

*Synopsis of Requirements to 1902.*—In the following political divisions medical diplomas do not now confer the right to practise medicine, an examination being required in all cases: Alabama, Arizona, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana (after January 1st, 1905), Indian Territory, Cherokee and Choctaw nations, Iowa, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Montana, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin.

The following require for admission to the licensing examination:

- Alabama, requirements of State Medical Association.
  - Arizona, diploma from recognized medical school.
  - California, diploma from legally chartered medical school, requiring in no particular less than the Association of American Medical Colleges.
  - Connecticut, diploma from reputable medical school.
  - Delaware, competent common-school education, diploma from legally incorporated medical school.
  - District of Columbia, diploma of school authorized by law to confer M.D. degree.
  - Florida, diploma from recognized medical school.
  - Georgia, diploma from legally organized medical school.
  - Idaho, diploma from legally chartered medical school.
  - Illinois, less than one year of high-school work, diploma from approved medical school.
  - Indiana, diploma from reputable medical school.
  - Indian Territory, Cherokee nation, diploma from reputable medical school; Choctaw, one term's attendance at reputable medical school.
  - Iowa, less than one year of high-school work, diploma from recognized medical school.
  - Louisiana, fair primary education, diploma of recognized medical school.
  - Maine, diploma of reputable medical school maintaining an approved standard of preliminary education and medical instruction.
  - Maryland, common-school education, diploma from legally incorporated medical school.
  - Minnesota, four full courses of lectures at recognized medical school.
  - Montana, diploma from legally chartered medical school.
  - New Hampshire, full high-school course, diploma from regularly organized medical school.
  - New Jersey, common-school education, diploma from legally incorporated medical school.
  - New York, four years' high-school course or its equivalent, diploma from registered medical school.
  - North Carolina, diploma from medical school in good standing.
  - North Dakota, three six months' lecture courses.
  - Ohio, full high-school course or its equivalent, diploma from legally chartered medical institution.
  - Pennsylvania, common-school education, diploma from legally chartered medical school.
  - Utah, diploma from chartered medical school in good standing.
  - Vermont, high-school course or equivalent and diploma from a United States medical school.
  - Virginia, evidence of a preliminary education, diploma from medical school.
  - Washington, diploma from authorized medical school having at least a three years' graded course.
  - Wisconsin, elementary education equivalent to admission to junior year of a credited high-school.
- The following require the licensing examination only: Hawaii, Massachusetts, Mississippi, Oregon, Tennessee, Texas, West Virginia.
- The following require approval of medical diploma by duly qualified boards: Kentucky, Nebraska, South Dakota; diploma must evidence four full courses.
- The following require either approval of medical diploma or examination by State or other duly qualified boards: Arkansas, Colorado, Indian Territory (Creek nation), Kansas, Michigan, Nevada, New Mexico, Oklahoma, Rhode Island, South Carolina, Wyoming.

The following requiring either approval of medical diploma or examination, admit to examination on: Arkansas, a good literary education; Kansas, four periods of study of six months each; Nevada, five years' practice in the State just prior to act or diploma from a reputable school without the United States; Oklahoma, full course of lectures. Rhode Island approves diplomas of schools that require for matriculation a high-school diploma or its equivalent, and for graduation four regular courses in four different years; Alaska has no law. In Cuba, the Philippines,\* and Porto Rico† the requirements are in process of transition.

The following political divisions have mixed examining boards, that is, the boards are composed of representatives of the several schools of medicine: Alabama, Arizona, Arkansas, California, Colorado, Hawaii, Idaho, Illinois, Indian Territory, Indiana, Iowa, Kansas, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Virginia, Washington, West Virginia, Wisconsin, Wyoming.

The following have separate examining boards for each recognized school of medicine: Connecticut, Delaware, District of Columbia, Florida, Georgia, Louisiana, Maryland, New Hampshire, New York, Pennsylvania, Texas, Vermont.

Alaska has no examining board.

James Russell Parsons, jr.

**EXCELSIOR SPRING.**—Onondaga County, New York. **POST-OFFICE.**—Syracuse. This spring is located in the city of Syracuse. It was analyzed by Charles A. Goessman in 1868, with the following result:

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.
Calcium carbonate.....	15.24
Calcium sulphate.....	36.45
Sodium chloride.....	584.53
Alumina.....	1.02
Silica.....	13.16
Sodium sulphate.....	17.69
Magnesium chloride.....	.15
Magnesium bromide.....	
Total.....	668.24
Carbonic acid gas present.	

This analysis indicates a very potent saline water, with diuretic and slightly aperient properties.

James K. Crook.

**EXCOCCURIA.** See *Euphorbiaceæ*.

**EXERCISE, PHYSICAL.** See *Training, Physical*.

**EXOPHTHALMIC GOITRE.** See the APPENDIX.

**EXPECTORANTS** are medicines that are used in catarrhal affections of the larynx, trachea, and bronchi, to modify secretion and facilitate the removal of morbid products.

Until recently our knowledge of their use was founded entirely on careful clinical observations. It had been observed that certain remedies ameliorate cough and increase expectoration in the early stage of acute inflam-

\* The assistant secretary to the military governor in the Philippines wrote September 4th, 1899, that "the Spanish law as to admission to practice still governs. In general this requires a diploma from a reputable college, school, or university of such profession or in lieu thereof an examination."  
† General Davis established, September 30th, 1899, in Porto Rico an examining committee for licenses to practise medicine, midwifery, and professional nursing. Only those with satisfactory credentials are admitted to the examinations.

mations of the air passages. Most of them, when given in large doses, produce nausea and vomiting, and a notable depression of the general circulation. They were therefore called *depressant, sedative, or nauseant* expectorants. Other remedies had been found to ameliorate cough and diminish expectoration in the latter stage of acute catarrhs, and in chronic catarrhs attended by copious secretion. In large doses many of them cause local irritation, with more or less excitement of the general circulation. Hence they were called *stimulant* expectorants. The recent experiments of Rossbach have confirmed the theory, founded on clinical observation, that some expectorants increase and others diminish secretion. They have rendered our knowledge more precise, and, besides, have established the important fact that some expectorants cause a diminution of the vascularity of the respiratory mucous membrane.

**DEPRESSANT OR SEDATIVE EXPECTORANTS.**—*Apomorphine Hydrochloras.*—Soon after apomorphine came into vogue, clinicians observed that it exerts a very decided influence in catarrhal inflammations of the air passages. In a short time after its administration is begun expectoration is effected more easily, and the sputa become more copious and less viscid. Usually these effects occur without any noteworthy nausea, or this is observed only after the first dose.

According to the experiments of Rossbach, the expectorant action of apomorphine is due to augmented activity of the mucous follicles; for it caused a very decided increase of the quantity of mucus of the exposed tracheal mucous membrane, when the nerves passing to the trachea had been divided, and all the large blood-vessels supplying this organ had been ligated.

In expectorant doses, apomorphine does not diminish the appetite, nor cause diarrhoea.

Apomorphine is indicated in catarrhal affections of the larynx, trachea, and bronchi, when only small quantities of viscid mucus are secreted; hence, especially in the early stage of bronchitis, when dry, sibilant râles are heard, and when coughing occurs frequently, and is attended by little or no expectoration.

Trustworthy observers state that they have obtained more speedy and more decided success from apomorphine than from all other means in bronchitis, tracheitis, laryngitis, phthisis, and the stage of resolution of pneumonia. Rossbach employed it in pseudo-membranous croup with excellent results, the membranous exudation becoming detached and expelled.

Apomorphine is contraindicated in the above-named affections when moist râles are heard and expectoration is copious. It should never be given when the bronchial tubes are overloaded with secretions which are not expectorated from want of strength.

When a cough is frequent and very severe, and little mucus is secreted, as shown by the scanty, viscid sputum, morphine may be combined with the apomorphine, if the latter do not speedily ameliorate the cough. Morphine does not prevent the action of apomorphine. The combination simultaneously increases secretion and lowers the excitability of the respiratory centre.

No fixed rules can be given as to the dose of apomorphine, on account of the differences in susceptibility to its action, and the great variations in extent and intensity of the catarrhal inflammations of the air passages. For adults, from gr. ss. to gr. i. in twenty-four hours is usually sufficient; but sometimes from gr. iss. to gr. ij. are required. Doses of gr.  $\frac{1}{10}$  to gr.  $\frac{1}{5}$  may be given every two or three hours. To children apomorphine may be given in doses of gr.  $\frac{1}{20}$  to gr.  $\frac{1}{10}$ , according to their age. At the age of one year the single dose may be gr.  $\frac{1}{20}$ , and this may be increased by the gr.  $\frac{1}{20}$  for each additional year, so that at the age of two years the dose will be gr.  $\frac{1}{10}$ , at three years gr.  $\frac{1}{5}$ , and so on. It may be prescribed as follows: R Apomorph. hydrochlor., gr. ss.-i. acid. hydrochlor. dil. gtt. x.; aq. destill.,  $\zeta$  iss. M. Sig.: One teaspoonful every two or three hours. The acid is added to prevent the change of color, which rapidly takes place if no acid is added, and the medicine is

not dispensed in a dark bottle. A syrup may be added, or, if desirable, each dose may be taken in sweetened water. Morphine may be added to the apomorphine, as in the following formula: R Apomorph. hydrochlor., gr. ss.-i.; morph. hydrochlor., gr. ss.; acid. hydrochlor. dil., gtt. x.; aq. destill.,  $\zeta$  iss. M. Sig.: One teaspoonful every two or three hours.

**Ipecacuanha.**—This medicine is frequently employed in catarrhal affections of the air passages, especially in the early stages, when cough is severe and expectoration scanty. It acts most rapidly when given in such doses as produce nausea. As the activity of the mucous glands becomes increased during nausea, it has generally been held that ipecacuanha acts by increasing secretion, but that this takes place only when nauseating doses are used. But it is frequently observed that the symptoms of broncho-tracheal catarrh become ameliorated by doses which do not produce notable sickness.

The action of ipecacuanha is due to the alkaloid emetine, which it contains in small and variable quantities.

Rossbach found that emetine causes a decided increase of the mucus of the trachea, without augmenting the quantity of blood in the mucous membrane. The increase of secretion also took place when the nerves going to the trachea had been divided, showing that it results from a direct action on the mucous glands or on the secretory nerves.

Ipecacuanha is indicated in acute and chronic catarrhs of the air passages attended with scanty and viscid expectoration. It is the expectorant generally employed in the bronchial inflammations of very young, very old, and feeble patients, and is especially applicable when these affections present more or less fever, a dry skin, soreness of the chest, oppressed breathing, painful cough, viscid sputum, and dry râles.

The dose of ipecacuanha varies from gr. ss. to gr. ij., on account of the variable quantity of emetine that it contains, and the differences in intensity and extent of the catarrhal inflammations. If small doses do not speedily cause a decided change in the expectoration, larger ones should be given, so as to induce slight nausea. The syrup and wine of ipecacuanha are given in doses of  $\mathfrak{v}$  x. to  $\mathfrak{v}$  xl.

**Antimonii et Potassii Tartras.**—Tartar emetic is a very depressing expectorant. When administered in small doses, gr.  $\frac{1}{15}$  to gr.  $\frac{1}{5}$ , at intervals of several hours, it usually produces no immediate effects; but after several doses have been taken a decided action on the heart and secretions becomes manifest, the heart's action becoming slower and feebler, and the secretions of the mucous membranes and skin decidedly augmented. After several days, if the medicine is continued, very marked debility ensues.

Tartar emetic is held to be serviceable in severe forms of bronchitis occurring in robust individuals. It is especially indicated when there are present dyspnoea, flushed face, full and strong pulse, soreness of the chest, with little or no secretion, as shown by the dry, sibilant râles heard on auscultation. On account of its depressing action, which is most evident in weakly persons, it is not a suitable remedy for debilitated, very young, or very old patients. It is contraindicated in catarrhs of the air passages complicated with severe disorders of the alimentary canal.

Tartar emetic is usually administered in doses of gr.  $\frac{1}{15}$  every two or three hours. R Antim. et potass. tart., gr. i.; syr. althææ,  $\zeta$  ss.; aq. destill.,  $\zeta$  i. M. Sig.: One teaspoonful every two hours. Sometimes minute doses are given at very short intervals, as by dissolving one grain in five or six ounces of water, and directing a teaspoonful of the solution to be taken every ten minutes until nausea ensues. As soon as this takes place, a marked increase of secretion and expectoration occurs, with decided relief of the soreness of the chest and dyspnoea. The wine of antimony, containing 1 part in 250 parts, is given in doses of  $\mathfrak{v}$  x. to  $\mathfrak{v}$  xl. It is one of the ingredients of the *compound mixture of glycyrrhiza*, which is given in doses of a tablespoonful.



*Lobelia* is used as an expectorant when bronchial catarrh is complicated with spasmodic contraction of the bronchial tubes, or when a severe cough is attended with difficult breathing, abundant sibilant râles, and viscid sputum. From its utility in such cases it has been inferred that it increases secretion, and at the same time relaxes the bronchial muscles. In spasmodic asthma it is frequently employed with much benefit. But it usually fails to produce any marked effect, unless given so as to cause nausea. The dose varies from gr. i. to gr. v., as an expectorant. Of the tincture (1 in 5) the dose is ℥ v. to ℥ xxv., and of the vinegar (1 in 10) double these quantities.

*Pilocarpine*.—This alkaloid was found, in the experiments of Rossbach, to cause a very profuse secretion of watery, transparent mucus from the trachea and bronchia, so that moist râles could be heard over all parts of the thorax. Trials of the remedy in cases of bronchitis were attempted, but the action on the salivary and sweat glands, and on the heart, was so disagreeable to the patients that they refused to persevere in its use. The ordinary therapeutic use of this medicine has occasionally been followed by pulmonary œdema.

*Alkalies*.—It has been frequently observed that bronchial catarrhs improve during the internal use of alkalies. Usually, expectoration takes place more readily, and the sputum is less adhesive. Hence it has been inferred that alkalies increase the bronchial secretion and render it more fluid.

The results of Rossbach's experiments are at variance with this view. After exposing the tracheal mucous membrane of cats, he injected into a vein 2 gm. of carbonate of sodium. The mucous membrane rapidly became pale, presenting a peculiar grayish-white color, and the secretion of mucus gradually diminished, and soon ceased completely. As this result was unexpected, the experiment was often repeated, but the same phenomena uniformly took place. Rossbach was unable to determine the cause of the arrest of secretion. That it was not due to the anæmia was evident from the fact that even more decided anæmia, produced by irritating the nerves distributed to the trachea, did not diminish the secretion of mucus. The local application of solutions of carbonate of sodium, containing from one to two per cent., caused no obvious change in the appearance of the mucous membrane.

The experiments of Rossbach confirm the clinical observation that increased alkalinity of the blood modifies the secretion of mucus, although they contradict the theory that it becomes increased. Perhaps it will be found hereafter, as suggested by Brunton, that the modification of secretion depends upon the quantity of alkali administered, small doses increasing and large ones diminishing the secretion.

If further observation should show that the action of alkalies is the same in man as in Rossbach's experiments, it would follow that alkalies might be used in all stages of bronchial inflammation, and that they would be serviceable not merely to modify secretion, but to diminish the hyperæmia, the chief morbid phenomenon of the disease.

**STIMULANT EXPECTORANTS.**—*Ammonii Chloridum*.—No medicine is more frequently employed in bronchial catarrhs than this salt. It is held to be suitable when no fever is present, and expectoration is difficult on account of viscosity of the secretion, and to be useless when the sputum is abundant and easily coughed up.

In observations on himself, Wibmer found a very decided increase of the bronchial mucus after doses of gr. viij. to gr. xv., taken hourly. Other careful observers also noticed an augmentation of the bronchial secretion from its use. The experiments of Rossbach seem to show a different mode of action. Under the influence of the salt the tracheal mucous membrane became anæmic, and the secretion of mucus gradually ceased. The utility of chloride of ammonium in catarrhs of the air passages may therefore depend upon a favorable modification of the vascularity of the mucous membrane, not merely upon a change of the quantity of the secretion.

Chloride of ammonium is indicated in bronchitis after the fever has subsided. When secretion is very viscid, it is frequently combined with ipecacuanha, or with minute doses of tartar emetic. To adults it is given in doses of gr. v. to gr. x. every two or three hours. ℞ Ammon. chlor., ℥ij. to ℥iv.; ex. glycyrrh., ʒ ss. to ʒi.; aq. destill., ʒ iv. M. Sig.: One tablespoonful every three hours. The extract of liquorice of this prescription renders the taste of the salt less disagreeable. If slight elevation of temperature exist, or if dry râles be heard, ipecacuanha may be added, or, in robust subjects, tartar emetic as follows: ℞ Ammon. chlor., ℥iv.; ex. glycyrrh., ʒ ss.; syr. ipecac., ʒij. to ʒiv.; aq. destill. ad ʒ iv. M. Sig.: One tablespoonful every three hours. ℞ Ammon. chlor., ℥iv.; antim. et potass. tart., gr. ss. to gr. i.; ex. glycyrrh., ʒ ss.; aq. destill., ʒ iv. M. Sig.: One tablespoonful every three hours.

*Ammonii Carbonas*.—This salt is employed in bronchitis, catarrhal pneumonia, and croupous pneumonia, when the fever has subsided or abated, and the general condition of the patient requires the use of stimulant remedies. It is held to act on the mucous glands of the air passages, thus increasing the quantity of mucus and rendering it more fluid. At the same time it stimulates the respiratory centre when given in tolerably large doses, and thus augments the efficiency of the expulsive efforts. The recent researches on the physiological action of this salt have fully confirmed the theory held in the early part of the last century that it possesses great utility in pulmonary affections, because it stimulates the nervous system, and hence enables debilitated patients more readily to cough up accumulated masses of mucus.

Usually it is given to adults in doses of gr. v. to gr. x. every two or three hours. On account of its pungency it is combined in prescriptions with gum arabic and sugar or liquorice. ℞ Ammon. carb., ℥ij. to ℥iv.; pulv. acacie, sacch. albi, āā ʒij.; aq. menth. pip. ad ʒ iv. M. Sig.: One tablespoonful every three hours.

*Aqua Ammoniac* and *Spiritus Ammoniac Aromaticus*, in appropriate doses, may be used as stimulant expectorants, to increase secretion and excite the respiratory centre.

*Scilla*.—Squill is perhaps more frequently used than any other expectorant in the advanced stage of acute bronchitis and in chronic bronchitis, especially when secretion, though not scanty, is tenacious, and hence expectorated with difficulty. The investigations on the physiological action of squill have not fully explained its expectorant action, no special modification of secretion of mucus having been observed. But they have conclusively established that squill modifies the action of the heart in the same manner as digitalis, rendering its contractions slower but more forcible. The general blood pressure, therefore, becomes increased, and the circulation in the respiratory mucous membrane accelerated. It is hence quite probable that catarrhal symptoms subside as the result of the improved pulmonary circulation. The fact frequently observed that squill is most effectual in bronchial catarrhs with obstructive heart disease, strongly supports this view.

Squill is usually administered in the form of the syrup, in doses of ℥ xx. to ℥ xl. every two or three hours. It is often combined with ipecacuanha and camphorated tincture of opium when secretion is scanty and the cough severe. ℞ Syr. scillæ, syr. ipecac., tinct. opii camph., āā ʒi. M. Sig.: One teaspoonful every three hours.

*Senega*.—The use of senega as an expectorant is based upon careful clinical observation, although it has been found to cause cough and expectoration of mucus in healthy persons. Experience has shown that it is most useful in the second stage of acute bronchitis, in chronic bronchial catarrh, and in pneumonia in the stage of resolution, when the symptoms indicate that the bronchial tubes contain large quantities of secretion. It is held to be especially serviceable when the sputa are muco-purulent and the power to expectorate is small.

The use of senega in bronchitis and pneumonia is indicated by the presence of numerous moist râles, purulent or muco-purulent expectoration, and oppression of

the chest. It should not be administered as long as the temperature is much above the normal. It is, however, doubtful whether senega tends to increase fever, as it has been found experimentally that saponin, which appears to be identical with the active principle of senega, lowers the temperature.

The preparations of senega most frequently used are the fluid extract and the syrup, in doses of ℥ x. to ℥ xx. and ʒi. or ij., respectively.

*Oleum Terebinthina*.—It has frequently been observed that oil of turpentine diminishes the sputum in various forms of bronchitis with profuse secretion, and lessens the offensive odor of the expectoration in fetid bronchitis and pulmonary gangrene. That it really lessens the amount of secretion in bronchial catarrhs was conclusively shown by Jürgensen (Ziemssen's "Handbuch," Bd. v., p. 182), who in numerous cases carefully measured the quantity of sputum, and constantly found a diminution. The clinical observations have been fully confirmed, and the mode of action of oil of turpentine plausibly explained by the investigations of Rossbach. In carefully conducted experiments he found that the oil exerts a very decided influence on the mucous membrane of the air passages. When a current of air which had passed through oil of turpentine, so as to become loaded with it, was applied to a part of the mucous membrane, the secretion of mucus gradually diminished, and finally ceased, and the membrane became very dry. A watery solution containing from one to two per cent., dropped upon the mucous membrane, caused an immediate increase of secretion and notable anæmia.

Oil of turpentine, when taken internally, is partly eliminated by the respiratory mucous membrane. In passing through the membrane it doubtless exerts an irritant or stimulant action on the blood-vessels, in consequence of which they contract. This contraction of the vessels is soon followed by absorption of exudation and lessened activity of the mucous glands. The decided improvement observed in the odor of the sputum in fetid bronchitis and pulmonary gangrene is doubtless attributable to the antiseptic power of oil of turpentine, by which it arrests the process of decomposition in the secretions. Rossbach supposes that its antipyretic action, its property of slowing respiration, and its depressing effect on sensory nerves may contribute to its therapeutic utility.

Oil of turpentine is indicated in all forms of bronchitis with free secretion, but especially when the expectoration is profuse, muco-purulent, and fetid.

It is usually given in doses of gtt. v. to gtt. xx. every two or three hours. Frequently it is administered in emulsion, as follows: ℞ Olei terebinth., ʒi.; vitellum ovi unius; syr. aurant., ʒ ss.; aq. cinnam. ad ʒ iv. M. Sig.: One tablespoonful every three hours. Jürgensen administers the oil in doses of about twelve drops six times daily in several ounces of milk. If the oil is taken in capsules, a small quantity of milk may be drunk after each one, in order to prevent irritation of the stomach.

*Terpin Hydrate*,  $C_{10}H_{16}O$ , is a hydrate of oil of turpentine that often forms when the oil is in contact with a small quantity of water for some time. On a large scale it is obtained by mixing oil of turpentine with alcohol and nitric acid. It is in the form of large colorless crystals, having no odor and only a very slight aromatic taste. It dissolves in 250 parts of water at 15° C., in 32 parts of boiling water, and in 10 parts of alcohol.

Terpin hydrate was introduced by R. Lepine, of Lyon, as an effective remedy for chronic bronchitis. He had used it in several hundred cases, and had observed that doses of 0.2 to 0.6 (gr. iij. to gr. ix.) daily rendered the sputa less tenacious and more copious, and facilitated expectoration. In cases of bronchorrhœa larger doses, 1.5 (gr. xxij.) daily, lessened the quantity of sputum. Such doses also increased the action of the kidneys, but, when these organs were normal, never caused albuminuria or hæmaturia.

The observations of Lepine have been corroborated by a number of clinicians in large hospitals. Thus Germain Séé found terpin hydrate very effective in catarrhal affec-

tions of the respiratory mucous membrane, the morbid secretion gradually diminishing under its prolonged use. In catarrhal forms of phthisis, he observed that the muco-purulent secretion lessened and often entirely ceased. He employed it also to arrest the hæmoptysis of the early stage of phthisis, and held it to act more rapidly than ergotin.

Dr. Manasse, of Berlin, found terpin hydrate very useful in whooping-cough, of which he treated forty-one cases, varying in age from nine months to twelve years. Every case was carefully observed, the frequency and severity of the paroxysms being noted daily. To children under one year of age he sometimes gave as much as 1.5 (gr. xxij.) daily, and never observed any injurious action on the digestive or urinary apparatus. And in no case, when 2.5 to 3.0 daily were given to older children, did the urine become albuminous or bloody. As a rule, in four or five days the paroxysms were less numerous and always less severe. The bronchial catarrh, which was present in most cases, diminished more rapidly than usual, and finally disappeared entirely. All the cases treated with terpin hydrate recovered. The medicine was given in the form of powder as follows:

℞ Terpini hydrat. 5.0-10.0 (gr. lxxv. to gr. cl.). Div. in part. æqual. No. x. S.: One powder three times daily.

The following formulæ have been recommended:  
℞ Terpini hydrat. 3.0 (gr. xlv.); sacch. alb., mucil. acacie, āā q. s. M. ft. pil. No. xxx. S.: One to four pills three times daily. ℞ Terpin. hydrat. 2.0 (gr. xxx.); spiritus (alcohol), aq. dest., syr. menthæ pip., āā 50.0 (ʒ iiiij.). M. S.: One tablespoonful from three to six times daily.

*Copaiba*.—Although the action of this agent on the mucous membrane of the air passages has not been investigated experimentally, it seems highly probable that it is analogous to that of oil of turpentine. Numerous careful observers have found it useful in chronic and in fetid bronchitis, and some of them state that it is equalled by no other medicine in catarrhs attended with profuse expectoration. It is usually given in emulsion in doses of ℥ x. to ℥ xx. from three to six times daily.

*Pix Liquida*.—Tar seems to be useful in chronic catarrh of the bronchi and in phthisis, when copious secretion is taking place. It often lessens the expectoration, eases the cough, and diminishes the oppression of the chest. Usually it is administered in the form of the official syrup, of which the dose is ʒi. to ʒiv. The following formula was recommended by Adrian: ℞ Picis liq., vitell. ovor., āā 25.0; glycerini, 50.0. M. Sig.: One or two teaspoonfuls from three to six times daily.

*Eucalyptol*.—This volatile oil has recently gained some repute in bronchorrhœa and fetid bronchitis. It is a powerful antiseptic. Taken internally, it is eliminated by the kidneys and the lungs, and seems to act upon the respiratory mucous membrane in the same manner as oil of turpentine. It is administered in doses of gtt. v. to gtt. xv. in capsules or emulsion.

*Grindelia* has lately been strongly recommended in spasmodic and catarrhal affections of the bronchial tubes, and in whooping-cough. According to some of the published reports, in some instances "it acts like a charm, instantly controlling the cough, and relieving the tickling in the throat and bronchial tubes." The fluid extract is given in doses of ℥ x. to ℥ lx.

*Ammoniacum*, benzoic acid, myrrh, balsam of Peru, balsam of tolu, garlic, and sanguinaria have been employed in bronchial catarrhs with good effects. They are, however, at the present time, rarely prescribed.

**MORPHINE AND ATROPINE**.—These alkaloids are so useful in diseases of the air passages, and so frequently administered simultaneously with some of the expectorants, that a very brief consideration of their mode of action is here appropriate.

*Atropine* is in constant use in phthisis to arrest night sweats. Many observers have noticed, during its administration, a decided lessening of expectoration and cough. This effect was usually ascribed to an action on the vagi



in the lungs, and on the mucous glands, which were supposed to become affected in the same manner as the sweat glands. In experiments, Rossbach observed that atropine acts very strongly upon the tracheal mucous membrane. He invariably found that the membrane, which had been secreting normally and was very moist, became absolutely dry. Gradually very decided hyperæmia supervened; yet no secretion occurred for an hour or longer, and afterward returned very slowly and feebly. The persistence of the dryness, notwithstanding the hyperæmia, proved that atropine acts on the mucous glands or secretory nerves. It is therefore an appropriate remedy in bronchial and pulmonary diseases, when the cough depends upon copious secretion in the trachea and bronchial tubes.

*Morphine* lessens cough in two ways—by diminishing secretion, and by lowering the excitability of the respiratory centre.

Rosbach observed that, normally, after removal of the mucus from the tracheal mucous membrane, about twenty seconds passed before the membrane was again completely moist. But after subcutaneous injections of morphine, the membrane did not become equally moist before the lapse of from eighty to one hundred seconds.

Cough may be very readily produced by slightly irritating the normal mucous membrane of the larynx and trachea, especially near the bifurcation of the bronchi. An hour after injecting morphine, Rossbach found that only very severe irritation produced cough, while gentle irritation had no effect.

When used simultaneously, both alkaloids act, lowering the excitability of the respiratory centre and notably lessening secretion. In chronic catarrhs, emphysema, and phthisis, with copious expectoration, they have been found of great utility. In phthisis, when the expectoration comes from cavities, no very marked diminution can be produced.

As a rule, the two alkaloids should be prescribed separately—atropine to be taken only in the evening, between six and ten o'clock; and morphine, in very small doses, during the day.

*Codeine.*—Codeine has recently come into use as a means of allaying cough. According to numerous reports, it is generally as effectual as morphine or the preparations of opium. Often it has been observed that the cough of mild forms of bronchitis ceased in a few days. But its principal advantage is that it does not depress the functions of the alimentary canal. The use of morphine is usually followed by a diminution of appetite, and often by constipation. Codeine, while it allays the cough, does not interfere with the appetite, or with the normal action of the bowels. This has been especially observed in phthisis, in which codeine was found to mitigate the cough without lessening the desire for food. When, to test the difference in action, Dover's powder was given to patients that had been taking codeine, the appetite, which had improved under the use of codeine, diminished again, showing the decided superiority of codeine. It has been found to be very useful in the bronchitis of children, and, in appropriate doses, has been given to infants, without any unpleasant effects.

Codeine should therefore be preferred to morphine in all cases of severe cough in which it is necessary to maintain a good appetite, as in bronchial catarrhs complicating chronic wasting diseases, in children, and in persons subject to constipation. Especially, should codeine be preferred to morphine to relieve the cough of phthisis; for if the means used to mitigate this tormenting symptom interfere with digestion and nutrition, little hope of saving life can be entertained.

The salts of codeine commonly used are the sulphate, phosphate, and hydrochloride. They all readily dissolve in water, and are usually prescribed in aqueous solution with a small quantity of syrup, or together with sugar in the form of powder. The dose for adults is gr.  $\frac{1}{4}$  to gr.  $\frac{1}{2}$ ; for infants, gr.  $\frac{1}{8}$ ; and for children three or four years of age, gr.  $\frac{1}{15}$  to gr.  $\frac{1}{10}$ , from three to five times daily.

*Heroine*, a derivative of morphine—diacetyl morphine—is rapidly coming into use as a cough remedy. It is a white powder, having a bitter taste, not easily soluble in water, but readily soluble in water acidulated with a few drops of acetic acid. Its salt, heroine hydrochloride, is soluble in two parts of water.

Heroine was introduced in 1898 by Prof. H. Dreser, of Elberfeld. In experiments upon animals Dreser had found that heroine notably slows the respiratory process and renders it deeper. He administered it in doses of 0.01 to patients having cough and found it to give much relief.

Harnack in experiments upon dogs observed also notable slowing of respiration, but it became decidedly weaker; hence he concluded that heroine is more poisonous than morphine and should not be given in doses larger than 0.005. Strubbe experimented upon dogs, cats, and rabbits, and obtained results agreeing essentially with those of Dreser. Sartissen, on the contrary, found the respirations shallower, although slower.

Numerous clinical observations of the action of heroine have been made in hospitals and in private practice, and with nearly uniformly good results. Perhaps the most careful observations are those of Brauser, made in Ziemsen's clinic. In eighty cases an accurate record was kept, and control trials were made with simple sugar, codeine, and morphine. The cases treated embraced phthisis, acute and chronic bronchitis, croupous pneumonia, pleuritis, cardiac dyspnoea, and patients having pain from other causes. In the great majority of the cases heroine promptly lessened the cough. Usually this result followed when 0.005 was given in the morning and at noon, and 0.01 in the evening. In most cases the respirations were slowed, often from five to eight in a minute, sometimes only two or three. In the same patients sometimes the respirations were lessened, sometimes uninfluenced. In about one-third of the cases no change in the frequency of respiration could be observed, especially in cases not presenting any marked acceleration. This occurred, however, also when the respiratory process was greatly accelerated, especially in pneumonia. In some cases of cardiac dyspnoea the action of heroine was notably beneficial, the breathing becoming slower and more nearly normal.

From these and numerous other cases Brauser concluded that heroine acts as promptly and effectually as morphine in relieving cough, and that it is very useful in dyspnoea, though not certain, giving decided relief in only about two-thirds of the cases treated.

Floret observed that heroine when given together with apomorphine produced disagreeable effects—vertigo and headache. In phthisis, when not far advanced, the combination of heroine and duotal (heroine 0.005-0.01; duotal 0.5, given four times daily) was followed by general improvement and a notable retrogression of the objective symptoms.

Samuel Nickles.

**EXPECTORATION.** See *Sputum*.

**EXPERT MEDICAL EVIDENCE.**—In the last few years the medical expert witness has figured prominently in many celebrated criminal and civil actions. At first his evidence was received by the court and jury with the deference and respect which honesty, intelligence, and learning always inspire. But in more recent times many things have conspired to place the medical expert witness on a much lower plane than he formerly occupied. The principal reasons for this degeneration may be found in the seeming partisanship of some of those who take the stand as experts; the employment of witnesses who are qualified neither by education nor by experience to act as experts; and the opinion, which has become impregnated in the public's mind, owing to the methods of procedure followed by the attorneys in the case, that the most able experts can be hired to swear to diametrically opposite conditions of facts. All of these things together have operated to prejudice the people, and consequently the jurors, against the introduction of medical expert evi-

dence. Indeed in more than one instance talesmen have been rejected as jurors because of their avowed disbelief in, and determination to reject, all expert evidence.

Medical expert evidence should, theoretically, often be of inestimable service in that it is perhaps the only way in which certain facts vital in importance can be brought to the attention of the jury, and the relation of these facts to the case explained. A medical expert is one who by study and experience has become especially learned or skilled in some branch of medical science and whose judgment and opinions therefore are sounder than those of the average physician. It is of the greatest importance, therefore, that one who poses as an expert should actually be qualified to act as such. Attorneys are not always careful in the selection of their medical witnesses, either from ignorance or because they cannot or will not pay the fees which the expert generally demands, and they often call to the stand physicians of excellent general knowledge but who are not at all prepared to meet the ingenious questions of a skilful cross examination. Again, the fault is with the physician who, tempted either by the pecuniary reward for his services or by the opportunity of achieving a certain degree of notoriety, places himself in a position which his limited knowledge and experience are inadequate to support. His answers to questions clearly show, to the expert at least, that he does not possess an intimate knowledge of his subject, and when confronted by an expert witness there often follows a flat contradiction of opinion. The evidence of the medical witness, like the evidence of any other witness, is addressed to the jurors and is for their consideration. They do not always know who are experts and who are not; so generally regard all the medical witnesses as possessing the same degree of skill and ability. They cannot, of course, be expected to detect the ignorance on the part of a medical witness which is so apparent to the expert. They simply recognize the contradictions which necessarily arise in a conflict between ignorance on the one hand and knowledge on the other; and confusion of mind and doubt naturally follow. For this reason medical evidence is sometimes completely ignored by the jurors and falls greatly in public estimation. The medical witness should never allow himself to act in the dual rôle of witness and associate counsel. The spectacle is seen at nearly every trial of prominence, and in many others, of one or more physicians sitting close to counsel, taking copious notes of the evidence, formulating questions to be used in direct and cross examinations, looking up references and in reality conducting the medical part of the prosecution or defence, and then when their turn comes taking their place in the witness chair to act as experts. Associate medical counsel is often of valuable assistance. No matter how skilful an attorney may be or how thoroughly he has studied his case, a well-trained medical mind can point out to him many features, and give him many suggestions which would otherwise escape him. A counsel often strengthens his case by the help of a medical associate and the employment of a physician as such is perfectly proper from every standpoint. But for such a one to take the stand as a witness stamps him as a partisan to the jury. It cannot help but regard him as a biased witness, who comes prepared to fight for "his side" of the case. The influence of his testimony is, of course, much less than that of the witness who confines himself to his duties as a witness only. It is, of course, incumbent on a physician who purposes to act as an expert witness to point out the medical aspects of the case to counsel and to suggest such questions for the direct examination as will enable him to express his investigations, deductions, and opinions in his own way and to his best advantage. He may also with propriety suggest the general course of the direct and cross examination of other experts, but further than this he should not go and cannot go without seriously compromising himself as an unbiased witness. Even the construction of hypothetical question which generally terminates the expert witnesses' direct examination, should not be performed by him. He may

point out to counsel the medical facts which should be incorporated in the question. But should the fact be elicited from the witness that he was the author of the question he has just replied to, the force of his answer is lost and his value as a witness is greatly diminished.

It generally appears to the public, particularly in notorious trials, that a certain number of experts called by one side swear positively and diametrically opposite to the experts called by the other side. It is this feature which has called down so much and so unfavorable criticism upon the medical expert witness and upon the value of expert testimony in general. A great deal has been written and much thought given to the formation of a plan by which medical expert testimony can be employed without the objectionable features which now mar it and yet preserve the constitutional rights of the prosecution or defence. It is not a simple question for solution, and none of the methods which have so far been advocated seems to fulfil all the requirements of the case. The fault lies mainly with the attorneys and not with the experts. It seems, at first glance, as if the experts on one side flatly contradict the experts on the other. This may be the case in some instances, for two minds working upon the same assumption may come to different conclusions. But it is not generally so, at least, in medicine. In trials, as they are conducted at the present time, there is no possible chance for an agreement of the experts. The witnesses for the two sides are not asked to give opinions based upon the same assumptions; each counsel has his own hypothetical question which differs from that of his opponents as night differs from day. They are based upon absolutely different assumptions of facts, and the answers given are in accordance with the assumption in each question. Should the opposing counsel exchange hypothetical questions, the answer of every expert witness would be changed also.

The expert opinions are of no value at all unless the assumptions contained in the hypothetical question are proved to be true. If the jury believes the assumptions in one hypothetical question, then the expert opinions based thereon are worthy of consideration; otherwise not. If these points were generally understood, it would be comprehended that the seeming clashing of expert opinions is in reality nothing of the sort, but that the opinions given are nearly what they claim to be, honest answers to absolutely different questions.

Another feature which stands in the way of obtaining the best expert evidence is the purposeful and wilful interference with which one attorney in the action foils every attempt, to the best of his ability, of the expert called by his opponent to obtain those details of the case which are requisite for the establishment of a sound medical opinion, while every facility is freely granted for every investigation his own experts desire to make. Thus a man on trial for murder pleads insanity. The experts called by his counsel have frequent interviews with the accused, and on these occasions he talks freely and openly and submits willingly to any examination they may desire. The relatives and friends communicate the family history, the personal history, and any other facts which may be of service to the examiner, and he comes into court well informed in every detail of the medical features of the case. But how is it with the expert called by the state? Has he had an equal chance for rendering a truthful solution of the question? He certainly has not. When he interviews the accused he is not welcomed. The prisoner sees in him a man who is to assist in taking his life and therefore gives as little information as he can. He is often carefully coached as to the replies he is to make to certain questions, and the friends and relatives either give no information at all or else give that which is either false or misleading. As a rule the examiner obtains but little more information than can be derived from a study of the physical symptoms, which in many cases is absolutely insufficient for a satisfactory diagnosis. These defects in the present system of expert medical evidence are frankly admitted by both physicians and lawyers, and any method by which