost always after six to twelve grains, and only in one-third of the cases after fifteen grains. Liquid stools occur in one-half of the cases after four to twelve grains, and in two-thirds of the cases after fifteen grains.

Sometimes, however, it operates in doses of one scruple to half a drachm, almost as soon as it reaches the stomach, causing a single but copious ejection.

On account of its rapid action and the absence of notable nausea, sulphate of zinc is adapted to cases requiring speedy evacuation of the stomach. Hence it is usually employed in narcotic poisoning.

To adults it is given in doses of six to twelve grains, repeated, if necessary, every ten minutes until vomiting ensues. \mathcal{R} Zinci sulphatis, amyli, $\mathfrak{a}\mathfrak{a}$ \mathfrak{z} ss. M. Div. in partes aequales ij. Sig.: One powder every ten minutes until vomiting is induced.

Cupri Sulphas.—This salt, like the sulphate of zinc, usually acts promptly and without marked nausea. Its emetic action is also frequently followed by colic and liquid stools.

While the action of sulphate of copper is generally rapid, occurring soon after administration, it is sometimes quite slow. Thus Ackermann found that five-grain doses, administered every fifteen minutes, caused vomiting in one hour. Formerly, when sulphate of copper was used as an emetic in the early stage of phthisis, it was frequently observed that its operation was delayed for more than half an hour (Thompson).

Sulphate of copper is preferable to other emetics in poisoning with phosphorus, because it possesses antidotal properties. It gradually becomes reduced by the phosphorus, and then covers the phosphorus with a layer of metallic copper, and thus prevents its volatilization and absorption (Bamberger).

Sulphate of copper has been especially recommended in croup. If the exudation impeding respiration be loosely attached, the powerful operation of sulphate of copper may cause its expulsion; but it can produce no other effect.

The dose of sulphate of copper for adults is from two to ten grains; for children, from one to five grains, repeated, if necessary, several times at intervals of ten or fifteen minutes. \mathcal{R} Cupri sulphatis, \mathfrak{z} i.; pulv. acaciae, \mathfrak{z} ij. M. Div. in chart. iv. Sig.: One powder every ten minutes until vomiting ensues (in narcotic poisoning). \mathcal{R} Cupri sulphatis, gr. vi.; aquae destill., \mathfrak{z} i.; syrapi, \mathfrak{z} ss. M. Sig.: A dessertspoonful every ten minutes until vomiting ensues (in croup).

Sinapis Alba.—Mustard in large doses rapidly induces

vomiting. When other emetics and the stomach pump are not at hand, it is employed in poisoning with narcotics. Sometimes it acts promptly when sulphate of zinc has failed. It should not be used when the poison is of such a nature as to produce inflammation of the stomach.

A teaspoonful of mustard flour may be administered in a teacupful of tepid water, and, if necessary, repeated once or twice at intervals of ten minutes.

Alumen.—Alum, in doses of half a drachm to two drachms, produces vomiting in from twenty to forty minutes. Its operation is attended by very little nausea and depression. It has sometimes been employed in croup and in narcotic poisoning. For children the dose is half a drachm administered in syrup, and repeated, if necessary, in half an hour.

GENERAL INDICATIONS FOR THE USE OF EMETICS.—Emetics are used to evacuate the stomach, to expel pathological products from the air passages, and to remove foreign bodies lodged in the oesophagus or upper part of the air passages.

1. To evacuate the stomach is the first indication in many cases of poisoning. As it is essential to accomplish this as speedily as possible, only those emetics should be used which act promptly. In poisoning by narcotics, such as morphine, opium, atropine, belladonna, stramonium, etc., one of the following emetics should be selected: apomorphine, sulphate of zinc, sulphate of copper, or mustard. The subcutaneous injection of apomorphine is quickly followed by copious vomiting, if the nervous centres are not greatly depressed. Hence, if a long time has not elapsed since the poison was taken, and profound sopor has not taken place, this emetic should be preferred to all others. But if the patient is so comatose that he cannot be aroused, apomorphine should not be used, as it would probably fail to induce vomiting and would greatly increase the depression.

If some time has elapsed since the poison was taken, vomiting is not readily induced. Then sulphate of zinc and sulphate of copper may fail in ordinary doses; hence some authors recommend very large doses, from twenty to forty grains. It is well to recollect, however, that according to the observations of Toulmouche, doses of fifteen grains and more of sulphate of zinc more frequently fail than doses of six to twelve grains. It should also be recollected that large doses of sulphate of zinc and of sulphate of copper, if they do not cause emesis, produce severe irritation of the intestinal mucous membrane, and, after absorption, depress the central nervous system. If moderate doses do not soon cause vomiting, recourse should be had to mustard flour, which generally acts promptly.

In poisoning with phosphorus, sulphate of copper is preferable to other emetics, as it prevents the volatilization and absorption of the poison.

In poisoning with strychnine or nux vomica, apomorphine is the most suitable emetic. In several instances the spasms produced by strychnine have immediately subsided after a hypodermic injection of apomorphine.

Apomorphine has been successfully employed in cases of poisoning with oil of bitter almond, with carbolic acid, and with kerosene.

Emetics are contraindicated in poisoning with corrosive substances, such as the concentrated mineral acids and the caustic alkalis.

Whenever emetics are employed in cases of poisoning by vegetable and animal substances, repeated emesis should be produced, as it is not rarely found that the vomit of the third or fourth evacuation gives evidence of the presence of some of the poison. In order to hasten and facilitate the action of the emetic, large quantities of tepid water should be given, and the fauces titillated with the finger or a feather.

Emetics are indicated to evacuate the stomach when indigestible food, or the products of fermentation or putrefaction, cause severe gastric irritation or alarming disorder of the nervous system. Sometimes convulsions in children, a comatose state in adults, intense headache,

and severe cramp-like pain in the stomach, have this origin. If the history of the illness and the general condition of the patient clearly point to this cause, emetics should be used. They usually give speedy relief. The best internal emetic is ipecacuanha, as it produces less irritation of the gastric mucous membrane than sulphate of zinc, sulphate of copper, or mustard. Large quantities of tepid water should be given as soon as nausea supervenes, in order to render the vomiting as easy as possible. A subcutaneous injection of apomorphine is, however, superior to all internal emetics, as it in no wise increases the irritation of the stomach and causes speedy evacuation. Especially should it be preferred to ipecacuanha when convulsions in children are caused by gastric irritation.

2. To expel pathological products from the air passages, emetics are occasionally indicated in bronchitis, bronchiolitis, catarrhal pneumonia, and croup. When respiration is difficult, rapid, and superficial, and moist râles are heard over various parts of the chest, emetics often give decided, although temporary, relief. Apomorphine is preferable to other emetics, as it possesses decided expectorant properties and acts rapidly and gently. It may, however, fail in capillary bronchitis, when the breathing is very difficult and decided cyanosis has taken place. The only internal emetic which should be administered to children to eject accumulations of mucus in the air passages is ipecacuanha. In strong adults this remedy may be combined with tartar emetic.

Emetics are generally resorted to in croup to expel the fibrinous exudation or false membrane. Sometimes they accomplish this, but more frequently fail on account of the firm attachment of the membrane. If the ejection takes place, a notable amelioration of the dyspnoea immediately occurs. As it is of the highest importance to prevent the depression which so rapidly occurs in croup, only those emetics are eligible which produce slight nausea, such as sulphate of copper, sulphate of zinc, and alum. Apomorphine has been successfully used in some cases, and in the early stage of croup deserves preference to other emetics.

3. Sometimes emetics are indicated when foreign bodies have lodged in the oesophagus and upper part of the air passages. They are useful when the substance lodged in the oesophagus is rounded, doughy, or pulpy, but may be harmful when it is very irregular (pieces of bone, needles, fish bones), as the efforts incident to vomiting may be followed by severe injury of the oesophagus.

When foreign bodies lodge above the glottis, they may be expelled by emetics; but if situated below, vomiting may cause them to lodge in the rima glottidis, especially if they be angular.

Apomorphine should be preferred to all other emetics to remove foreign bodies, as it acts speedily and certainly.

CONTRAINDICATIONS.—At the time, now happily past, when it was supposed that the whole course of febrile and inflammatory diseases might be favorably modified by the action of emetics, especially by such as induce severe and prolonged nausea, authors found it necessary to enumerate numerous contraindications, such as inflammation of any of the abdominal organs, diseases of the heart and blood-vessels, great debility, the extremes of life, pregnancy, the presence of hernia, etc. When the presence of a poison in the stomach indicates its rapid evacuation, an emetic must be given regardless of all other considerations, if the stomach pump cannot be used. But in cases of gastric irritation in which life is not imperilled, other less rapid methods of treatment should be instituted, if the operation of vomiting itself endangers the life or future well-being of the patient. Samuel Nickles.

EMETINE. See *Ipecac.*

EMMENAGOGUES. See *Ecbolics.*

EMODIN. See *Buckthorn* and *Cascara Sagrada.*

EMOLLIENTS (from Latin *emollire*, to soften) are substances which tend to soften, relax, and protect the parts to which they are applied. As a rule they are fatty and have very little, if any, real medicinal activity; but this lack of active medicinal virtue in no way detracts from their therapeutic value. Emollients are "for outward application" only. Substances of a similar kind, but for internal use, are called demulcents, and these two terms must be kept distinct. Demulcents are for mucous membranes; emollients for the skin. (See article *Demulcents.*)

ACTION AND USES.—The action of emollients is almost entirely mechanical; by their moisture and warmth they cause the blood-vessels to dilate, and with relaxation of contractile tissues pressure on the nerves is lessened, and thus the tension and pain in an inflamed part are relieved. Emollients also exert a protective influence over inflamed surfaces which would otherwise suffer from friction and even from the oxygen of the air; in cases in which the skin is broken, or the epidermis stripped off, the process of repair can go on without let or hindrance under the protective covering of an emollient. The judicious use of emollients is also responsible for the exclusion of many pathogenic organisms which would otherwise find an easy entrance through a broken skin, and which, having once gained admission, would do more than ordinary harm in tissues whose powers of resistance were already enfeebled. Without emollients wounds, burns, and superficial inflammations would heal but slowly; by emollients the skin is often preserved from cracks, chaps, and fissures, and should these unfortunately supervene emollients are the best remedial agents we have. The application of emollients to those surfaces of the body which come in contact, as the thighs, will lessen the friction and increase the comfort. Emollients also tend to prevent bed-sores and heal blisters; they are also useful in some forms of skin diseases, such as eczema.

List of Emollient Substances.—The chief are: Almond oil, cacao butter, castor oil, cold cream, glycerin, goose grease, lanolin, lard, liniments, linseed oil, neatfoot oil, olive oil, paraffin, petrolatum, soap, spermaceti, suet, vaseline. Care must be taken to avoid using rancid fat or oil, for this would act as an irritant, and do more harm than good. Other substances, as collodion, white of egg, etc., act as protectives, but are not emollients. Poultices made of substances retaining heat and moisture are sometimes grouped with emollients, or even regarded as emollients, but they are not rightly included under that heading. R. J. E. Scott.

EMPHYSEMA OF THE LUNGS.—*Definition.*—Emphysema is the condition in which there is dilatation of the air vesicles with atrophy of the alveolar walls.

Strictly speaking there come under this definition three forms of the disease: Hypertrophic or large-lunged emphysema, atrophic or small-lunged emphysema, sometimes known as senile atrophy, and local or compensatory emphysema. In addition to these forms it is convenient to consider here certain other conditions to which the term emphysema is applied, viz., acute vesicular emphysema and interstitial emphysema.

I. HYPERTROPHIC EMPHYSEMA (Syn. Large-Lunged Emphysema).—*Morbid Anatomy.*—The lungs are large and distended and do not collapse when the chest is opened. The borders are rounded, encroaching on the heart, sometimes meeting and even overlapping beneath the sternum; the apices project far above the clavicles and the diaphragm is depressed by the voluminous lungs. In color the organs are of a pale gray or grayish-red, and often streaked with lines and spots of pigment. The outlines of the lobules are more distinct than in health, and on close observation the individual air cells appear as clear dilated vesicles reaching the size of small shot or somewhat larger; in occasional instances large thin-walled blebs or bullae form from the union of smaller vesicles and reach the size of a cherry or walnut. To the feel the organs are soft and downy, they pit on pressure owing to loss

of elasticity, they do not crepitate like healthy lungs, and when placed in water they float higher than usual.

These changes, although they may be generalized, are seen earliest and reach their highest development in those areas of the lungs which are unsupported by firm and resisting portions of the chest wall. They are thus best seen at the apices, along the anterior borders, especially on the left side, at the lingula and at the bases of the lungs, particularly at the free borders and on the left side where the firm support of the liver is lacking.

Microscopically the alveolar walls are much thinned and the vesicles and infundibula are much enlarged. Rindfleisch has shown that extensive anastomoses take place between the pulmonary arterioles and the veins.

The bronchi frequently show evidence of chronic catarrhal inflammation, a condition which, as will be presently seen, is a frequent precursor of emphysema.

In rare instances rupture of the thinned-walled vesicles may occur and an escape of air take place into the pleura, producing pneumothorax, or into the cellular tissue of the lung or mediastinum, whence it may reach the subcutaneous tissues of the neck and thorax and cause subcutaneous emphysema.

Changes in the right heart are commonly seen in advanced cases of emphysema. Owing to the increased strain thrown on the right ventricle as the result of the occlusion of large areas of capillary vessels, dilatation-hypertrophy sets in primarily on this side, leading to tricuspid regurgitation and ultimately to the same train of morbid changes, consisting in chronic congestion of the various viscera, as are seen in cases of chronic heart disease. The main branches of the pulmonary artery sometimes undergo chronic sclerotic changes, the result of long-continued high arterial pressure.

Pathogenesis.—Much discussion has centred about the pathogeny of emphysema, and the chief theories of its production may be briefly discussed under three heads.

1. *Inspiratory Theory.*—Laënnec first advanced the view that emphysema occurred during inspiration owing to the inspiratory movements being more powerful than the expiratory. Gairdner subsequently developed this theory of emphysema and put forward a hypothesis which is still regarded as correct but only in a very limited sense. According to this writer diminution in the volume of the lung, due to collapse from bronchitis or broncho-pneumonia, or again recession from fibroid change, precedes the development of emphysema, and the adjacent air vesicles dilate to take the place of the collapsed areas. That such a sequence does occur is generally admitted in the development of local or compensatory emphysema, but it is regarded as of altogether secondary importance in the production of the form of the disease now under discussion. Gairdner's suggestion that the inspired air expanded in the air vesicles under the influence of the body heat hardly needs refuting, as it is now well known that the inspired air is heated in the nasal cavities.

2. *Expiratory Theory.*—Jenner (*Med. Chir. Soc. Trans.*, vol. xi.), although preceded by Mendelssohn, independently advanced the view that emphysema was produced chiefly by forces acting during expiration. He showed that during violent expiratory actions, such as cough or straining efforts, certain portions of the lungs being unsupported by rigid parts of the chest wall, yield and dilate under the influence of expiratory forces, and that the apices, the anterior borders and the bases, especially along their free margins, are exactly those parts which are least supported and which are affected earliest and in the highest degree by emphysema. In support of his view Jenner pointed out the bulging that takes place at the apices during an attack of cough, especially when the lung is affected by emphysema, and he also quotes Louis as his authority for the statement that the base of the left lung is affected by emphysema twice as often as the right, owing to the absence of the firm support afforded by the liver.

The frequency of emphysema in old-standing cases of bronchitis is readily explained by the application of Jen-

ner's views. During the accompanying cough a deep inspiration is taken, the glottis is closed, and a violent expiratory effort is brought about by the muscles of expiration, compressing the lung and causing dilatation of these organs in the parts referred to. A similar mechanism comes into play during the severe muscular efforts caused by such movements as lifting or dragging heavy weights, straining at stool, or playing on a wind-instrument.

The emphysema which is so frequently seen in old cases of asthma is not so readily explained. The bronchitis and cough which are such common accompaniments of asthma are undoubtedly responsible in great part, inducing emphysema by expiratory efforts as in bronchitis, but this hardly seems the whole explanation. During an attack of asthma a temporary emphysema frequently develops, particularly when the attack is prolonged or severe, and passes off as it subsides. The enlargement and fixation of the chest in the inspiratory posture, together with the noticeable difficulty in expiration, indicate difficulty in expelling air from the chest, and in consequence the alveoli become overfilled. Accepting the usual view that asthma is due to obstruction of the smaller tubes, resulting from spasm or catarrh, it is assumed that the resistance to the exit of air is greater than to its entry, and in consequence the alveoli gradually become distended.

3. *Vital Causes.*—Most clinicians agree that emphysema is occasionally found when no apparent cause has been in operation or when the history of cough or other cause has been slight or of short duration. In such instances it is assumed that there is a congenital deficiency in the quality of the lung tissue, allowing it to yield under the ordinary strain to which it is of necessity subjected. In support of this view it may be urged that emphysema is not uncommonly found in several members of a family, and a number of observers have recorded a marked hereditary tendency in the disease.

Cohnheim has endeavored to show that a defective development of elastic tissue underlies the production of emphysema, but a deficiency in this tissue may simply represent the atrophy accompanying the morbid process.

Summing up, then, the conditions tending to produce emphysema we must attribute special weight to violent expiratory efforts. Owing to the yielding character of certain portions of the thoracic cavity the air is compressed and driven into the underlying alveoli, which dilate and ultimately become emphysematous. In this form of emphysema inspiratory causes, apart from the possible inspiratory distention caused by asthma, play no part, and lastly, whilst it seems probable that as in other tissues there may be a lack in resisting power, we have no definite anatomical knowledge in what this consists.

Etiology.—Age. Emphysema occurs at all periods of life, but it is more frequently found in adults beyond middle life, although it occurs even in young children.

Sex. Males are more exposed to the causes favoring the development of emphysema, and it is consequently more frequent in this sex than in females.

Occupation. All occupations involving exposure and catarrhal affections or heavy straining efforts tend to produce emphysema by causing violent expiratory efforts. It is thus found more amongst the laboring than the leisure classes.

Previous Diseases. Of all the causes of emphysema chronic or recurring bronchitis is by far the most common. It is indeed unusual to find old-standing cases of this nature without some accompanying emphysema. In children the cough of pertussis and of the pulmonary lesions associated with measles are occasional factors in the development of the disease, and Osler remarks on the frequency of emphysema in the asthmatic attacks associated with adenoid growths. In chronic cardiac disease and in arterial sclerosis with its accompanying cardiac and renal lesions emphysema is often seen.

It is probable that inflammatory changes in the lung sometimes lessen its resisting power and favor the pro-

duction of emphysema. A case of Hertz's is quoted by Hilton Fagge, in which emphysema rapidly developed in a cornet player after an attack of double pneumonia.

Symptoms.—The onset of emphysema is slow and insidious, although it occasionally develops rather rapidly after an attack of bronchitis or whooping cough. No special symptoms are noticed in the earlier stages of the malady, although there is a frequent history of chronic or recurring bronchitis.

Dyspnoea is by far the most important and prominent feature of the malady. The patient notices after any unusual effort that he suffers somewhat from shortness of breath. The difficulty is aggravated by every slight attack of bronchial catarrh. As the disease advances the dyspnoea increases and there are paroxysmal attacks like asthma, especially with any accession of catarrhal trouble, and are accompanied by wheezing, prolonged expiration, and orthopnoea. Eventually dyspnoea becomes more constant and present even at rest, the patient sits propped up by pillows or in an armchair, and the slightest exertion is accompanied by an increase of dyspnoea.

A slight tinge of lividity about the lips and finger nails is present, indicating deficient aeration of blood, and in advanced stages there may be a most intense degree of cyanosis. With this, however, the patient may not be incapacitated for slight exertion, and as Osler remarks there is hardly any other condition in which a patient may go about and even walk to a hospital with a lividity of startling intensity.

Hemoptysis is not often noticed in emphysema, and when present is suggestive of a complicating tuberculosis. Recurring hemorrhages have, however, been observed, and although usually slight, have been known to be severe and even to prove fatal.

Cough and expectoration, strictly speaking, depend on associated bronchitis, but many individuals, in whom bronchitis is a subordinate feature, suffer from a slight cough and expectorate clear perles of mucus.

The course of the disease is usually progressive. The symptoms are much aggravated during attacks of bronchitis, and each attack tends to increase the emphysematous condition and the distress of the patient. Dilatation of the right heart may still further aggravate the dyspnoea and distress of the sufferer; œdema of the lower extremities, albuminuria, and signs of portal obstruction set in and the clinical picture is that of advanced cardiac disease. There is dilatation of the veins of the neck and sometimes pulsation indicating tricuspid regurgitation.

Although there is commonly some failure in general nutrition in emphysematous patients, it is only in the terminal stages of the disease that emaciation becomes at all marked. Clubbing of the finger nails is less frequent than might be anticipated, occurring, according to Esbach, only once in six cases.

Physical Signs.—The recognition of the disease rests on the presence of certain physical signs. In a well-marked instance the appearance of the chest is very characteristic. The thorax is rounded or barrel-shaped, the antero-posterior diameter is increased, and a cyrtometer tracing may even show that it exceeds the transverse. The clavicles are prominent, the supraclavicular and infraclavicular fossae are deeper than usual, the shoulders are rounded, and the back is convex, causing the scapulae to assume a more horizontal position. The thorax is in fact fixed in the inspiratory position, and the sternomastoid and trapezius muscles are prominent and hypertrophied. The first and second pieces of the sternum sometimes form a prominent angle, known as the angle of Ludovici, the bone being convex from above down; the intercostal spaces are wide, whilst the projection of the lower ribs gives the abdomen a hollow appearance. There is very slight inspiratory movement, the tape measure showing a movement often not exceeding one-quarter or one-half an inch.

The vocal fremitus is somewhat diminished as is also vocal resonance.

Whilst the above signs are present only in well-marked cases of the disease, by means of percussion even

slight degrees of emphysema can be detected. The resonant areas of lung are increased, and instead of cardiac dullness beginning at the fourth rib it is found at a lower level and may indeed be altogether replaced by pulmonary resonance which passes into the tympany of the stomach. The liver dullness is also lower than usual, and in marked instances may be completely replaced by pulmonary resonance. Although displaced downward, it is only seldom that the hepatic border can be palpated owing to the arching forward of the lower ribs already referred to. In the back the resonant note of the lungs is also lower than usual, reaching as low as the lower border of the twelfth rib. Not only are the resonant areas of the lungs increased in extent, but the character of the note is changed, becoming louder and deeper than normal, and in some instances it is even tympanitic.

On auscultation the breath sounds are distant and feeble, whilst expiration is frequently but by no means always prolonged.

The cardiac impulse is feeble owing to the presence of the lung between the heart and the chest wall, and both first and second sounds are often much enfeebled from the same cause. A systolic murmur is not very uncommon at the lower end of the sternum and sometimes indicates a tricuspid regurgitation. Increased pulsation in the epigastric region is often found due to the low position of the diaphragm, and it is sometimes intensified by enlargement of the right ventricle.

Diagnosis.—Emphysema is readily recognized by the characteristic shape of the chest and in slighter degrees of the affection by the increases in the resonant areas of percussion. A history of bronchitis should always suggest careful mapping out of the extent of pulmonary resonance. Emphysema is very apt to obscure the diagnosis of other affections within the thorax, and it may prove difficult or impossible to recognize an enlarged heart, an aneurism, or a tuberculous focus at the apex in the presence of marked emphysema. The diminution of the liver dullness sometimes leads to an erroneous diagnosis of cirrhosis, an error easily committed without a due appreciation of the increased area of pulmonary resonance.

Prognosis.—Emphysema is an extremely chronic malady, lasting for a long period of years. The prognosis is influenced largely by the frequency and severity of attacks of bronchitis, each of which tends to cause further damage to the lung tissue. In individuals who can afford to reside in a suitable climate and avoid attacks of bronchial catarrh the condition may be stationary. The condition of the heart and kidneys requires careful consideration. The outlook is not good when evidence of breaking down of cardiac compensation is present, and such serious signs as dropsy and albuminuria usually presage a fatal issue. Emphysema is a frequent accompaniment of interstitial nephritis and is in such instances altogether a subordinate feature, the prognosis resting on the condition of the kidneys.

Treatment.—Jenner truly remarks that as "emphysema is an incurable disease, its prevention is of the highest importance, and to determine its cause . . . is to determine to some extent the means to be employed for its prevention." It is of much importance to prevent frequent recurrences of bronchitis and to this end the various causes of bronchitis should be as far as possible avoided. If circumstances permit residence in a temperate and equable climate is to be recommended in winter and in the changeable and uncertain weather of the spring and fall. After the development of any degree of the disease it is of importance to avoid any occupation involving straining efforts as such are certain to aggravate the malady.

Patients with emphysema usually seek advice for attacks of bronchitis or asthma, and as the treatment of these conditions does not differ from that ordinarily adopted it is not necessary further to refer to them here.

The use of the compressed-air bath is highly spoken of by C. T. Williams, Fowler, and others. Dyspnoea is markedly lessened and the good effect continues after a

course of baths. The lack of apparatus has hitherto prevented any extensive use of this mode of treatment. Expiration into rarefied air, carried out with the view of emptying the chest of residual air and so aiding expiration, has not been attended with such good results as the use of compressed air.

When symptoms of cardiac failure are present digitalis and strychnine are of value, and in cases of marked cyanosis and dyspnea bleeding and the withdrawal of ten to twenty ounces of blood may be necessary.

It is of importance not to overload the stomach, as distention of the abdomen increases the difficulty of breathing and precipitates asthmatic attacks. An occasional dose of calomel or blue pill followed by a saline is of much value in relieving the portal circulation, particularly in plethoric subjects.

II. ATROPHIC EMPHYSEMA (syn. *Small-Lunged Emphysema, Senile Atrophy*).—This variety of emphysema is met with in old people and is really a senile atrophy of the lung, accompanied by some dilatation of the air vesicles.

The contrast between hypertrophic and atrophic emphysema is very striking, the only feature they have in common being some dilatation of the air sacs.

In atrophic emphysema the lungs are small and dark-colored from excess of pigmentary deposit. They can be compressed into a very small space and collapse when the thorax is opened. The bronchi share in the general atrophy and sometimes present evidences of catarrhal inflammation. Some of the air cells are enlarged, partly as the result of atrophy of adjacent alveolar walls, partly from the bronchial cough which is so common in advanced life. The other organs present the changes of senile involution.

Individuals who are the subjects of this condition are thin, old, and shrivelled-looking, and they do not suffer from any symptom which can be dissociated from the debility and failure of old age. Dyspnea is absent owing to the general atrophy of the tissues causing a lessened demand for oxygen.

The thorax is diminished in size and the ribs lie more obliquely than usual, being closely packed together and the lower ones depressed so as to be near the iliac crest. The shoulders are often rounded and stooping is therefore present. Percussion resonance is increased owing to the thin chest wall, but the cardiac dulness is not diminished and may even be increased owing to retraction of the lungs.

III. COMPENSATORY EMPHYSEMA.—This form of emphysema results from disease of any portion of the lung in which the volume of the organ is diminished. It is seen constantly in the neighborhood of old tuberculous foci or of areas of collapse in broncho-pneumonia. With disease resulting in contraction of one lung the opposite side becomes emphysematous, this change being seen in its highest degree in the fibroid lung, and to a less extent in pleurisy or pneumothorax. In the earlier stages of the affection the air vesicles are simply dilated, but ultimately the adjacent alveolar walls atrophy and a permanent dilatation ensues. Gairdner's view that emphysema is due to inspiratory stretching of the air vesicles is probably in part the explanation of this form of emphysema, although the expiratory stretching due to cough, so rarely absent in pulmonary disease, doubtless intensifies the condition. When confined to a small area this form of emphysema is chiefly of pathological interest and may give rise to no physical signs. A hyperresonant note with feeble respiratory murmur and prolonged expiration over a limited area of lung is suggestive of the condition, and if present at the apex of a lung usually indicates a tuberculous focus.

Compensatory change in a healthy lung may be of the nature of true hypertrophy. It is indicated by an increased rather than diminished expansion, and by the presence of puerile breathing.

ACUTE VESICULAR EMPHYSEMA.—In any condition in which extreme dyspnea is present this type of emphysema develops. It occurs in the dyspnea of cardiac or

renal disease, in asthma and bronchitis, and in obstruction of the air passages.

There is only a temporary distention of the air vesicles, passing off with the cessation of the dyspneal attack, and not going on to atrophy and destruction of the alveolar walls.

The condition is recognized by the extreme inspiratory distention of the thorax, by the increase of the resonant areas of the lungs, and by the hyperresonant note. (Edema is frequently present, evidenced by the crackling râles at the bases and by sonorous and sibilant râles over the chest.)

The treatment is that of the primary condition.

INTERSTITIAL EMPHYSEMA.—This form of emphysema is rather rare and, clinically, is of but slight importance. Air occasionally passes into the interstitial tissue of the lung from rupture of an air vesicle. This accident is seen after severe paroxysms of cough, and it is probable that such a condition not infrequently occurs and recovery ensues without any special symptoms. In some instances, however, the air passes along the connective tissue to the mediastinum and thence to the subcutaneous tissue of the neck and thorax, where it is recognized by the crepitating sensation conveyed to the fingers. On the other hand, the air may find its way down from a wound in the neck, beneath the deep fascia, and thence to the connective tissue of the lung. Money has recorded cases of tracheotomy wounds in which this complication arose, and in a few instances pneumothorax was induced by rupture of the pleura.

Frederick G. Finley.

EMPHYSEMA, SUBCUTANEOUS (*εμφύσημα, inflation*; from *εν, in, and πνέω, to blow*), also known as cellular or surgical emphysema, may be defined as a pathological condition in which air or other gases are either developed in or introduced into the cellular tissue beneath the skin. The cases of air or gases being developed in the tissues are infrequent, and are generally the result of decomposition, or come more appropriately under the head of gangrenous emphysema. We are here concerned with those cases in which the air is introduced into the tissues.

ETIOLOGY AND PATHOLOGY.—The most common location of subcutaneous emphysema is the chest; and the causes may be divided into traumatic and pathological. The former may occur in any of the following ways: (1) The air cells of the lung may rupture from overdistention following violent expiratory effort of any kind, and, the pleura remaining intact, the air escapes into the cellular tissue between the lobules, thence by the root of the lung into the superior mediastinum, then to the cellular tissue at the root of the neck, and here becoming subcutaneous is capable of spreading over a large part of the body. It may cause dyspnea, and, if very severe, prove fatal. (2) The lung may receive a wound (the chest wall remaining intact), as when it is lacerated by a fractured rib; in this case the air, on inspiration, passes into the pleura, and during expiration, the wound of the lung being closed by the valve-like action of the tissues, the air is pumped out and finds its way into the subcutaneous tissues. (3) A wound of the chest wall may penetrate the pleural cavity (and possibly the lung), and if the wound be narrow and of a valvular character, with the external and internal openings not opposite to each other, then during inspiration the air easily passes into the pleural sac, but on expiration the edges of the wound falling together cause "the valve" to close, and the air which cannot escape in any other way infiltrates the cellular tissue. (4) In a long, sinuous wound of the chest wall, which does not reach the pleura, air may be drawn into the tissues during inspiration, but, the wound closing during expiration, emphysema results. In the above cases, if the lung is wounded, there may or may not be a pneumothorax. If the wound happens to be at a spot where adhesions exist between the two layers of the pleura, there will be no pneumothorax. (5) Wounds of the trachea, larynx, or bronchi may produce emphysema. "Emphysema occurring at the time of the oper-

ation (i.e., tracheotomy) is due to too small a skin wound or to opening up the cellular tissue in attempts to pass the tube; it may be very extensive and spread down into the thorax; in such cases it is sometimes fatal from pressure upon the lungs. Champneys (Med. Chir. Trans., 1882) has shown experimentally that there is serious danger of mediastinal emphysema and pneumothorax when artificial respiration or sudden violent inspiratory effort is made after division of the deep cervical fascia; hence the tube or dilator should be put in quickly and the fascia disturbed as little as possible." (Ashby and Wright: "Diseases of Children," Am. ed., 1893, p. 186.) Emphysema may also follow paracentesis thoracis, but is generally slight, though severe cases are not unknown. "Erichsen mentions a case in which the scrotum became blown out to the size of a cocoon five minutes after a puncture of the chest, in which the patient coughed violently" (*Lancet*, 1889, i., 220). In the head we may have orbital emphysema from fracture of one of the thin orbital bones and the establishment of a communication with one of the air-containing cavities. In the abdomen emphysema has been caused by rupture of the duodenum or perforation of the caecum.

SYMPTOMS.—History of the injury. Disability, varying with the degree and location of the hurt. Painful constriction of the chest at the seat of the lesion, with dyspnea and tendency to suffocation. The chief symptom is the swelling, which has little or no discoloration, is possibly pale, is not painful, has no sense of weight, on pressure it pits but slightly and the pitting is very transient, but there is a peculiar and unmistakable crepitation or crackling which is pathognomonic of this condition. The swelling begins at the seat of the lesion (but when it is first seen at the root of the neck it is caused by rupture of the lung) and increases rather rapidly, its size varying somewhat with the laxity of the subcutaneous tissues; it is mostly limited to the trunk and neck, though occasionally it may extend over the greater part of the body. In severe cases the air may separate the fascia and penetrate between and below the muscles. The palms and soles and also the scalp generally escape. When the swelling is very small, it is lobulated, and by pressure the air can be driven out. An external wound can generally be found when the air has entered from without; if from within, an expiratory effort will cause the swelling rapidly to increase in size. On the face, the features may be obliterated, and the eyes hidden by the swollen lids.

PROGNOSIS AND TREATMENT.—The prognosis is as a rule quite favorable; the air generally becomes absorbed rapidly and completely, only rarely inducing inflammation. The danger is in the pressure, or in the pneumothorax, with which emphysema is often associated. Care must be taken to prevent sepsis. If absorption do not take place, we may try pressure by means of strapping or bandages; these failing, we try multiple punctures or incision. Antiphlogistic measures are in order.

Subcutaneous emphysema appears to have attractions for others besides the physicians. In Europe it is artificially induced by malingers, by mendicants, by prisoners, and those who from lack of patriotism or some other cause do not wish to serve in the army. These enterprising individuals by means of a small wound inflate the subcutaneous tissues and then produce a deformity which, though transitory, may possibly serve their purpose and excite the sympathy if not the admiration of the more honest and hard-working portion of the community.

Fifteen years ago Dr. Silvester, in the *Lancet* (1885, i., 11; ii., 418), suggested the self-induction of subcutaneous emphysema as a method of "life-saving from drowning"; but the idea does not seem to have been generally accepted. R. J. E. Scott.

EMS.—This well-known spa, about 70 miles from Cologne via Coblenz, is beautifully situated in the narrow valley of the River Lahn, at an elevation of 300 feet. On both sides of the river rise precipitous and forest-covered mountains. It exhibits all the characteristics of a spa town: numerous hotels, large and small, villas and lodging houses; the bath-houses with a magnificent Kursaal; public gardens admirably laid out, with a fine covered walk; bazaars, restaurants, cafés, and an English church.

The climate is a mild one, the average temperature of the year being 49.1° F., and for the summer, May, 57.9° F., June 64.6° F., July 66.2° F., August 63.5° F., September 57.9° F. The annual rainfall is 26.2 inches. The season extends from May 1st to September 30th. May and September are the pleasantest months; the summer is said to be rather too warm for comfort. The town contains about 8,000 inhabitants and about 22,400 persons visit it annually, among whom are many Americans, English, and Russians. Here one can lead a pleasant life with good music and good society. For many years the Emperor William I. was accustomed to take these waters, and it was here, on July 15th, 1870, that he made his memorable answer to the French ambassador which led to the war of 1870-71.

The warm waters of Ems have been known and used since the fourteenth century or even earlier, and flow from warm alkaline saline springs whose source is from a very compact sandstone which runs into quartzite; the temperature ranges from 80° F. to 120° F. The principal constituents are sodium carbonate, sodium chloride, and free carbonic acid; the Eisenquelle contains only carbonate of iron. There are eight or nine springs, all similar chemically but differing in temperature; those most used are the following, with their temperatures: Kesselbrunnen, 116° F.; Krähnchen, 96° F.; Fürstenbrunnen, 103° F.; Augusta, 102° F.; Victoria, 81° F.; Kaiserbrunnen, 83° F.

According to Buckland, the chief ingredients in sixteen ounces are as follows:

Bicarbonate soda.....	14 to 15 grains.
Chloride sodium.....	7 "
Bicarbonate lime.....	1 to 2 "
Bicarbonate magnesium.....	1 to 2 "
Carbonic acid gas.....	6 to 8 cu. in.

These waters are used principally for drinking, but they are also employed for the purposes of gargling, inhalation, and bathing.

The baths are well fitted up with apparatus for hot and cold douches and various other methods for water application. There are six public bath-houses with one hundred and eighty bath-rooms. One of the especial features in the utilization of these waters is the method of applying sprays to the throat, and the inhalation of finely pulverized water, either simple or medicated. There are also rooms for gargling; a milk and whey cure; and a "terrain kur." Massage is also given in connection with the baths. The waters are chiefly drunk between six and eight in the morning, and the "jour médical" is very much like that at other European spas.

A large quantity of this water is annually exported. From the town a wire-rope railway leads to the top of the wooded Malberg, 1,090 feet high, where are charming walks provided with convenient resting places; there are also numerous other attractive excursions in the vicinity. The accommodations are good and abundant, and the health reports are satisfactory.

The waters of Ems are employed in a variety of maladies, and, as is more or less the case in all carefully regulated spas, the hygienic-dietetic rules inculcated along with the use of the waters undoubtedly greatly increase their efficacy. Two-thirds of the patients who visit Ems are sufferers, it is said, from chronic catarrh of the nose, larynx, pharynx, and bronchi. Indeed, one of the unpleasant features of the place is the coughing and expectoration met with on all sides. Chronic bronchitis from measles or whooping-cough receives marked benefit from the treatment here. Chronic gastric and intestinal catarrh, hepatic congestions, atonic dyspepsia associated with anæmia, cystitis, gouty and rheumatic affections, especially the former; excessive nervous irritability, hypochondria, hysteria, paralytic affections of the limbs,