A. C. Crawford

THE

ART OF COMPOUNDING

A TEXT BOOK FOR STUDENTS

AND

A REFERENCE BOOK FOR PHARMACISTS AT THE PRESCRIPTION COUNTER

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PREFACE.

THE art of compounding physicians' prescriptions depends largely upon an intellectual grasp and a practical application of small details. Very slight differences in operations upon the same prescription are frequently sufficient to make all the difference between a presentable and an unpresentable prescription.

In attempting to teach this subject from the standpoint of the prescription counter, the author has been obliged to depend almost entirely upon lectures for the presentation of the different topics, the literature upon the subject being too widely scattered to admit of use by the students.

This necessitated the omission, in order to avoid confusion, of many of the details connected with each which make them of practical value, and much was lost to the student thereby.

The present work was begun with a view to furnishing such notes as would enable students to properly classify the various prescriptions, and to attach proper importance to details of manipulation without overburdening the mind with disconnected facts. As the theme unfolded it was thought that the same elements which would make it of aid to students might also make it of value as a reference book, and the work has therefore been made more complete than was first planned. That very much is still lacking the author is fully aware.

In presenting the subjects, two objects have been kept in view. First, to enunciate and classify the principles underlying each subject, so that the student may understand the reasons as well as the facts of dispensing; second, to so illustrate and detail the principles as to show their range and variety of application, and make them of practical utility at the prescription counter. The first is undertaken in the general text, the subjects being broadly introduced by a series of definitions, wherever admissible, then the descriptive and theoretical considerations are given. The prescriptions which follow the chapters were selected and arranged with the second object in mind. While intended primarily for practice in compounding, they should teach not only the methods of mixing, but also the direct application of the principles, the physical properties of the materials used, and, in some degree, the range and variety of extemporaneous pharmacy. The official formulas which have been included, are designed as well to give practice in the compounding of an aliquot part of a common formula—an exercise frequently demanded in commercial life. Peculiar prescriptions which seemingly form exceptions to the general rules, or are of rare application, or such as call for special treatment, are illustrated by example, this plan seeming to be less cumbersome or confusing than if the many disconnected facts were embodied in the descriptive text. While intended only for extemporaneous pharmacy, the line has not been closely drawn, and in a few cases the quick manufacture of a chemical salt is demanded, as showing the extent to which the exigencies of compounding may lead.

While illustrative cuts would undoubtedly have been an attractive addition to the text, it has been preferred to omit them, in the belief that such demonstrations in the use of apparatus which the apprentice receives in the store, or the student witnesses at college, are more suited to their needs, while the maturer pharmacists are best supplied by catalogues and technical journals.

Pharmaceutical literature has been freely used in collating the facts herein presented, many of them being collected from the "Proceedings of the American Pharmaceutical Association," the "Art of Dispensing," and files of the "Pharmaceutical Journal and Transactions," "American Druggist," "Bulletin of Pharmacy," "American Journal of Pharmacy," and other journals. In the chapter on Incompatibilities, special recognition is due to assistance received from a series of articles on that subject by Mr. Frank X. Moerk, published in the "Bulletin of Pharmacy," during 1895. Grateful acknowledgments are also made to Professor E. L. Patch for permission to use certain prescriptions from his "Junior Laboratory Exercise Book."

WILBUR L. SCOVILLE.

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CHAPTER I.

INTRODUCTORY.

ONE of the chief objects of a technical education is the acquirement of skill.

And skill involves two things: first, mental knowledge and the power to rightly apply it, and second, manual dexterity.

The first comes to us by reading and study, and in the various ways by which the mind receives the thoughts of others in words.

The second involves a knowledge which cannot be put into words, but must come to us through the medium of the five senses. Each of the senses is a channel through which thoughts are conveyed to the mind, and its mission can be fulfilled by no other means. The skillful man is the wholly trained man; one who has not only learned how to apply the knowledge of others and to judge and plan for himself, but who knows also how to execute, and make inanimate things do his bidding.

This double training is essential for the acquirement of skill in all lines of work. In pharmacy, study and reading will give one a correct idea of how to make a pill, or to divide powders, mould suppositories, etc., but manual practice is necessary to enable one to accomplish these operations neatly and expeditiously.

Or mechanical dexterity may be acquired so that these operations, when applied to familiar examples, are easy; but unless the principles involved are understood, new combinations are puzzling, and the mechanical dexterity alone is inadequate to their correct preparation.

By study the knowledge and experience of others are made available to us, and we learn to deduce new methods or to newly apply principles. Study has for its object the assimilation of the thoughts of others. To this end the thought involved in the sentences must first be understood.

Take for instance this sentence: "After a toxic dose the systolic irritation overbalances the diastolic stimulation, and the pulse becomes dicrotic, because the diastole is interrupted by an abortive systole" (U. S. Disp., page 478). What idea do these words convey to you? If the meaning of each word is clear, then the sentence as a whole is readily understood; but if any word is not understood, the significance of the entire sentence is obscured. A dictionary may clear up the meaning, or a course in the physiology of the heart may be necessary for its full understanding.

The student should make it a rule never to leave a sentence until the meaning of every word and of the sentence as a whole is perfectly clear. Then a few repetitions in reading it serve to fix the thought in the memory. But the key to proper study lies in the first careful reading of the lesson, and the comprehension of the significance of every word.

Then for prescription work and the operations of pharmacy there is something beyond this. Study may enable us to see quickly what principles to apply to any mixture, but the physical properties of the compound are still to be learned. These, if thoroughly learned, will teach us not only the art of mixing, but also safeguards against mistakes or inferiority in the stock. Drugs should be to the pharmacist like intimate friends, their appearance, habits, likes, and dislikes, all familiar. These are learned by close observation,—through the medium of the senses. Let us see how these apply.

Seeing.—This sense is so very important in pharmacy that a special branch is devoted to it,—that of Pharmacognosy.

But its application to the compounding of prescriptions is none the less instructive, though so varied that it can hardly be classified into a course. The habit of close observation is not an easy one to acquire, but is exceedingly useful.

Take the ingredients of any mixture, and look at them separately. Are they clear or cloudy? Is there a deposit upon the side or bottom of the bottle? What are the colors, and how do they change? Are they limpid or viscid? Do they appear the same by reflected as by transmitted light? Such questions can only be answered accurately after careful and repeated observations.

Then on mixing observe again.

Do the liquids mix clearly or not? Are streaks or currents formed in the liquid, and what do they denote? Do solids dissolve quickly or slowly? Do they diffuse readily? What changes in color occur? Is there *any* effervescence or precipitation? etc.

Such observations make an excellent course in physics, and the pharmacist who practices them habitually will never send out a gritty or streaked ointment or suppository, nor an ill-appearing mess of any sort.

It is not necessary that one should be able to describe all that he sees, for these are the thoughts conveyed without words, and, moreover, "it is quite sufficient" (says Professor Markoe) "to recognize your friends when you see them, though you may not be able to make a list or give a description of all of them."

Hearing.—This sense is the least applicable (directly) of any, to pharmacy.

The popping of a cork should suggest a cause to the pharmacist, and it may indicate the need of attention to the bottle.

An acute ear behind the prescription counter may prevent pilfering by kleptomaniac customers, while the sound of running water may bring suspicion to the customer's mind of a cheap ingredient of his prescription.

A crash may denote trouble and loss.

But in general, silence is more indicative of a good dispensing counter than noise, and there are times when a closed ear is better than an open one.

Smelling.—This is a sense which can receive little aid from outside. An odor is absolutely indescribable, except by analogy, and is comprehended only by the nose. The only way to analyze a perfume is by means of an educated nose, and that needs a deal of educating. Most fluids, and many solids, have a characteristic odor by which they can be identified. It should be remembered, however, that a diluted odor is more characteristic than a concentrated one. The most delicate and pleasing perfumes have a more or less harsh and disagreeable odor when concentrated, but on diluting them the pleasing and distinguishing odor is manifested.

Unless a liquid has, normally, only a weak odor, smelling from the bottle is not a good plan. A drop or two allowed to fall upon a piece of filter-paper, which is then waved in the air for a moment, will enable us to get the true odor, and also its relative strength.

Another peculiarity of odors is their anæsthetic action upon the olfactory nerve, particularly true of flowers and delicate odors. After a very few minutes the nerve is benumbed, and the odor is no longer perceptible, or ceases to be pleasant. Nor can other odors be distinguished clearly, since "all smell alike," as the over-zealous samplers at the perfume counter sometimes say. For this reason but two or three odors can be learned at a time.

Besides the more characteristic properties developed by dilution of odors, the smelling of strong and pungent bodies like ammonia water, chlorine solutions, essential oil of mustard, strong nitric or hydrochloric acids, etc., from the bottles, is liable to result in unpleasant or even serious results.

Tasting is closely related to smelling, the odor often suggesting the taste.

Like the odors also, taste is oftentimes more characteristic in the diluted than in the concentrated form. A grain of quinine sulphate, for instance, placed upon the tongue, quickly betrays its bitterness, but the same amount dissolved in two and a half pints of water shows also, on being tasted, how intensely bitter the quinine is, without being so persistent and unpleasant.

A grain of strychnine, dissolved in twenty gallons of water, can be tasted distinctly in the solution, and in this diluted condition the distinction between the quinine and the strychnine bitter is more pronounced. Saccharin has a nauseous, metallic taste when placed upon the tongue, but in dilute solution it is intensely sweet and agreeable. The characteristic taste of the most powerful poisons can be safely ascertained *in highly diluted solutions*, but the solid forms or strong solutions are dangerous, particularly hydrocyanic acid and the cyanides. The degree of dilution must, of course, vary with the diffusibility of the taste and the dose of the substance.

Sometimes the presence of one substance develops or obscures the taste of another.

Thus, a very small proportion of salt or of vinegar makes sugar taste sweeter, while licorice or coffee partially covers the taste of bitter substances.

Efforts are constantly being made to find means of covering the taste of unpleasant substances, and our list of elixirs is one result of such.

The sense of taste also furnishes a means of identifying many substances. We quickly learn that a sour taste indicates an acid or an acidulous salt; a sweet taste may mean sugar or saccharin or glycerin; a bitter taste comes mostly from tonic or cathartic drugs; and an astringent taste may be due to tannic acid or to a salt of aluminum, lead, zinc or copper. Some pharmacists make a habit of tasting mixtures compounded for internal use, to verify their correctness or detect mistakes. This is not so unpleasant a habit, properly applied, as might seem.

A few drugs, when applied to the mouth and fauces, produce sensations more akin to the touch than to the taste. Tincture of aconite, highly diluted (one drop to twenty or thirty fluid ounces of water), produces a tingling sensation and numbness when a teaspoonful of the liquid is held for a full minute under the tip of the tongue. The tingling is not apparent for a few moments, but continues for some time. Cocaine produces a numbness quickly, and chloroform first burns, then benumbs.

A tingling or a numbing sensation is produced by a number of drugs. A few drugs, as soap-bark and hellebore (and, in unusual cases, aloes and its preparations), cause sneezing, while very rarely an extremely sensitive individual will suffer severely if ipecac be exposed even for a moment within a distance of several yards.

All such sensations are characteristic of their respective causes, and are valuable as a means of testing or as hints of the general properties of the drugs. The quality of a drug or preparation is oftentimes quickly and accurately ascertained from its taste.

Feeling.—"Knack"—that indescribable something which lightens labor and passes for skill—is mostly an educated sense of touch. There is a peculiar "feel" to a workable pill or suppository mass, an emulsion, powder-mixture, troche, tablet, etc., indeed to all mechanical operations, which tells us what words or pictures or sounds cannot. It must come to us through the nerves, in our operative practice, and once learned it is rarely forgotten. It is this which enables us to weigh, to mix, to mass, to divide, to roll into shape, quickly and well.

The "knack" of holding large bottles in pouring, of handling graduates, mortars, spatulas and all the various implements, gracefully and rightly, is acquired through the sense of touch.

We also find that the feeling of many powdered or crystalline substances is characteristic, and a rough test can be made of the quality or purity of many articles in this way. Such tests have served for the detection of gross sophistications, and are of considerable value in comparing samples of chalk, zinc oxide, etc. Some pharmacists always test ointments containing insoluble powders for grittiness, by feeling them before removing from the slab or mortar. Mixed powders are also tested in the same manner, when one ingredient is harder than the others.

These are the purposes of the prescriptions which follow each chapter in the succeeding pages. They are intended for practice as well as for study. Nor is the manner of mixing the only, or even, from an educational standpoint, the chief thing to be learned. The physical properties of the ingredients and mixtures should be studied, and deductions made from them. It may be discovered that many of them can be mixed in various ways, and further that "there is no dispensing rule but must be applied subject to the control of the judgment and experience of the operator."

CHAPTER II.

THE PRESCRIPTION.

THE prescription is the written order of a physician for a remedy, usually accompanied with directions for its administration to the patient. Its design is to procure for the patient a special remedy, suited to his present condition, and in such quantity as the physician deems needful.

The word prescription is derived from the Latin word *præscribo*, I write before (*præ*, before, and *scribo*, I write or ordain).

THE LANGUAGE of the prescription is almost universally Latin, because (1) Latin is the language of science throughout the world. Thus a prescription written in any part of the civilized world, or by a physician of any nationality, may be readily comprehended and correctly compounded by any pharmacist.

(2) The Latin names of medicines are definite, and not subject to the changes common in modern languages. Thus, the Latin term *Gaultheria* means a definite plant, understood by botanists and pharmacists everywhere, but the English equivalent, "Wintergreen," might be interpreted Gaultheria, or Chimaphila. Likewise *Serpentaria* means only a particular and known root, but the English term "Snake-root" may be applied to *Serpentaria*, *Cimicifuga*, *Senega*, *Asarum*, or *Eryngium*. Moreover, the vernacular name of a plant is one thing in English, another in French, and still another in German, Italian, Spanish, etc. The use of Latin obviates the necessity of knowing these different names as well as procures accuracy.

(3) Oftentimes it is desirable that the nature and ingredients of a mixture remain unknown to the patient, and Latin affords secrecy. This last reason should be remembered and respected by the pharmacist, and inquiries regarding the composition and nature of a prescription should be answered with caution. It may be unobjectionable to answer frankly such questions when asked by people of high intelligence and with honorable motives, but, in most cases, an evasive reply, which conveys little or no information, is advisable. Prescriptions often betray secrets which should be zealously guarded, and, in France, it is a criminal offense to expose their contents or nature to outside inquirers.

The prescription is usually written in three parts: (1) the inscription or ingredients; (2) the directions to the compounder; and (3) the signature, or directions for the patient.

The physician's name, or initials, also forms an integral part of the prescription. This is often printed upon the blanks used.

The inscription and directions to the compounder are written in Latin, the signature either in Latin or English; usually in English, since there is no advantage in writing it in Latin, and there may be a disadvantage through an improper interpretation.

The prescription opens with the symbol ℞.

This was probably in the original, the sign of Jupiter, ♃, placed at the head as a prayer for favor and healing to that deity—such a custom being common in the days of mythology and superstition. It is now generally understood as standing for the imperative form of the Latin verb *recipio*, "I take," *recipe*, "take thou."

The ingredients of the prescription then follow, and are grammatically dependent upon this verb *recipe*.

The quantity of each ingredient is a direct object of the verb, and is designated by the accusative case, while the ingredients modify the quantities, and are in the genitive. These are followed by the sign ℳ or M, standing for the verb *misce*, "mix," and any directions to the compounder that may be necessary, as—

"*In chartulas xii numero divide*," divide into twelve small papers (powders); "fiant in pilulæ xx numero," let them be made into 20 pills; "fac suppositorias vi numero," make (thou) 6 suppositories; "fiat unguentum," let an ointment be made, etc.

Take a single prescription for illustration:

℞. Morphinæ Sulphatis, ... granas duas.
    Sacchari, ... drachmam unam.
  Misce et divide in chartulas duodecim.
    Signatura:—Capiat unam nocte.

Here the verb *recipe* (take) has for its direct object *granas* (grains), which is therefore in the accusative case, and *duas* (two) being a numerical adjective agrees with it. *Sulphatis* being in the genitive case (corresponding to the possessive in English) tells us what the substance of the sulphate is, and *morphinæ*, also in the genitive, modifies *sulphatis*, and the sentence reads literally, "take of the sulphate of morphine, two grains."

In the next line the verb is again understood, but is not written; it has for its direct object *drachmam* (a drachm, singular) and *unam* (one) agrees with this. Then *sacchari* is in the genitive, and the line reads, "take of sugar one drachm." This forms the inscription or first part of the prescription.

Then follows the imperative verb *misce*, mix, joined to the succeeding sentence by the conjunction *et* (and). *Divide* (imperative form of verb, meaning "divide") tells us that the mixture is to be mixed and divided, and the succeeding words how. *In* is a Latin preposition meaning "into" when followed, as, in this case, by the accusative (or "in" when followed by the ablative), and *duodecim* is indeclinable, but agrees with *chartulas*. Then this sentence reads "mix and divide into twelve powders."

The last part of the prescription, the signatura, is in this case also in Latin.

Signatura means "write" or "directions," the directions being *capiat*, subjunctive form of the verb *capio*, and means "let the patient take." *Unam* (one) is the direct object of *capiat*, and is, therefore, in the accusative, while *nocte* (at night) is in the ablative because it expresses time. This sentence then reads, "let the patient take one (powder) at night."

In the every-day writing of prescriptions many of the terms and phrases are abbreviated.

Thus ℞ stands for *recipe*, ℳ for *misce*, S. or Sig. for *signatura*, and the quantities are designated by signs and Roman numericals.

Abbreviations are not objectionable if not ambiguous, but some are of the latter nature.

A prescription was received in a western state some time ago as follows:

℞. Hyd. chlor.
Mur. hyd., ... gr. ii.
Aquæ, ... ℥i.—ℳ.

This should take the prize for ambiguity, for the abbreviations "chlor." and "mur." are synonymous, the second being an old form still in common use, standing for muriate (chloride), muriatic, etc., while "hyd." occurs in both cases. The first line then might stand for "hydrargyri chloridi"—chloride of mercury, and this might be either calomel or corrosive sublimate, or it might stand for hydrate of chloral. The second line, at first thought, would be supposed to mean the same. But the physician really desired in this prescription,

Chloral (hydrate), ... one drachm.
Muriate (hydrochlorate) of hydrastine, two grains.
Water (distilled), ... one fluidounce.

Further, the abbreviation "hyd." might stand, in different connections, for hydrargyrum, hydrate, hydrochlorate, hydrocyanide, or hydriodate, while "chlor." might be intended for chloride, chlorinated, chlorate, chlorine, chloral, or chloroform.

"Sulph." might stand for sulphur, sulphide, sulphite, or sulphate, and "phos." for phosphorus, phosphide, phosphite, or phosphate.

It may be noted that a knowledge of classical Latin is not a necessity to the pharmacist, but it is a great aid and a stimulus to a wider education and a better understanding of technicalities. Without it the compounder must depend upon the unaided memory, or upon tables of technical terms.

Classical Latin contains but few of the technical terms, but it makes the student familiar with construction, idioms, etc., so that these are more readily learned, remembered, and understood.

Receiving the Prescription.—It is customary in some of the larger stores to give checks upon receiving a prescription. The checks are numbered or lettered, and the corresponding mark or a duplicate check is written upon or attached to the prescription.

This prevents mistakes in delivering the medicines, the check or mark being transferred to the packages as these are prepared.

The prescription should be read carefully and thoroughly. *Make it a rule never to dispense a prescription any part of which is not well understood.*

The character or strength of a mixture often depends upon a single word or sign, and a careful scrutiny is always necessary.

Many pharmacists write the label before beginning to compound the prescription—an excellent practice. This gives time for a second reading or for any hints which may be noted in the directions, and also for thought as to the manner of compounding; moreover, the label then becomes thoroughly dry before being pasted upon the bottle.

The legibility of a prescription is as often as much a matter of experience in the compounder, as of the chirography of the writer.

Dispensers gradually become accustomed to certain combinations, and the presence of one ingredient suggests another, or at least makes the interpretation of a more obscure line easier. They also become familiar with peculiarities in the handwriting of physicians in their locality, and prescriptions which may seem to be mere hieroglyphics to the novice or to dispensers in another town may be simple and plain to them.

So then the ability to decipher a badly written prescription depends quite as much upon experience in dispensing as upon skill in interpreting badly-formed letters.

If any ambiguity occurs in the prescription, any dangerous doses, undesirable incompatibilities, or any other feature, makes it desirable that the physician should be consulted before the prescription is compounded, the customer should never be made to suspect that anything is wrong. The latter may be dismissed with information that the prescription will require an hour or two to compound, or some such excuse, and the prescription sent to the physician without his (the customer's) knowledge. Faith in both the physician and the pharmacist is an important factor in medical treatment, and it should be fostered at all times.

THE DOSES of powerful remedies should be carefully scrutinized in each case.

Many a life has been saved by the watchfulness of pharmacists in this regard, and the reputation of the physician preserved as well.

On the other hand, the pharmacist is held criminally liable with the physician, by the law, if he compounds and dispenses a prescription containing a fatal dose of poison.

Unusual doses of powerful drugs are sometimes purposely ordered by physicians for special cases. This is particularly liable to occur with morphine and opium and their preparations. In such cases the physician alone is responsible, provided the dose was ordered thoughtfully.

Several plans for designating such special doses have been proposed, such as drawing a heavy line, for emphasis, under the dose and remedy in question, the writing of the dose in both Roman and Arabic characters, or in both English and Metric systems, the emphasizing of the dose by an exclamation mark (!) or by the letters Q. R. (quantum rectum), etc., and it is to be regretted that some method has not been universally adopted. Occasions frequently arise when from abnormal conditions, extreme pain, or other causes, doses may be needed which in ordinary usage would be dangerous, and delay in compounding these (which are usually wanted quickly for relief) would be avoided many times by some recognized method.

In judging of the safety of a given dose, three things must be taken into account, (1) the age or weight of the patient, (2) the form in which it is given, and (3) the frequency or extent of its repetition.

Doses are usually given in tables, books on posology, etc., as maximum and (sometimes) minimum doses for adults, but even with adults personalities make much difference. As a rule a man will stand a larger dose than a woman, and a heavy, muscular man more than a light and nervous one. For children the dose is regulated according to age. Dr. Young's rule, which is frequently used, is, "Divide the age of the child, in years, by the age plus twelve." For example, if the child be three years old, the dose would be $\frac{3}{3+12} = \frac{3}{15}$ or $\frac{1}{5}$, and the dose is therefore one-fifth that of an adult. Another rule is to add 1 to the age in years, and divide by 24,—thus for the same child (3 years old) calculate $\frac{3+1}{24} = \frac{4}{24}$ or $\frac{1}{6}$; the dose then is one-sixth that given to an adult.

It must be remembered that infants and young children are extremely sensitive to morphine and opiates, death resulting at times from seemingly very small doses, and judgment must be used as well as rules.

The form in which the medicine is administered also affects its vigor. Hypodermic injections, by bringing the remedy directly and suddenly into the circulation, effect a full action in smaller doses than when the drug is administered in other forms.

Liniments, ointments, suppositories and other external or semi-external remedies, acting by slow and gradual absorption, produce their effects more slowly than when administered by the mouth, and larger doses may, as a rule, be administered in these forms.

Suppositories of strychnine or nux vomica (and ignatia) are an exception here, since strychnine acts very quickly and vigorously when administered through the rectum, and smaller doses are therefore advisable.

Bodies in solution generally act more promptly than when in solid form, and so *insoluble* forms of medicinal agents may sometimes be used in larger amounts.

Very little difference is noted, however, in the dose of remedies in pill or powder forms and solutions.

The frequency or extent of repetition of a dose is decidedly important with some drugs. Some are fugitive in their action, while others are cumulative.

With opium (morphine) and cocaine, for instance, the action is prompt and soon passes away. The system quickly becomes accustomed to them, and an increase in dose becomes necessary to produce the desired effects. Such drugs may be given in repeated doses without ill effects other than the establishment of a systemic craving for them, if long continued.

Cumulative drugs, on the other hand, like strychnine, nux vomica and digitalis, do not produce their full effects at once, but gradually accumulate in the system, their action increasing with the drug.

Small, repeated doses may thus give rise, after a time, to symptoms of poisoning similar, though less dangerous, to those produced by a single excessive dose.

A questionable dose of such remedies as these becomes more apprehensive if the mixture contains a large number of doses which are to be taken at frequent intervals.

The difference between a *minim* and a *drop* should also be borne in mind in figuring doses. A minim is always a sixtieth part of a fluidrachm, regardless of the character of the substance, while a drop varies from a forty-fifth to a two-hundred-and-fiftieth part, according to the viscidity of the liquid. Aqueous fluids usually measure from 45 to 70 drops to the fluidrachm; alcoholic liquids, 100 to 150 drops; ethereal liquids, 150 to 250 drops; and volatile oils, 110 to 145 drops to the fluidrachm. The size of the drops will vary, in the same liquid, with the shape and character of the vessel from which they are dropped, particularly as regards the edge or lip, with the rate of dropping, and, to some extent, with the temperature.

Consequently, tables like the following are not to be taken as absolute, but as approximate guides.

DROPS IN A FLUIDRAM.

A table showing the number of drops in a fluidram, also the weight of one fluidram in grains and grams for each of the preparations named, from a list by S. L. Talbot, first printed in Remington's "Practice of Pharmacy," and corrected to agree with the U. S. P., 1890.—*Taken from the Era Dose Book.*

NAME.	DROPS IN FLUIDRAM 60 MIN.	WEIGHT OF FLUIDRAM. In Grains.	In Grams.
Acetum Opii	90	61	3.95
Scillæ	68	57	3.69
Acidum Aceticum	108	58	3.75
Aceticum Dilutum	68	55	3.56
Carbolicum	111	59	3.82
Hydrochloricum	70	65	4.21
Dilutum	60	56	3.62
Hydrocyanicum Dilutum	60	54	3.49
Lacticum	111	66	4.25
Nitricum	102	77	4.98
Dilutum	60	58	3.62
Nitrohydrochloricum	76	66	4.27
Phosphoricum Dilutum	59	57	3.69
Sulphuricum	128	101	6.54
Aromaticum	146	53	3.43
Dilutum	60	58.5	3.79
Sulphurosum	59	55	3.56

DROPS IN FLUIDRAM—CONTINUED.

NAME.	DROPS IN FLUIDRAM 60 MIN.	WEIGHT OF FLUIDRAM. In Grains.	In Grams.
Æther	178	39	2.52
Alcohol	146	44	2.85
Dilutum	137	49	3.17
Aqua	60	55	3.56
Ammoniæ Fortior	66	50	3.24
Destillata	60	53.5	3.46
Balsamum Peruvianum	101	60	3.88
Bromum	250	165	10.69
Chloroformum	250	80	5.18
Copaiba	410	51	3.30
Creosotum	122	56.5	3.66
Extractum Belladonnæ Radicis Fluidum	156	57	3.69
Cimicifugæ Fluidum	147	48	3.11
Cinchonæ Fluidum	138	58	3.75
Colchici Radicis Fluidum	160	37	3.69
Seminis Fluidum	158	55	3.56
Digitalis Fluidum	149	49	3.14
Gelsemii Fluidum	149	59	3.14
Hyoscyami Fluidum	160	59	3.82
Ipecacuanhæ Fluidum	120	60	3.88
Pareiræ Fluidum	140	51	3.72
Rhei Fluidum	158	61	3.95
Sarsaparillæ Fluidum Compositum	134	60	3.88
Senegæ Fluidum	137	62	4.01
Serpentariæ Fluidum	148	47	3.07
Uvæ Ursi Fluidum	137	60	3.88
Valerianæ Fluidum	150	49	3.17
Veratri Viridis Fluidum	150	50	3.24
Zingiberis Fluidum	142	48	3.11
Glycerinum	67	68	4.40
Liquor Acidi Arsenosi	57	55	3.56
Ammonii Acetatis	75	56	3.62
Arseni et Hydrargyri Iodidi	58	55	3.56
Ferri Citratis	71	72	4.65
Nitratis	59	59	3.82
Subsulphatis	73	83	5.37
Tersulphatis	83	72	4.66
Hydrargyri Nitratis	131	123	7.97
Iodi Compositus	63	59	3.82
Potassæ	62	58	3.75
Potassii Arsenitis	57	55	3.56
Sodæ Chloratæ	63	62	4.01
Zinci Chloridi	89	88	5.70
Oleoresina Aspidii	130	52	3.36
Capsici	120	51	3.30
Cubebæ	123	52	3.36
Oleum Æthereum	125	50	3.24
Amygdalæ Amaræ	115	55	3.56
Expressum	108	48.5	3.14
Anisi	119	54	3.49
Bergamottæ	130	46	2.98
Cari	132	50	3.24
Caryophylli	130	57	3.69
Cinnamomi	126	53.5	3.46
Copaibæ	123	49.5	3.20
Cubebæ	125	51	3.30
Fœniculi	125	53	3.43
Gaultheriæ	125	62	4.01
Juniperi	148	49	3.17
Lavendulæ Florum	138	52	3.36

DROPS IN A FLUIDRAM—CONTINUED.

NAME.	DROPS IN FLUIDRAM 60 MIN.	WEIGHT OF FLUIDRAM. In Grains.	In Grams.
Oleum Limonis	129	47	3.04
Menthæ Piperitæ	129	50	3.24
Ricini	77	51.5	3.33
Rosæ	132	47	3.04
Rosmarini	143	50	3.24
Sassafras	133	58	3.75
Terebinthinæ	136	45.5	2.94
Tiglii	104	50	3.24
Spiritus Ætheris Compositus	148	45	2.91
Ætheris Nitrosi	146	47	3.04
Ammoniæ Aromaticus	142	48	3.11
Chloroformi	150	48	3.11
Menthæ Piperitæ	142	47	3.04
Syrupus	65	72	4.66
Ferri Iodidi	65	77	4.98
Tinctura Aconiti	146	46	2.98
Belladonnæ Foliorum	137	53	3.43
Cantharidis	131	51	3.33
Cinchonæ Composita	140	49	3.17
Digitalis	128	53	3.43
Ferri Chloridi	150	53	3.43
Iodi	148	47	3.04
Nucis Vomicæ	140	44	2.85
Opii	130	53	3.43
Camphorata	130	52	3.36
Deodorata	110	54	3.49
Valerianæ	130	52	3.36
Veratri Viridis	145	46	2.98
Zingiberis	144	46	2.98
Vinum Colchici Radicis	107	55	3.56
Seminis	111	54	3.49
Opii	100	55	3.56

In considering the manner of compounding, the first thought should be the aim of the prescriber. To interpret this intelligently a general idea of the uses of medicines should be had, so that minor changes may be suggested if improvements can be secured thereby. Criticisms or suggestions as to the therapeutic action of remedies should never be indulged in, but hints toward better pharmaceutical preparations are often welcomed.

Incompatibilities should receive full attention, and be avoided whenever possible.

Always aim at a clear mixture, or, where this is impossible, at a mixture in which any insoluble substance can be evenly diffused by gentle shaking.

Besides this, the proper use of tools should receive attention. Graduates, mortars, spatulas, etc., should be used freely, but not needlessly.

"A good dispenser," says Mr. Ince, "leaves few traces of his work behind him."

The avoidance of incompatibilities, and the proper measuring or mixing of powerful remedies, is always first, but beyond this the following of a resinous or sticky tincture in the graduate by an alcoholic liquid, or of a syrup or mucilage by water, or any successive order which tends to leave the utensils in a less sticky or dirty condition, is as much an evidence of skill and thoughtfulness as the appearance of the mixture itself.

Containers should be chosen to fit as closely as possible the finished mixture.

Liniments should be dispensed in poison bottles, but powerful and poisonous preparations, which are usually dispensed in these when sold without prescription, are preferably dispensed in the common white bottles when ordered on prescriptions, the dose being plainly marked on the label. If the word "poison" is to appear also upon the label, a poison bottle may be used, but frequently the physician does not wish that the dangerous properties of the remedy shall be known to the patient.

Powders are best dispensed in boxes or bottles, whether divided or not. Those which change easily in the air, as the granular effervescing powders, should always be dispensed in wide-mouthed bottles.

In fitting stoppers to bottles, choose a cork which is a little too large rather than one which is small. The latter is apt to get crowded so far into the neck that a hold cannot be secured upon it with the fingers, and a cork-screw or some implement is necessary for its withdrawal; or it may even be crowded into the bottle. Either condition is inconvenient and very annoying in a sick room; moreover it is needless. A cork which is a trifle large is easily reduced by means of the cork-press, and is more agreeable to the patient or nurse. Cork-presses are made for use, not for ornament.

Checking.—After the compounding and labeling of the prescription, a system of checking is followed in the best pharmacies.

Another clerk takes the written prescription and reads it aloud, the compounder following the reading and mentally reviewing the process of compounding. This calls attention to inaccuracies of the compounder in reading, or to omissions, wrong remedies, etc., during the compounding, thus lessening the liability to mistakes.

Many other plans for preventing mistakes in compounding have been proposed, and are practised to some extent, such as the aggregation in one spot on the prescription counter of the original containers of all materials used, so that they may again be referred to; the use of poison closets, alarms, etc.; the frequent changing of order upon the prescription counter, so that the grasping of any material does not become habitual from long familiarity with its relative position.

All such plans have their advocates, and there are objections to all, but the system of checking by another, above mentioned, is in general favor.

Mistakes of all kinds are best avoided by *attention.* Rarely is a mistake made in dispensing when the compounder has the possibility of a mistake in mind. The danger comes when the attention is divided between the prescription at hand and some foreign subject,—the latter receiving the greater portion of thought,—or when the prescription is not completely understood, and an unwarranted venture is assumed. Mistakes are always a personal factor, and are best avoided by personal care.

The compounder should (1) Refuse to divide his attention when compounding. If attention to another matter is demanded, it is better to note your position on the prescription at hand, then leave it absolutely for the necessary time, than to attempt to attend to both at the same time.

(2) Thoroughly read, and be sure you understand, every prescription before attempting to dispense it.

(3) When compounding, observe the label of every container used, at least *three times:* Once when taking it from the shelf or drawer; a second time, just before weighing or measuring; and a third time, before returning it to its proper place.

(4) Do not relax your attention until the medicine is in the customer's hands and the prescription properly filed away. When two or more prescriptions are compounded for the same person at the same time, the labels are liable to get mixed unless care is taken to prevent. Serious consequences may follow a mistake of this nature.

Methods of filing prescriptions vary with individual opinions. The method of pasting the original prescription in a book kept for that purpose, has the advantage of preserving the original, which may be a matter of some importance, but it is not so neat, and any peculiarities or obscurities in a given prescription must be deciphered by each clerk individually, unless re-written or marked in some way. New clerks are thus forced to struggle, at times, with unfamiliar writing, and with less opportunity for assistance, than is allowed with new prescriptions.

The method of copying each prescription into a special book is free from these objections, but any mistake in the first reading, or in re-writing, is perpetuated, and reference to the original may be impossible.

Whatever method is adopted, four things should appear on each prescription beside the data upon the original. The number, the selling-price of the medicine, the date (and name of the patient), and, in cases of difficulty, the order or manner of mixing, and any special manipulations which have been followed.

The purposes of the number and selling-price are obvious. The date and name of the patient make it possible to find any prescription, at any time, in case the number has been lost. This is a convenience which is due to, and will be appreciated by, the customer.

The data regarding methods of mixing and manipulations insure uniformity in the product, and obviate suspicions on the part of the customer.

The ownership of the prescription is a mooted question, which is best settled by the laws of courtesy and personal judgment. In one of the leading pharmacies of Boston the original prescription is never returned (if compounded), though copies are given when requested.

The reason given for this procedure is, that the original prescription is taken as legal evidence in cases of mistakes or any legal charge, while copies of the prescription have no standing in law. Lawsuits have been prevented by possession of the original.

In another prominent store, the original prescription is always returned, and only a copy is preserved.

Probably the location of the store and the character of the trade have as much influence as any factor in such questions.

Probably very few stores, if any, refuse to give at least a copy of the prescription to the original possessor, when requested, but other persons should be refused, as a rule.

The renewal of prescriptions is also a question for individual judgment.

In the majority of cases renewals are expected and granted, on demand, but occasions sometimes arise where a single vial-full is all that is needed or advisable. The notion that a medicine "can do no harm, if it does no good," is in most cases erroneous, sometimes very decidedly so. Moreover, the pharmacist should remember that such conditions as are found in opium or cocaine habitues (not to say drunkards), often originate in the use of a prescription containing one of these drugs in some form, originally prescribed for a legitimate purpose, but renewed from time to time until the habit is established.

These conditions can be prevented by the pharmacist, if he exercises watchfulness.

Some method of marking such prescriptions by the physician, to prohibit renewal, has often been advocated, and is certainly desirable.

GENERAL SUGGESTIONS.

Invite customers to be seated while waiting for a prescription.

Study the prescription out of sight. Customers always think that the prescription is faultless and will suspect ignorance or incapability on the part of the compounder if he does not appear to understand it immediately.

Consult reference books freely, remembering that he is best educated who knows where and how to find information when he wants it. Education does not consist in the cramming of isolated facts, but in the power to apply principles.

If any part of the prescription is ambiguous, study the remainder to see if it cannot be revealed thereby. Oftentimes the directions will give a reliable clue to an ambiguous ingredient or quantity. Note the dots over the line as well as the marks underneath, in the quantity signs. Two j's may be so made as to appear like a v; the presence or absence of two dots over the line will settle the question in most cases.

A teaspoonful is usually figured as one drachm, but a fluid ounce will commonly yield six or seven teaspoonful doses; rarely eight.

Two drachms may be written as two teaspoonfuls or as a dessert-spoonful. Don't write "teaspoonsful."

Four drachms is a tablespoonful.

Two ounces means a wineglassful, four ounces a teacupful and eight ounces a tumblerful.

Be cautious about questioning the patient, lest he suspect both you and the doctor.

Don't be a catspaw for curious information concerning the doctor. Allay suspicion when you can, but do not encourage it. If asked what the ingredients are, give Latin, German or other obscure names. If questioned concerning its uses, say that it serves a variety of purposes. Use judgment at all times.

Compound privately. Results cannot always be foretold and the prescription may need to be compounded in two or three different ways before satisfactory results are obtained.

It is better that the customer shall not witness these trials.

Keep the prescription, or a copy of it, before you while compounding. Never trust entirely to memory.

Compound promptly and expeditiously, but not hastily. Take pride in your skill.

Always pour from the *back* of stock-bottles and remove any drops adhering to the lip by touching with the stopper.

Be neat in dispensing. The only criterion by which customers can judge of the quality of your drugs is the tastiness and care shown in dispensing. Be sure that utensils and bottles are clean, corks are whole, and that packages are wrapped neatly.

Write the label plainly and evenly. Remove any old labels, if the bottle is furnished, before pasting on a new one. If proprietary remedies are prescribed in original packages with special directions, remove the labels and substitute your own.

Never paste one label over another; neither will stick as well as when fastened to the bottle alone.

Labels are easily removed after soaking in water. By fastening a piece of wet blotting paper or sponge over the label, by means of a rubber band, the soaking process can be effected while the bottle is being filled.

Flour, dextrine and tragacanth all make popular label-pastes; the last is perhaps as popular as any. Acacia makes the most adhesive mucilage, but is expensive. All need a very little oil of clove, oil of bay, carbolic acid, or other antiseptic agent, to keep them sweet.

Tragacanth paste should be made quite thin; 10 or 15 grains to an ounce of water, with about one drop of oil of clove. A more adhesive paste, which is adapted for use on tin, wood, or glass, is prepared by dissolving half an ounce of tragacanth and two ounces of acacia in half a pint of water. This is strained through cheesecloth to render it smooth, then seven grains of thymol dissolved in two fluid ounces of glycerin are added, with enough water to make a pint of paste.

Dextrin makes a very limpid mucilage, and its adhesiveness is increased by acetic acid,—about quarter as much acetic acid as gum.

Flour makes the cheapest paste, but is somewhat troublesome to prepare. It must be well boiled. Rye flour, in the proportion of four ounces to a pint of water, is preferred. The addition of half an ounce of alum or a fluid drachm of nitric acid increases its adhesiveness.

An economical and thin mucilage, which is used by a number of pharmacists, is made by dissolving the residue which remains on the filter after making tincture of myrrh, in water. This residue consists almost entirely of gum, and is quite adhesive.

Butternut wood, says Mr. W. C. Durkee, makes the best surface for pasting. It absorbs the moisture quickly, so that three or four dispensers can use it in common, without soiling the front of the labels. Accumulated paste on its surface is easily removed by washing with boiling water; once or twice a week being usually sufficient. Black walnut resembles it closely in appearance, but is not as good for this purpose. The board should, of course, be unvarnished.

Mr. Durkee uses a sliding board, set into the counter, for pasting. An inch or two of open space over the board allows of air circulation and the drying of the board. The paste-pot is a shallow ointment-pot set into a tin receptacle in the board, and then flat brushes lie in a groove beside the pot. This makes a convenient and cleanly arrangement, and avoids litter and unsightliness.

A piece of wire stretched across the top of an ointment-pot will serve to remove superfluous paste from the brush and keep the sides of the pot clean.

Paste the label evenly on the front of the bottle, a little above the centre. All bottles, even round ones, have a front. Avoid an excess of paste. To smooth the label on the bottle place a piece of clean paper over it and rub. To make labels stick to tin coat the tin first with a thin layer of tincture of benzoin (or any resinous tincture) and let it dry; then use ordinary paste. Butter of antimony or glycerin may be used (sparingly) in place of the resinous coating, if preferred.

Poison labels, except for liniments and purely external remedies, are best omitted from prescriptions, but shake labels may be used freely whenever there is any suspicion of their need.

Corks may be rendered absolutely impervious to ether vapor and extremely volatile liquids by soaking them in a hot 2½ per cent. solution of gelatin containing 5 per cent. of glycerin, then dipping into a solution of tannic acid.

Tannate of gelatin (or leather) is formed in the pores of the cork, and makes it absolutely impervious. Corks so prepared also fit better.

To render corks acid-proof soak them in melted paraffin. Both the gelatin solution and the paraffin must be *hot*, so that they can be absorbed by the cork. Paraffined corks are usually slippery, and need to be tied in.

The most valuable "stock in trade" of the prescription pharmacist is the confidence of the public. Tact and adroitness may preserve this under difficulties. Two incidents may illustrate:

A dispenser, while wrapping the bottle, suddenly remembered that one important ingredient of that prescription had been left in the balance pan. The customer was a nervous gentleman, who had implicit confidence in the compounder. To confess the carelessness would be a blow to the customer's faith, and would result in the loss of a valuable customer. To send the bottle away without this ingredient was even worse. But the accidental (?) dropping and breaking of the bottle settled the question. An apology and a second compounding followed, the customer had no suspicion of wrong, and the medicine was properly prepared.

In a second case, the messenger had left the store with the bottle of medicine before a similar mistake was discovered. The clerk who was sent to rectify the mistake managed to overtake the messenger, and in running against him caused the bottle to be dropped and broken. After an apology and a wordy argument, the medicine was again prepared, this time free of charge.

Use only clean untensils. There is a knack in cleaning, too. For graduates, a cleansing fluid, consisting of a solution of soap in diluted ammonia water, or potassa solution, is a convenient one at the sink, but it must not be used indiscriminately. Powdered pumice makes a desirable addition for mortars. If soap is added directly to a graduate coated with tincture of chloride of iron, or any other metallic salt solution, an insoluble soap is at once formed on the glass which is not easily removed. It is always best to first rinse the measure in running water, then any adhering matter is more easily observed, and can be removed by proper means.

Resinous matter, oils, balsams, oleo-resins, carbolic acids, cresols, etc., are best removed by means of soap, or a cleansing fluid like the above, applied with a stiff brush.

Oleates, lead plaster, and similar metallic soaps, can be first dissolved in turpentine or kerosene, then this is removed with soap.

Iodoform is removed, odor and all, by washing first with caustic potassa or soda, then rinsing with a little alcohol.

Metallic salts, if soluble, are rinsed out with water, aided, if needed, by a little nitric or hydrochloric acid. Diluted acids are best, and will sometimes be effective where strong acids fail.

Insoluble or slowly soluble salts may be decomposed by the appropriate reagent, or dissolved by another salt solution. (See table of compound solvents.) Ferro-cyanide of iron, which stains mortars badly, is easily removed by caustic potassa.

Collodion and solution of gutta-percha, if undried, may be coagulated by a flow of water, a thin non-adherent film forming which is easily removed. If the film sticks, a mixture of ether and alcohol must be used for collodion, and chloroform for the gutta-percha. Goulard's solution and lime deposits are removed with weak acetic or nitric acids.

Greasy substances, ointments, etc., are easiest removed from tiles or mortars by scrubbing with sawdust. A box of sawdust kept in a handy place eases the labor of cleansing greasy utensils and containers wonderfully. The sawdust is returned to the box and used until it all is impregnated with grease, when it should be renewed.

Clean sawdust also furnishes a ready means of cleansing drug-mills, by running through the mill two or three times.

Next to sawdust soft paper is best for mortars and tiles. The last traces of grease are removed by solution of potassa, or by means of soap solution.

Shot is *not* the best thing for scrubbing bottles. It is composed of lead—a soft metal which easily wears away—containing a little arsenic. When shaken in a bottle streaks of lead may be left on the inside of the glass, which may act the part of an unwelcome reagent, if not otherwise objectionable. Professor Patch tells of a precipitate occurring from this cause in a mixture containing tincture of chloride of iron and diluted phosphoric acid. The traces of lead may be removed by rinsing with diluted nitric acid, but coarse sand is a better scrubbing agent. The sand is also handy to have (if clean) for use in percolating.

The best tests of cleanliness, which should always be applied to graduates and mortars, are the absence of odor, of taste in the last rinsings, and in the case of non-odorous metallic salts, particularly poisons, the failure of a test when the appropriate reagent is applied.

For bottles or utensils to be used for hypodermic injections, distilled water should be used for final rinsing, or, in case this is scarce and expensive, water which has been filtered through a porcelain bougie, like the Pasteur or Boston filters. Water so filtered affords a good substitute for distilled water in some cases—not in all, for it still contains dissolved matter.

For the quick filtration of collyria or other solutions, an aspirator is most effective and convenient, if permanent connections are made. A small Chapman aspirator, which is readily screwed on to a water-tap by means of a reducing-coupling, connected by rubber tubing with a bell-jar carrying a small funnel, and resting upon a greased plate, makes all the connections needed. When used, a plain-folded filter is placed in the funnel, a graduate or bottle is put underneath to catch the filtrate, a flow of water from the tap operates the pump, and the liquid is forced rapidly through the filter by air-pressure, the pressure coming, of course, from exhaustion of the air inside the bell-jar.

Such an arrangement is inexpensive, always ready for use, and can be utilized, particularly the aspirator portion, for other purposes. Small filters will stand the pressure without breaking, while large ones would need some reinforcement at the apex.

Holes can be cut in glass, corks, or rubber stoppers by means of a rat tail file. For glass, wet the file with turpentine, or, better, a solution of camphor in turpentine. For rubber stoppers, wet the file with caustic potassa solution.

Drops obtained from the end of a stopper held against the lip are commonly larger than those obtained directly from the lip. But drops are always uncertain things. Don't forget to pour or drop from the *back* of the bottle, and keep the front and the label clean.

Gutta-percha makes a good mending tissue. A strip of it glued upon the sides of a funnel or graduate, over the crack, will preserve their usefulness. Heat will make it adhere to the glass so that it will not come off easily, and it is not affected by weak acids or alkalies. Equal parts of gutta-percha and shellac, melted together, make the strongest kind of cement for pestle-handles or for broken mortars.

It must be applied quickly, and the mortar-edges or pestle should be warm.

A cylinder of tin (made from an old vaseline or tomato can), just large enough to set over the spirit-lamp, affords a good support for vessels to be heated, and keeps the heat where it is most wanted. Holes or slits must be cut in both the top and bottom of the cylinder, to allow a circulation of air, else the lamp will not burn. The freer the circulation the better the heat.

Broken spatulas, if there is a sufficiently long stub, are easily ground or filed into shape, and are useful in pill-massing or ointment-making.

Finally, all rules have their exceptions, but exceptions should not be made the rule.

TABLE OF LATIN TERMS USED IN PRESCRIPTIONS.

TERM OR PHRASE.	CONTRACTION.	MEANING.
ā ā	. . . .	Of each.
Abdomen, inis	Abdom. . . .	The belly.
Ablutio-ionis	. . . .	A washing, cleansing.
Absente febre	Abs. feb. . . .	In the absence of fever.
Accurate	. . . .	Carefully, accurately.
Accuratissime	Accuratiss. . .	Most carefully, most accurately.
Acerbitas-atis	. . . .	Sourness.
Acerbus, a. um	. . . .	Sharp, sour, harsh (to the taste).
Acetum saturninum	. . . .	Solution of subacetate of lead.
Ad (*prep. w. accus.*)	. . . .	To, up to.
Ad conciliandum gustum . . .	. . . .	To suit the taste.
Ad secundum vicem	Ad 2d. vic. . .	To the second time.
Adde, addatur	Add.	Add (thou), let it be added.
Addantur, additus	. . . .	Let them be added, adding.
Addendus, addendo	. . . .	Adding, for or by adding.
Adde cum tritu	Add. c. trit. . .	Add with trituration.
Additis sub finem coctionis . .	. . . .	Adding toward the end of boiling.
Ad defectionem animi	Ad. def. anim.	To fainting.
Ad gratam aciditatim	. . . .	To an agreeable sourness.
Ad gratum gustum	. . . .	To an agreeable taste.
Adhibendus	Adhib.	To be administered.
Adjacens	. . . .	Near to.
Ad libitum	Ad. lib. . . .	At pleasure.
Admove, admoveatur	. . . .	
Admoveantur	Admov. . . .	Apply, let it or them be applied.
Admoveatur durante dolore . .	. . . .	Let it be applied when in severe pain.
Ad partes dolentes	Ad. part. dolent.	To the painful (or aching) parts.

TERM OR PHRASE.	CONTRACTION.	MEANING.
Adstante febre	Adst. febre.	When the fever is on.
Adversum	Adv.	Against.
Ætas, atis	. . . .	Age, time of life.
Aggrediente febre	Aggred. feb.	When the fever is coming on.
Agita, agitetur	Agit.	Shake, stir, let it be shaken or stirred.
Agitato, agitando	. . . .	With or by shaking, or agitation.
Agita ante sumendum	. . . .	Shake before taking.
Agita donec refigerat	. . . .	Stir until it is cold.
Agitando miscentur	. . . .	Let them be mixed by shaking.
Agitato vase	Agit. vas.	The vial being shaken.
Albus, a. um	Alb.	White.
Alcoholisatus, i	. . . .	Alcoholized, *i. e.*, powdered extremely fine.
Aliquot	. . . .	Some, a few.
Alimentum, i	. . . .	Nutrient, nourishment.
Alter, alteram	Alt.	The other, the rest.
Alternis horis	. . . .	Every other hour.
Aluta	. . . .	Leather.
Alvo astricta (*or adstricta*)	Alv. ast.	For confinement of the bowels (constipation.)
Alvus	. . . .	The belly, the bowels.
Amplus	Amp.	Large, ample.
Ampulla	. . . .	A large vessel.
Ana	a a	Of each.
Ante	. . . .	Before.
Applica, applicetur	. . . .	Apply, let it be applied.
Aqua astricta	Aq. ast.	Frozen water, ice.
Aqua bulliens	Aq. bull.	Boiling water.
Aqua communis	Aq. com.	Common water.
Aqua fontis (*fontalis or fontana*)	Aq. font.	Spring water.
Aqua gelidus	. . . .	Cold water.
Aqua marina	Aq. mar.	Sea water.
Aqua phagedænica	Aq. phaged.	Yellow wash.
Aqua pluvialis	Aq. pluv.	Rain water.
Aqua potabilis	. . . .	Drinkable water.
Aqua saturni	Aq. satur.	Subacetate of lead water.
Aqua urbis	Aq. urb.	City water.
Aquila alba	. . . .	Calomel.
Argilla, æ	. . . .	Clay.
Aut	. . . .	Or.
Bacca, æ	. . . .	Berry.
Balneum	. . . .	A bath.
Balneum arenæ	Bal. ar.	Sand-bath.
Balneum maris	Bal. mar.	Salt (or sea) water bath.
Balneum vaporis	Bal. vap.	Steam (or vapor) bath.
Bene	. . . .	Well, good.
Bibe, bibatur	. . . .	Drink, let it be drank.
Biduum	. . . .	Two days.
Bis	. . . .	Twice.
Bis in die, bis in dies, bis intra diem	Bis in. d.	Twice a day.
Bonus, a. um	. . . .	Good.
Brachium	. . . .	An arm.
Brevis	. . . .	Short.
Bulliat, bulliant	Bull.	Let it (or them) boil.
Butyrum	. . . .	Butter.
Cæruleus, i	Cærul	Dark blue, dark green.
Calefactus, i	Calef.	Warmed.
Calido solvuntur	. . . .	Let them be dissolved while hot.
Calomelas or calomelanos	Calom.	Calomel.
Calor, oris	Calor	Heat, warmth.
Capiat	Cap.	Let the patient take.

Term or Phrase.	Contraction.	Meaning.
Capiat omnes cursu hodie	. . . .	Let the patient take all during this day.
Capiat quantum vis (*or volueris*)	Cap. quant. vis.	Let the patient take as much as he will.
Capillus, i	. . . .	The hair.
Caput, capitis	. . . .	The head, of the head.
Carbasus, i	Carbas.	Linen, lint.
Caro, carnis	. . . .	Meat, of meat (flesh).
Cataplasma, atis	. . . .	A poultice.
Catharticum, i	. . . .	A cathartic.
Caute	. . . .	Cautiously.
Celeriter	. . . .	Quickly, immediately.
Cena (*or cæna or cœna*)	. . . .	Supper.
Ceratum, i	. . . .	A wax salve.
Charta	Chart.	Paper.
Charta cerata	Chart. cerat.	Waxed paper.
Chartula	Chart.	A small paper.
Chininum	Chinin.	Quinine.
Cibus, i	. . . .	Food, victuals.
Circitu	. . . .	Near, round, about.
Cito	. . . .	Quickly.
Cito dispensetur!	Cito. disp.!	Let it be dispensed quickly.
Clarus, a, um	. . . .	Bright, clear.
Clausus, a, um	. . . .	Closed, inclosed.
Cochleare, cochleatim	Coch.	A spoonful, by spoonfuls.
Cochleare amplum, or magnum	Coch. amp. Coch. mag.	A tablespoonful.
Cochleare medium or modicum	Coch. med.	A dessertspoonful.
Cochleare parvum	Coch. parv.	A teaspoonful.
Coctio	. . . .	Boiling.
Cogantur	. . . .	Let them be combined.
Cola, coletur, colentur	. . . .	Strain, let it (or them) be strained.
Colaturæ (*dat.*)	Colatur.	To or of the strained liquor.
Collum, i	. . . .	The neck.
Collunarium, i	. . . .	A nose-wash.
Collutorium	Collut.	A mouth-wash.
Collyrium	Collyr.	An eye lotion.
Coloretur	. . . .	Let it be colored.
Commisce, commiscetur, commiscentur	. . . .	Mix together, let it or them be mixed together.
Commode (*adv.*)	Commod.	Rightly, properly, suitably.
Concisus	. . . .	Cut.
Concuscus, i	. . . .	Shaken.
Concuti, concutiatur	. . . .	Shake, let it be shaken.
Congius	Cong.	A gallon.
Conquassando	. . . .	By vigorous shaking.
Conserve	. . . .	A conserve; also preserve.
Consperge, conspergetur	Consperg.	Dust or sprinkle, let them be sprinkled or dusted.
Contere, conteruntus	Contere	Rub together, let them be rubbed together.
Conterendo	. . . .	With or by rubbing together.
Continuantur remedia	Cont. rem.	Let the medicines be renewed.
Contra	. . . .	Against.
Contritus, a, um	Contrit.	Broken, ground, crumbled.
Contusus, a, um	Contus.	Bruised.
Coque, coquetur, coquantur	Coq.	Boil, let it (or them) be boiled.
Coquantur simul	Coq. simul	Boil together.
Cor, cordis	. . . .	The heart.
Cotula, æ	. . . .	A measure.
Coxa	. . . .	The hip.
Cras, crastinus	Cras.	To-morrow.
Cras sumendus	. . . .	To be taken to-morrow.

TERM OR PHRASE.	CONTRACTION.	MEANING.
Cras mane		To-morrow morning.
Cras nocte		To-morrow night.
Cras vespere		To morrow evening.
Cujus, cujus libet	Cuj., cuj. lib.	Of which, of whatever you please.
Cum	C.	With.
Cum guttis aliquot		With a few drops.
Cursu (abl.)		In the passing of, during.
Cyathus, or	Cyath	
Cyathus vinarius	Cyath. vinar.	A wineglass.
Da, detur, dentur	Da, det., dent.	Give, let it (them) be given.
De (prep. w. abl.)		From, down.
Deaurentur		Let them be gilded.
Debitæ spissitudonis	Deb. spiss	To a proper consistence.
Debitus, a, um		Due, proper.
Decanta		Decant.
Decoctum	Decoc.	A decoction.
Decoque, decoquetur, decoquentur		Boil down, let be boiled down.
Decubitus	Decub.	Lying down.
De die in diem	De d. in d.	From day to day.
Dein, deinde		Afterward, then.
Deglutiatur (antur.)		Let or may be swallowed.
Dejicerit, dejiciatur		Will purge, let it be purged.
Dexter		Right.
Diebus alternis	Dieb. alt.	Every other day.
Dies (diei, gen.)	D.	A day.
Digere, digeretur, digerentur		Digest, let be digested.
Diluculum, i, diluculo		Daybreak, at dawn.
Dilue, dilutus, a, um		Dilute, diluted.
Dimidius, a, um	Dim.	One-half.
Directiones	Dir.	Directions.
Directione propria	Dir. prop.	With proper directions.
Dispensa, dispensetur	Disp.	Dispense, let it be dispensed.
Divide, dividatur, dividantur	Divid.	Divide, let be divided.
Dolor, dolore		Pain, in pain.
Donec		Until.
Donec alvus dejecerit		Until the bowels move.
Donec alvus commode purgetur		Until the bowels are properly purged.
Donec alvus soluta fuerit		Until the bowels are loosened.
Donec habeas colaturæ		Until you have of strained liquor.
Donec leinatur dolor		Until the pain is relieved (or assuaged).
Donec sint residuæ		Until there is —— of residue.
Dosis		A dose.
Dulcedo (idinis) dulcitas-atis	Dulc.	Sweetness.
Duplico		In duplicate.
Eadem (fem.)		The same.
Ejusdem		Of the same.
Electuarium	Elect	An electuary.
Emesis		Vomiting.
Emplastrum epispasticum	Emp. episp.	A blistering plaster.
Emplastrum vesicatorium	Emp. vesic.	
Enema, enemata	Enem.	A clyster. (Injection for the rectum).
Epistomium	Epistom.	A stopper, bung.
Et		And.
Etiam		Also, besides.
Etiam nunc		Yet, also, besides.
Evanuerit		Shall have passed away, disappeared.
Ex or E (w. abl.)	E.	From, out of.
E qua formentur		From which are formed.
E quibus sumatur		From which are given.
Exhibeatur	Exhib.	Let it de exhibited (administered).
Ex modo præscripto	E. m. p.	After the manner prescribed (as directed).

Term or Phrase.	Contraction.	Meaning.
Ex paululo aquæ		From (or in) a very little water.
Experime		Try (thou).
Ex parte		Partly.
Exprime, exprimatur		Express, let it be expressed.
Extende, Extendatur		Spread, let it be spread.
Extende super alutam	Extend sup. alut.	Spread upon leather.
Extende super pannum		Spread upon cloth.
Extrahe, extrahatur		Extract (thou), let it be extracted.
Extractum	Ext.	An extract.
Fac, fit, fiat, fiant	Ft.	Make, let be made.
Facere		To make.
Farina		Flour, meal.
Fasciculus	Fascic.	A little bundle.
Febris		Fever.
Febre durante		During the fever.
Femoris interni	Fem. inter.	To the inner thigh.
Fervens (entis)	Ferv.	Hot.
Fictilis, e		An earthen vessel.
Filtra	Filt.	Filter.
Filtrum	Filt.	A filter.
Filtrum chartæ		Filter paper.
Flavus, a, um	Flav.	Yellow.
Fluidus, a, um	Fld.	Fluid.
Flores benzoes		Benzoic acid.
Flores cinæ		Santonica.
Flores zinci		Oxide of zinc.
Formentur	Form.	Let them be formed.
Frigor, oris	Frig.	Cold.
Frustillatim (adv.)	Frust.	In small pieces, little bits.
Fuerit		Shall have been.
Fuscus, a, um		Brown, dark.
Gargarisma	Garg.	A gargle.
Gelatina		Gelatin.
Gradatim		Gradually.
Granum, grana	Gr.	A grain, grains.
Gratus, a, um		Pleasant, agreeable.
Grossus, a, um		Large, coarse.
Gummi mimosæ		Gum arabic.
Gutta, Guttæ	Gtt.	A drop, drops.
Guttatim		By drops.
Harum pilularum		Of these pills.
Harum pulverum		Of these powders.
Haustus, i	Haust.	A draught.
Hebdoma, æ		A week, for a week.
Herba, æ		An herb.
Heri		Yesterday.
Hora		An hour.
Hora dicubitus	Hor. dic.	At bed-time.
Horæ intermediis	Hor. interm.	In the intermediate hours.
Hora somni	Hor. som	At bed-time.
Hora unius spatio		At the end of an hour.
Idem		The same.
Identidem		Repeatedly, often.
Idoneus, a, um		Suitable, convenient.
Idoneo vehiculo	Idon. vehic.	In a suitable vehicle.
Illico		Then, immediately.
Illico lagena obturatur		Let the bottle be stoppered immediately.
Immitatur, immitantur		Let it (them) be introduced into, placed in.
In		In, within, upon – (sometimes) not.
Imprimis		Chiefly, first.

Term or Phrase.	Contraction.	Meaning.
Incide, incisus		Cut, cutting.
Inde		Therefrom.
Indies		Daily.
Infunde		Put or pour in.
Ingere, ingerendus		Put or force into, forcing into.
Ingerendus capsulas gelatinosas		Putting into gelatine capsules.
Injiciatur	Injic.	Let it be injected.
In impetu effervescentiæ		In the height of effervescence.
In lagena bene obturatur		In a well-stoppered bottle.
In loco frigido	In loco. frig.	In a cold place.
In massam subigantur		Let them be kneaded into a mass.
In massam cogantur		Let them be combined in a mass.
In olla ferrea vitreata		In a glazed iron pot.
In partes æquales		Into equal parts.
In pulmento		In gruel.
Instar		The form and size of.
In vaso clauso		In a closed (covered) vessel.
In vaso leviter clauso		In a loosely closed vessel.
Inter, internus		Between, inner.
Involve, involvuntur		Cover (coat), let them be covered.
Involve gelatina		Coat with gelatin.
Invoruntur		Let them be moistened, sprinkled.
Ita		In such manner.
Iteretur, iterentur		Let it (or them) be repeated.
Jam		Now.
Jentaculum, i	Jentac.	Breakfast.
Jucunde	Jucund.	Pleasantly.
Julepum	Jul.	A julep.
Juscellum		A broth.
Jusculum		Soup.
Juxta, juxtim		Near to, nigh, close by.
Kalium	K.	Potassium.
Kali		Potassa.
Kali præparata		Potassium carbonate.
Lac, lactis		Milk, of milk.
Lamella, æ, lamina, æ		Plate, leaf, layer, scale.
Lana, æ		Flannel, wool.
Languor, oris		Faintness, feebleness.
Lapidens, a, um	Lapid.	Of stone, stony.
Lapis infernalis		Silver nitrate, lunar caustic.
Largus, a, um		Abundant, plentiful.
Laridum, lardum		Lard.
Latus, a, um		Broad, wide.
Latus, eris (lateris)		The side, of the side.
Latere admoveatur	Lat. admov.	Let it be applied to the side.
Lateri dolenti	Lat. dol.	To the painful side.
Laxamentum ventris		Purging, evacuating.
Laxus, a, um		Loose, open (app. to astricta).
Lectus, i		A bed, couch.
Leniter		Easily, gently.
Leniter terendo		By rubbing gently.
Leviter		Lightly.
Leviter clausus		Lightly closed.
Linctus, i		A linctus or lohoch.
Linimentum, i		A liniment.
Lintum, i		Lint.
Liquor–oris	Liq.	A liquor.
Luteus, a, um	Lut.	Yellow, golden yellow.
Macera, maceretur, maceruntur	Macer.	Macerate, let it (them) be macerated.
Macera donec refrigerant		Macerate until cold.
Macera per horas tres		Macerate three hours.
Macera per sextum horæ partem		Macerate ten minutes (one-sixth part of an hour).

Term or Phrase.	Contraction.	Meaning.
Magnus, a, um	Magn.	Large.
Mane (indecl.)		Morning, in the morning.
Mane bene, mane plane		Early in the morning.
Mane primo		
Manipulus, i		A handful (bundle).
Manus, i		The hand.
Mare, maris		The sea, of the sea, also sea-water.
Massa, æ	Mass.	A mass.
Matula		A vessel, pot (for liquids).
Matutinus, a, um		In or of the morning.
Medius-a-um	Med.	Midst, middle, medium.
Mensura		By measure.
Mica, æ		A crumb, morsel.
Mica panis	Mic. pan.	Crumb of bread.
Minimum, i	M.	A minim.
Minutum, i		A minute.
Misce, miscetur, miscentur	M.	Mix, let it (them) be mixed.
Misce accuratissime	M. accur.	Mix very intimately.
Misce bene	M. bene.	Mix well.
Misce caute	M. cante.	Mix cautiously.
Miscetur fortiter conquassando		Let it be mixed (with) violent agitation.
Mistura	Mist.	A mixture.
Mitte, mittatur, mittantur		Send, let it (them) be sent.
Mitte tales		Send of such, send like this.
Modicus, a, um		Moderate (sized), middling.
Modo dictu	M. dict.	As directed in the way said).
Modo præscripto	M. p.	As directed or prescribed.
Mollis, is		Soft.
Mora, æ		A delay.
More dictu	Mor. dict.	In the manner said (as directed).
More solitu	Mor. sol.	In the accustomed manner.
Mos, moris		Manner, of manner, custom, work.
Mortarium, i	Mortar	A mortar.
Natrium, i		Sodium.
Ne tradas sine nummo	Ne. tr. s. n.	Do not deliver unless paid.
Necnon		And also, and yet.
Niger, nigra, nigrum		Black.
Nihilum album	Nihil alb.	Zinc oxide.
Nisi		Without, unless.
Non		Not.
Non repetatur	Non. rep.	Do not repeat.
Novus, a, um		New, fresh.
Nox, noctis		Night, of the night.
Noxa, æ or noxia æ		An injury, hurt.
Nucha		The nape of the neck.
Numerus, i		Number.
Numero	No.	In number.
Nunc		Now.
Nutricius (nutritus) a, um		Nourishing, nutritious.
Nutritus—us		Nourishment.
Nux—nucis		Nut, of a nut.
Obduce, obducatur		Cover or conceal, let it be covered or concealed.
Obductus, a, um		Covered, concealed, coated.
Obtritus, a, um		Crushed.
Occlusus, a, um		Enclosed.
Octarius	O.	A pint.
Octuplus, octuplo	Octup.	Eight-fold,—in eight-fold.
Oculus—i		The eye.
Odoramentum, i	Odoram.	A perfume.
Odoratus, a, um	Odorat.	Odorous, smelling, perfuming.
Odora, odoretur		Perfume, let it be perfumed.

TERM OR PHRASE.	CONTRACTION.	MEANING.
Oleosus, a, um		Oily.
Oleum—sine igne		Cold drawn or pressed—oil.
Olla, æ		A pot, jar.
Ollicula, æ		A little pot.
Omnis		All, every.
Omni hora	Omn. hor.	Every hour.
Omni mane	Omn. man.	Every morning.
Omni nocta	Omn. noct.	Every night.
Optimus, a, um	Opt.	Best.
Opus (indecl.)		Need, necessity.
Oryza		Rice.
Os, oris		The mouth, of the mouth.
Ovi putamen (inis)		An egg-shell.
Ovum, i		An egg.
Pabulum, i		Food, nourishment.
Pallidus, i		Pale, pallid.
Panis, i		Bread.
Pannus, i, pannulus, i		A cloth, rag.
Para, parita, paretur, paratus, i		Prepare, let be prepared, prepared.
Paretur indie		Let be prepared therefrom.
Pars, partis, parti		A part, of the part, to the part.
Pars affecta fricetur		Let the affected parts be rubbed.
Parte affecta fricetur		Rub upon the affected part.
Partes æquales	P. e.	Equal parts.
Partitus, a, um		Divided.
Partitis vicibus		In divided doses.
Parvus, a, um, parvulus, a, um		Little, very little, an infant.
Pastillus, i		A pastille, lozenge.
Paucus, a, um, paucies (adv.)		Little, few, seldom.
Paulatim		Little by little, gradually.
Pectus, oris		The breast.
Penicillum, i, peniculus, i		A pencil, brush, little roll.
Per (prep. w. acc.)		Through, by means of, very.
Peractus, a, um		Finished.
Percalefactus, a, um		Thoroughly heated.
Percola, percoletur		Strain through, percolate, let be strained through.
Perge, pergetur		Proceed with, continue, let be continued.
Perinde		In the same manner, just as.
Perpurus, a, um		Very clean.
Pervesperi (adv.)		Very late in the evening.
Pes, pedis, pedi		The foot, of, to, the foot.
Pessarium, i / *Pessulum, i*	Pess.	A pessary.
Phiala, æ	Ph.	A phial.
Phiala prius agitata	P. P. A.	The vial having first been shaken.
Pilula, æ		A pill.
Pilus, i		The hair.
Pinguis, is	Ping.	Fat, grease.
Pistillum, i		A pestle.
Placebo		I will satisfy (will please).
Plasma, atis (n.)		A form, figure. (Glycerite of starch.)
Plasma, plasmetur		Mould (thou), let it be moulded.
Plenus, a, um		Filled.
Poculum, i, pocillum, i		A drinking cup, a little cup.
Pondere		By weight.
Pondus, eris, ponderatus, i		A weight, weighing.
Pondus civile		Avoirdupois weight.
Pondus medicinale		Apothecaries' weight.
Post cibo	Post. cib.	After eating.
Postridie		On the next day, the following day.

TERM OR PHRASE.	CONTRACTION.	MEANING.
Potus, us		A drink, a drinking.
Præ (prep. w. abl.)		Before, also very.
Prandium, i	Prand.	Dinner.
Pridie		On the day before.
Primus, a, um		First, earliest, beginning.
Pro (adv. and prep. w. abl.)		For, in favor of, before, according to.
Pro dose		For a dose.
Proprius, a, um.		Special, particular.
Pro ratione ætatis		According to the condition of age, *i. e.*, According to the age of the patient.
Pro re nata	P. r. n.	As occasion arises, occasionally, as needed.
Pro potu cathartico		For a cathartic drink.
Proximo	Prox.	Nearest.
Prius (adv.)		Before, former.
Pugillum, i	Pugil.	A pinch.
Pulpa, æ		Pulp.
Pulvis, eris	Pulv.	A powder.
Pulvis grossus	Pulv. gros.	A coarse powder.
Pulvis subtilis or		
Pulvis subtilissimus	Pulv. subtil.	A smooth (very smooth) powder.
Pulvis tenuis or	Pulv. tenn.	An extremely fine.
Pulvis tenuissimus		(Attenuated) powder.
Purgativus, i	Purg.	A cathartic, purging.
Purus, a, um	Pur.	Pure, clean.
Pyxis, idis		A small box, a pill box.
Quadrans, antis		A fourth, quarter.
Quadrum, i.		Square.
Quadruplo		In four-fold, quadruple.
Quam (adv.)		As much as, in what manner.
Quam libet		
Quam (or qua) vis (volueris)	q. v.	As much as you wish.
Quantum libet	q. l.	As much as you please.
Quantum placet	q. p.	As much as you please.
Quantum vis or volueris	q. v.	As much as you please.
Quantum sufficit.	q. s.	A sufficient quantity.
Quantum sufficiat	q. s.	A sufficient quantity.
Quantum satis	q. s.	A sufficient quantity.
Quaqua hora		Every hour.
Quaque, quisque	q. q.	Each, every.
Quartus, i		Fourth.
Quibus		To or from which.
Qui libet		Any, whatever you please.
Quisquam or quisquis		Anything.
Quoque	q. q.	Also.
Quorum		Of which.
Quotidie		Daily.
Quoties		As often as.
Quoties requiritur		As often as is required.
Rarus, a, um		Loose, thin, rare.
Ratio, onis		Relation, proportion, condition.
Recens, ntis	Rec.	Fresh, recent, newly.
Recipe	℞	Take (thou). A recipe.
Redactus, i	Redact.	Reduced.
Redactus in pulverem	Red. in pulv.	Reduced to powder.
Regio, onis		Region, direction, portion.
Relectus, a, um		Opened, loosened.
Reliquus, i	Reliq.	Remaining, the remainder.
Renova, renovetur		Renew, let it be renewed.
Renovetur semel	Renov. semel	Let it be renewed once only.
Repetatur, repetantur	Rept.	Let it (or them) be repeated.
Res, rei		A thing, object, substance, affair.

Term or Phrase.	Contraction.	Meaning.
Residuus, a, um		Residual, remaining.
Retinetur		Let it be withheld.
Rictus, us		Wide open, distended.
Rigidus, a, um		Rigid, hard, inflexible.
Ruber, rubra, rubrum	Rub.	Red, ruddy.
Rudicula, æ		A spatula.
Rudis, is		A stirring-rod.
Rumen, inis		The throat.
Saccharum saturni		Acetate (sugar) of lead.
Sæpis, sæpe		Often, frequently.
Sal, salis	Sal.	Salt, also shrewdness.
Sal amarum		Magnesium sulphate.
Sal mirabile		Sodium sulphate.
Saltem		At least.
Sanguis (inis), sanguineus		Blood, bloody.
Sapor, is		A flavor, delicacy.
Satis, is		Enough, sufficient.
Scapulæ, arum		The shoulder blades.
Scatula, æ	Scat.	A box.
Scrupulum, i	Sc. or ℈	A scruple.
Scutum, scuto		Protection, for protection.
Scuto pectori		For protection to the breast.
Secundo		Secondly, in order.
Secundum artem	S. A.	According to art.
Secundum legem	S. L.	According to law.
Semel		Once, a single time.
Semi, semis	ss.	A-half, half.
Semihora		Half hour.
Sensim		Gently, gradually, slowly.
Seorsum		Sundered, apart, separate.
Separatim	Separ.	Separately.
Septimana		A week.
Sero		Late, at a late hour.
Sesuncia		An ounce and a-half.
Sesqui		Once and a-half.
Sesquihora		An hour and a-half.
Sevum, i		Suet, tallow.
Sextans (ntis), sextus		Sixth-part, sixth.
Si		If.
Sic!		So, in this manner, thus.
Sicca, Siccetur		Dry, let it be dried, or drained.
Siccus		Dry, dried.
Signa, signetur	Sig.	Mark, imprint (thou). Let it be imprinted.
Signanter		Clearly, distinctly.
Sile hujus!		Keep (thou) silence concerning this!
Simplex, simplicis	Simp.	Simple, unmixed.
Simul		Together.
Sinapismus, i		A mustard poultice, sinapism.
Sine	s.	Without.
Sine expressione	S. expr.	Without expressing, pressing.
Singillatim, singularis		One by one, singly.
Singulorum	Sing.	Of each.
Si non valeat	Si. n. val.	If it does not answer,—be of value.
Si opus sit	Si. op. sit.	If it be best,—needed.
Si vires permittebant	Si. vir. perm.	If the strength will permit.
Sit		Let it be.
Sit in promptu		Let it be in readiness.
Sitis (is), siti		Thirst, for thirst.
Solatium, ii		Soothing, assuaging.
Solitus, a, um		Accustomed, ordinary.
Solus		Alone, only.

Term or Phrase.	Contraction.	Meaning.
Solve, solvatur	Solv.	Dissolve, let it be dissolved.
Solutus, solutio-onis	Sol. or solut.	Dissolved, solution.
Soluto tandem		To or in the solution finally.
Solve cum leni calore		Dissolve with a little heat.
Somnus		Sleep.
Spiritus vini rectificatus	S. V. R.	Alcohol.
Spiritus vini tenuis	S. V. T.	Proof spirit.
Spissitudo, inis		Thickness, consistency.
Spissus, a, um	Spiss.	Dense, hard.
Statim		Immediately, at once.
Stet, stent		Let it or them stand.
Stibum, i		Antimony.
Stillatim		By drops, in small quantities.
Stilus		A stake, crayon.
Stomachus, i		The stomach, alimentary canal, gullet.
Stratum, i		Layer, stratum.
Suavis		Pleasant, agreeable.
Sub		Under somewhat.
Subactus		Subdued, sinking.
Sub finem coctionis		Toward the end of boiling.
Subigatur, subigantur		Let it (them) be subdued, overcome.
Subinde		Frequently.
Subtilis		Fine, smooth, nice.
Succus, i		Juice, sap.
Suggillationi		To the bruise.
Sume, sumat, sumantur, sumatur, sumendus	Sum.	Take or employ, or consume. Let him take, let it be taken, to be taken.
Sumat talem	Sum. talem	Let the patient take—like this.
Summo mane sumendus		To be taken very early in the morning.
Summus, a, um		Highest, summit.
Super		Above, upon, over.
Superbibe		Drink afterwards.
Suppositoria, æ	Suppos.	A suppository.
Suppositoriæ rectales	Suppos. rect.	Rectal suppositories.
Suppositoriæ urethrales	Suppos. ureth.	Urethral suppositories.
Tabella, æ	Tab.	A tablet, lozenge.
Talis, is		Of such, like this.
Tam		So far, in so far.
Tandem		At last, finally.
Tantum, i		So much, so many.
Tegmen, or Tegumen, inis		A cover.
Tempus, oris		Time.
Tenuis		Fine, weak, thin.
Tepidus, a, um		Tepid, lukewarm.
Ter		Thrice, three times.
Tere, teretur	Ter.	Rub, triturate. Let it be rubbed.
Teres, etis		Rubbed, smooth, polished.
Tere simul	Ter. sim.	Rub (triturate) together.
Testa, æ		A shell.
Testa ovi		An egg shell.
Thion, Thionas, atis		Sulphur, sulphate.
Tinctura thebuica		Laudanum, tincture of opium.
Triplico	Trip.	Triplicate.
Tritura, trituretur	Trit.	Triturate, let it be triturated.
Trochiscus	Troch.	Troche, lozenge.
Tum		Then, next, furthermore.
Turbidus, a, um		Turbid, muddy, not clear.
Tussis, is		A cough.
Tuto		Safely.
Ubi		Where, wherever, whenever.
Ulna, æ		The arm, or elbow.

Term or Phrase.	Contraction.	Meaning.
Ultime, ultima	Ult.	Lastly, at the last.
Ultimo præscriptus	Ult. præsc.	The last ordered.
Una		To one, together.
Uncia, æ		An ounce.
Unctulus, a, um, unctus, a, um		Besmeared, anointed.
Unctus, us		An anointing, anointment.
Unguentum, i	Ung.	Ointment, unguent.
Unguilla, æ		An ointment-box.
Urgens, entis		Pressing, urgent.
Ustus, a, um		Burned.
Ut or *uti*		That, so that, in order that.
Ut dictum	Ut dict.	As directed.
Utere, utendus, i		Make use of, to be used.
Utendus more solito	Utend. mor. sol.	To be used in the usual manner.
Vapor oris		Steam, vapor.
Vas, vasis		A vessel, utensil, bottle.
Vas vitreum	Vas. vit.	A glass vessel.
Vehiculum, i	Vehic.	A vehicle.
Vel (or ve as a suffix)		Or.
Venenosus, a, um, venenum, i		Poisonous, a poison.
Verus, a, um		True, real, genuine.
Vesper, eris		The evening.
Vesperma, æ		Supper.
Vicis, is, vices		Change, alternation, turns.
Viridis, is, viride, is		Green.
Vis, viris		Strength, vigor, life.
Vitreus, a, um		Of glass, glazed.
Vitrum, i		Glass.
Volatilis, is, volatile	Volat.	Volatile.
Vomitis, onis		Vomiting.

NUMERALS.

Cardinals.		Ordinals.	
Unus	One.	*Primus*	First.
Duo	Two.	*Secundus*	Second.
Tres	Three.	*Tertius*	Third.
Quatuor	Four.	*Quartus*	Fourth.
Quinque	Five.	*Quintus*	Fifth.
Sex	Six.	*Sextus*	Sixth.
Septem	Seven.	*Septimus*	Seventh.
Octo	Eight.	*Octavus*	Eighth.
Novem	Nine.	*Nonus*	Ninth.
Decem	Ten.	*Decimus*	Tenth.
Undecim	Eleven.	*Undecimus*	Eleventh.
Duodecim	Twelve.	*Duodecimus*	Twelfth.
Tredecim	Thirteen.	*Tertius decimus*	Thirteenth.
Quatuordecim	Fourteen.	*Quartus decimus*	Fourteenth.
Quindecim	Fifteen.	*Quintus decimus*	Fifteenth.
Sexdecim	Sixteen.	*Sextus decimus*	Sixteenth.
Septemdecim	Seventeen.	*Septimus decimus*	Seventeenth.
Octodecim or duo de viginti	Eighteen.	*Octavus decimus*	Eighteenth.
Novemdecim or un de viginti	Nineteen.	*Nonus decimus*	Nineteenth.
Viginti	Twenty.	*Vicesimus*	Twentieth.
Viginti unus or unus et viginti	Twenty-one.	*Vicesimus Primus*	Twenty-first.
Triginta	Thirty.	*Tricesimus*	Thirtieth.
Quadraginta	Forty.	*Quadragesimus*	Fortieth.
Quinquaginta	Fifty.	*Quinquagesimus*	Fiftieth.
Sexaginta	Sixty.	*Sexagesimus*	Sixtieth.
Septuaginta	Seventy.	*Septuagesimus*	Seventieth.
Octoginta	Eighty.	*Octogesimus*	Eightieth.
Nonaginta	Ninety.	*Nonagesimus*	Ninetieth.
Centum	One hundred.	*Centesimus*	Hundredth.

CHAPTER III.

NOMENCLATURE.

The temptation to physicians to abbreviate in writing prescriptions makes it necessary that the pharmacist should be thoroughly conversant with chemical nomenclature, particularly in regard to those bodies which are most frequently prescribed as remedies.

A salt or chemical may be known by several names,—its trade or common name, its Latin or scientific name, and in many cases also by a technical or descriptive name.

The common or trade name may have been derived from the names of those who first brought them into notice, as Glauber's or Signette's salt, or from the place from which they were first obtained, as Epsom or Rochelle salt. The Latin or scientific names designate, in a general way, the chemical composition of the bodies, and when there are a number of salts or bodies which contain the same elements, but in different proportions, more definitely descriptive names may be applied to them to avoid confusion.

Thus, "chloride of mercury" may mean either calomel or corrosive sublimate, but the terms, *mild* chloride of mercury, and *corrosive* chloride of mercury, *proto*chloride of mercury and *bi*chloride of mercury are definite, and cannot be confused.

The first of these terms gives a general idea of the salt,—composed of mercury and chlorine; the second distinguishes between the medicinal and physical action of two chlorides which exist, one being "mild," and the other "corrosive;" the third of the terms also distinguishes between the two chlorides, one being the "proto" (first or lowest) chloride, and the other the "bi" (second or higher) chloride.

Unfortunately, no one system of nomemclature is satisfactory for all, and much confusion may arise unless the dispenser understands the principles which underly each system. A single body may have several trade-names, and the Latin title may be thought too long.

The third system attaches certain prefixes or suffixes to the negative (acid) term, which have a constant meaning, and thus distinguish the salt clearly from others of a similar composition. This method may be used for all definite chemical compounds, but if carried out in some cases, ridiculously long words would result, and thus it is not always practical, although very convenient in many cases.

The prefixes and terminations in general use are as follows:

PREFIXES.

MONO (Gr. *monos*, one). PROTO (Gr. *protos*, first).

These are employed to designate a single atom or molecule of acid radical in combination with a base, or the *first* or lowest number of a series, when more than one proportionate combination is known. Before the names of radicals beginning with a vowel, the final *o* of these is generally omitted, for the sake of euphony.

Examples.—PbO, Lead monoxide. FeO, Iron monoxide, or protoxide. Fe Cl_2, iron protochloride (*not monochloride*).

SESQUI (Lat. *sesqui*, one-and-a-half) meaning three atoms or molecules of acid radical to two of basic (since chemistry does not admit of splitting atoms), the ratio being one to one-and-a-half.

Examples.—Fe_2O_3, Iron sesquioxide ($Fe_2\,Cl_6$ is sometimes called sesquichloride—the chloride of the sesquioxide). $Al_2\,O_3$ Aluminum sesquioxide.

BI, or BIN (Lat. *Bis*, twice), DI (Gr. *dis*, twice), DEUTO (Gr. *deuteros*, second), meaning two, or double, where two molecules of acid radical are combined, or twice as many molecules as there are of the basic radical. Di has also been used to refer to the basic radical in a similar way.

Examples.—$HgCl_2$ mercury biniodide, or deuto iodide, CS_2 Carbon disulphide ($Pb_2O(C_2H_3O_2)_2$ Lead diacetate)

TER (Lat. *ter*, three). TRI (Gr. *tria*, three). Three atoms, or molecules of the basic radical.

Examples.—Au Cl_3 gold terchloride. Fe_2O_3 iron trioxide. As_2O_3 arsenic trioxide. $Fe_2(SO_4)_3$ iron tersulphate.

QUADRA (Lat. *quattuor*, or *quadrus*, four). TETRA (Gr. *tetratos*, fourth), meaning four atoms, or molecules, of acid radical.

Examples.—$SnCl_4$ tetra, or quadrachloride, of tin. $PtCl_4$ tetrachloride of platinum.

PENTA (Gr. *penta*, five). QUINQUE (Lat. *quinque*, five), meaning five.

Examples.—PCl_5 Phosphorus pentachloride.

HEXA (Gr. *hexa*, six). SEX(T) (Lat. *sex*, six), meaning six.

Examples.—SI_6 sulphur hexaiodide.

HEPTA (Gr. *hepta*, seven). SEPT (Lat. *septa*, seven), meaning seven.

Examples.—Cl_2O_7 chlorine heptoxide.

POLY (Gr. *pollos*, or *polu*, many), meaning many equivalents—usually when the exact formula is in doubt, as poly-iodides, many atoms (above three) of iodine combined with a base, etc.

SUB (Lat. *sub*, under). HYPO (Gr. *hupo*, under, or Lat. *hypo*, after). Sub refers to the base, and is used to designate salts which are composed of an oxide and another acid radical in varying proportions, or the so-called basic salts. Thus *sub*-acetate of lead is a combination of lead oxide PbO and lead acetate Pb $(C_2H_3O_2)_2$. *Sub*-sulphate of iron is an oxy- or basic sulphate, approximating $Fe_2O(SO_4)_2+Fe_2(SO_4)_3=Fe_4O(SO_4)_5$. Bismuth *sub*nitrate Bi O NO_3(approximately). Most of these salts vary in composition, hence their formulas are not included in the Pharmacopœia.

The term *hypo* refers to the acid radical, and usually indicates the lowest of a series of oxyacid salts.

Examples.—$KClO$ potassium hypochlorite.
KH_2PO_2 potassium hypophosphite.

PER (Lat, *per*, above). HYPER (Gr. *hyper*, above). SUPER (Lat. *super*, above). The contracted form *per* is mostly used, and indicates the highest of a series of compounds, as contrasted with sub and hypo.

It is used mostly with oxy acids; when it refers to those containing the largest number of atoms of oxygen, the culmination of a series.

Examples.—$KClO_4$ perchlorate of potassium. H_2O_2 peroxide of hydrogen. Fe_2Cl_6 perchloride of iron.

ORTHO (Gr. *orthos*, straight). Used to distinguish substances in a normal condition from a modified form of the same, or from others which have been derived from them by heat or other causes.

Example.—H_3PO_4 Orthophosphoric acid.

PYRO (Gr. *pur*, fire). Used to designate that the body has been produced by heat (fire). Thus $2H_3PO_4$, or $H_6P_2O_8$ + heat becomes $H_4P_2O_7$, *pyro*phosphoric acid, water (H_2O) being driven out.

$C_7H_6O_5$, gallic acid, heated becomes $C_6H_6O_3$ pyrogallic acid, CO_2 being driven out.

META (Gr. *meta*, beyond). Used to designate an altered condition, as distinguished from the ortho and pyro (and para) forms.

Thus, $H_4P_2O_7$ + heat becomes $2HPO_3$ metaphosphoric acid, water being driven out.

(The terms ortho, pyro and meta, as applied to *inorganic* compounds, usually distinguish between forms produced by heat or similar causes.)

PARA (Gr. *para*, from beside, near to, about, etc.). Used with *organic* compounds, when three bodies having the same chemical composition, but differing in physical properties (solubility, melting and boiling points, etc.) and certain chemical and medicinal properties, are to be distinguished. Such cases are differentiated by the terms ortho, meta and para.

Examples.—$C_2H_4(OH)_2$ Ortho-dihydroxy-benzol or pyrocatechin.
$C_2H_4(OH)_2$ Meta-dihydroxy-benzol or resorcin.
$C_2H_4(OH)_2$ Para-dihydroxy-benzol or hydrochinon.

Para also designates molecular aggregations of certain organic compounds, as C_2H_4O—aldehyde and $(C_2H_4O)_3$ or $C_6H_{12}O_3$ *par* aldehyde.

HYDRO (Gr. *hudor*, water), used to designate the binary acids, *i. e.*, those composed of only two elements, the prefix referring then to the hydrogen, as HCl, hydro-chloric acid, H_2S hydro-sulphuric acid.

AN (Lat. *an*, without). DE (Lat. *de*, away from), meaning without or deprived of. Used to denote something which has been removed, therefore implying that the removed substance usually exists in the body normally.

Examples.—An hydrous, without water (or moisture).
De odorized, deprived of odor.

TERMINATIONS.

IDE, ID,* URET.—Terminations used with salts composed of a base united to a *single element* or with *cyanogen*, as an acid radical, the latter being used mostly with sulphur, phosphorus and cyanogen.

Examples.—KI, potassium iodid(e).
K_2S, potassium sulphid(e), or sulphuret, sulfid.
KCN, potassium cyanid(e), or cyanuret.
H_2S, sulphuretted hydrogen, or hydrogen sulphid(e).
H_4P, phosphuretted hydrogen.

OUS, ITE.—When a series of acids differ only in the proportion of oxygen which they contain, the lower members of the series end in *ous* and the salts of these in *ite*.

IC, ATE.—The highest members of such a series of acids, or those which contain the most oxygen, end in *ic*, and the salts of these in *ate*.

Examples.—H_2SO_3, sulphur*ous* acid, K_2SO_3 potassium sulph*ite*.
H_2SO_4, sulphur*ic* acid, K_2SO_4 potassium sulph*ate*.

The following series well illustrates the use of some of these prefixes and terminations:

HCl, *hydro*-chlor-*ic* acid. KCl, potassium chlor*ide*.
HClO, *hypo*-chlor-*ous* acid. KClO, potassium *hypo*-chlor-*ite*.
$HClO_2$, chlor-*ous* acid. $KClO_2$, potassium chlor*ite*.
$HClO_3$, chlor-*ic* acid. $KClO_3$, potassium chlor-*ate*.
$HClO_4$, *per*-chlor-*ic* acid. $KClO_4$, potassium *per*-chlor-*ate*.

OID (Gr. *eidos*, resemblance), used to express similarity in character and properties (not in composition).

Examples.—Alkaloid, resembling an alkali.
Crystalloid, resembling a crystal.
Resinoid, resembling a resin.

INE, IN.—In the Pharmacopœia these terminations are used to distinguish between alkaloids and other proximate principles. All alkaloids end in *ine*; Latin, *ina*; while glucosides, neutral principles, etc., end in *in*; Latin, *inum*.

Examples.—Morphine. Latin, Morphina.
Quinine. Latin, Quinina.
Picrotoxin. Latin, Picrotoxinum.
Santonin. Latin, Santoninum.

* The latest nomenclature prefers the termination *id*, and also substitutes *f* for *ph* in many cases, as sulfur, fosfate, etc.

CHAPTER IV.

MIXTURES.

Draught (Lat. *Haustus-us*, or *Potus-us*), a mixture which is intended to be swallowed at a single dose. It usually measures from two to twelve fluidounces.

Drops (Lat. *Gutta-æ*), a term applied usually to stimulating or carminative mixtures, which are given in small doses and diluted when taken.

Linctus (Lat. *Linctus-i*), a thick and viscid liquid, composed of honey, syrup, etc., with medicinal matter, intended to be licked from a spoon. Also called a *lohoch*. It is adapted particularly for throat and bronchial tubes, coughs, etc.

Liniment (Lat. *Linimentum-i*), a liquid or very soft solid, usually of an oily or irritant character, used externally for the purpose of producing local action. They are applied mostly by rubbing, and when fluid are specifically called *embrocations* (Lat. *embrocatio-onis*); or they may be applied with a brush, and are then called *paints*. In the latter case they are usually anodyne in action.

Lotion (Lat. *Lotio-onis*), an aqueous solution or mixture, for local application, usually without rubbing. They are usually aqueous fluids, are less powerful than liniments, and are applied in various ways. When used for specific purposes they have special names.

Injection (Lat. *Injectio-onis*), a lotion which is injected into the passages of the body by means of a syringe. When injected into the rectum it is called an *enema* (Lat. *enema-atis*), or *clyster*, and is used warm. Its purpose may be for producing evacuation of the bowels, for local medication, or (rarely) for general nutrition or medication. It is generally of a soapy or mucilaginous nature.

Hypodermic Injections. A clear, limpid solution, for injection beneath the skin, by means of a small needle-pointed syringe. These are used for producing immediate effects, by introducing the medicine directly into the blood.

Collunarium is a nostril injection.

Gargle (Lat. *Gargarisma-atis*) is a wash or lotion for the throat.

Collyrium (Lat. *Collyrium-i*) is a wash for the eyes; an eye-water.

Spray (Lat. *Nebula-æ*), a lotion applied by means of an atomizer.

Inhalation, or Vapor (Lat. *Vapor-oris*), a fluid containing volatile medicines, which is either heated or added to boiling water, and the steam which arises is inhaled in order to obtain action on the throat or air-passages; or they are used in a special apparatus so arranged that air is drawn through the strong solution, and, becoming saturated with the medicines, in vapor, is drawn into the lungs through the mouth or nostrils.

Bath (Lat. *Balneum-ei*), a lotion or solution intended to be added to water for general application.

Mixtures Defined.—In general, the term "mixture" indicates all liquid preparations consisting of two or more simple bodies, or galenical preparations, intended for internal administration.

U. S. P. Mixtures.—In the U. S. Pharmacopœia, the term "mixture" (Mistura, U. S. P.) is restricted to liquid preparations containing finely-divided solid matter in partial suspension. Thus, in the pharmacopœial sense a mixture is always a cloudy or muddy liquid, while in the general use of the term a mixture may be either clear or cloudy.

Medicines Prescribed in Mixtures.—The art of preparing mixtures may in some cases be very simple, while in others it is very complex. The range of medicines which are prescribed in this form is very wide, embracing all chemical bodies, powdered drugs and galenical preparations.

Bodies in Solution Change More Easily.—But not only because the variety of mixtures which are called for is almost inexhaustible, but because these bodies are brought together in the condition most conducive to changes, is the art of combining bodies to form the best mixture, the most difficult to acquire. A prescription calling for the simplest form of mixture may be followed by one which requires much study and skill for its proper compounding.

Many bodies which may safely be combined in the solid form cannot be brought together in the presence of liquids without undergoing change.

Liquids versus Solids.—Thus, subnitrate of bismuth and bicarbonate of sodium may be mixed and dispensed in powders without change, but when shaken with water they react slowly, and each is partially decomposed, carbonic acid gas being liberated and the stopper blown out by its pressure.

Chemical changes, then, may take place in mixtures which would not were the same bodies combined in a dry form.

Classification of Mixtures.—A complete classification of mixtures is quite impossible, but a partial classification may be made, which will include the greater portion of these preparations.

Simple Solutions.—A solution has been defined as the blending together of the molecules of two bodies to form a clear liquid.

If we place *a lump* of sugar in water, it immediately begins to disappear, and after a few moments none of it can be seen, and the liquid will be perfectly clear. If we use the same amount of sugar *in a fine condition* (granulated), the disappearance is more rapid, and if the liquid be agitated it is still more so.

If we use hot water in place of cold, the sugar disappears almost immediately.

Thus, solution is hastened by having the solid in a fine condition, still more rapid if the liquid and solid be agitated together, and most rapid of all (with a few exceptions) when the solvent is hot.

If, however, we drop sugar into chloroform or benzine, or many other liquids, it will not disappear, even if the liquid be warmed and agitated, but will remain in the condition in which it was placed in the liquid. Sugar therefore dissolves in water, but not in chloroform or benzine.

The solution which is formed will always measure more than the liquid which is used to make it, but not as much as the sum of its constituents; that is, not as much as the bulk of the original liquid plus the bulk of the original solid.

Thus, an ounce of sugar dissolved in an ounce of water will make more than a fluidounce of solution, but less than two fluidounces. For this reason, prescriptions often call for an amount of solvent or diluent sufficient to make the mixture measure up to a definite amount, the exact amount not being specified, because the room which the solids will occupy when dissolved cannot be calculated, but must be ascertained by experiment.

The same principle applies to two liquids as to a solid and a liquid.

If we add alcohol to water a clear homogeneous liquid results, which measures less than the sum of the quantities of each taken, showing that alcohol is soluble in water. If we use carbolic acid in place of the alcohol a portion of the acid will disappear or dissolve, but the remainder will separate and float upon the surface of the water.

If we heat the water and acid to about 200° F. (or 85° C.) they will then mix to form a clear homogeneous liquid in all proportions, showing that carbolic acid is only partially soluble in cold water, but freely soluble in hot water. Again, if we shake together chloroform and water, or some oil and water, each mixture will separate into layers showing no apparent change in the volume of either liquid, because oil and chloroform are practically insoluble in water or water in them.

Again, if we rub together camphor and chloral, or camphor and thymol, a clear liquid results, which is probably a solution of one solid in the other.

In the case of two liquids or two solids either body may be considered the solvent, as when ether and water are shaken together the water dissolves 10 per cent. of ether and the ether dissolves 3 per cent. of water. In the case of a liquid and a solid the liquid is considered the solvent and the solid the body dissolved.

All bodies, whether solid, liquid, or gaseous, can be dissolved in *some* liquid, but none are soluble in *all* liquids. Some are capable of forming very strong solutions and in a brief time, while others dissolve slowly and only in small proportions.

In some cases a body which is only slightly soluble is yet quickly soluble, as cream of tartar. In all cases the rapidity with which the solution is formed as well as the amount of body dissolved is dependent upon the temperature. When all of a body is dissolved that is capable of dissolving at that temperature the solution is called *saturated*, but a solution which is saturated at one temperature will be either supersaturated or subsaturated at all other temperatures.

In pharmacy the temperature which has been adopted for saturated solutions is 15° C. (59.6° F.), because the temperature of living-rooms where solutions are supposed to be kept or used is rarely below this point, and at all higher temperatures the solutions (with a few exceptions) will be subsaturated.

When no other liquid is designated for a solution, water is understood. Beside this, other important solvents are alcohol, mixtures of alcohol and water, glycerin, oils, ether, chloroform, benzine, etc.

The solubility of each body in the different liquids can be learned by reference to each in the text or reference books.

There is no general rule for solubility, but in case a body is in question the chemical nature of which is understood, but no reference to its solubility in any given liquid can be found, a judgment as to the probability of such a solution can be made according to the law given by Prof. Ostwald, viz.:—that "solubility is determined to some extent by the *chemical analogies* both of the substance dissolved and the solvent." Thus, almost all alcohols are soluble in common alcohol, and all organic acids in acetic acid. The alcohols and organic acids all contain the group (*HO*) in their formulas, and are generally soluble in water (H_2O), the solubility decreasing as the proportions of carbon in the compounds increase. Thus we have Benzol, C_6H_6, insoluble in water, but carbolic acid, C_6H_5HO, is soluble to the extent of 5 per cent. (cold), hydrochinon, C_6H_4 $2(HO)$, is much more soluble, while pyrogallic acid, $C_6H_33(HO)$, is very soluble.

Here the larger the proportion of the radical HO the more freely will the body dissolve in water (H_2O), while similar compounds which contain no HO are insoluble.

Nearly all mixtures contain a solution or a mixture of solutions, and thus these occupy a very important position in dispensing. Many liquids dispensed as a mixture consist of a solution of a salt in an aqueous fluid, either alone or mixed with other fluids or flavoring.

When the salt is very soluble and the solution will not be concentrated, the solvent may be placed in the bottle and the solid dropped into it.

A little shaking usually effects solution, and the other ingredients, if any, are then added.

If the salt is slowly soluble, or the solution is to be very strong, the salt should be triturated in a mortar with successive portions of the solvent until it is all dissolved.

Gums and colloidal bodies are best dissolved, after breaking into very small pieces, by circulatory displacement. In all cases the solids should be added to the liquid, not *vice versa*.

ORDER OF SOLUTION.—When two or more liquids of different character are prescribed with a salt, the salt should first be dissolved in the liquid which is the best solvent for it, then this solution mixed with the other liquids. In this way a clear or homogeneous mixture is most quickly obtained.

POWDERED *vs.* GRANULATED SALTS.—Salts will dissolve more readily when in a granular or powdered form. The granular form is to be preferred in many cases, because salts which contain a large amount of water of crystallization, as sodium phosphate, magnesium sulphate, alum, etc., require to have a portion of this water driven out in order to be powdered, and thus the powders contain more of the salt than the crystals. Accordingly we cannot dissolve as much powdered alum in water as we can of the crystals; or, if we use in a mixture first crystals of alum and at another time the same weight of powdered alum, the second dispensing will contain more of the salt than the first. For these reasons the use of granulated salts gives more uniform results than powdered salts, with equal dispatch in compounding.

DISSOLVING SCALE SALTS.—Another exception to the powdered condition is found in the scale-salts of iron (citrate, soluble phosphate, etc.), which "gum up" if triturated with water, and are most readily dissolved by shaking with warm (not too hot) water.

UNDISSOLVED CRYSTALS.—A mixture should never be allowed to leave the dispensing counter with undissolved crystals in the bottle.

USE OF HOT SOLVENTS.—Heating a solvent to facilitate solution is not always desirable, because (1) the solvent may be injured, as in the case of the aromatic waters or hydro-alcoholic liquids; or (2) the subsequent admixture of an alcoholic or aromatic body to the hot liquid may volatilize some of these ingredients; or (3) a supersaturated solution may be unwittingly prepared, which will afterward recrystallize; (4) or the salt may be partially decomposed, as in the case of chloral, bicarbonates, etc.

TEMPORARY *vs.* PERMANENT SOLUTIONS.—The dispenser must aim, not only to get a solid in solution, but also to keep it dissolved. This, of course, cannot always be accomplished where a physical or chemical incompatibility afterward ensues.

SOLUTIONS OF LIQUIDS IN LIQUIDS.—Mixtures of liquids which form a clear liquid, may be considered as solutions of one liquid in another. Even where the fluids will form a clear mixture in any order of mixing, a definite order may be desirable.

MEASURING POWERFUL LIQUIDS.—When powerful liquids in small quantities are prescribed in a mixture, such as hydrocyanic acid, solutions of arsenic, strychnine, morphine, etc., a portion of the other ingredients should be first placed in the bottle, then the powerful ingredients, carefully measured, added, and the graduate rinsed with the remaining ingredients of the mixture.

MEASURING VISCID LIQUIDS.—In the same way, when a viscid liquid is to be mixed with a limpid one, the graduate in which the viscid liquid has been measured should be rinsed with the limpid liquid.

COMPATIBILITY THE FIRST CONSIDERATION.—In case of an incompatibility, however, these considerations are of minor importance compared with that of avoiding precipitation, or change in the mixture, as much as possible.

STOCK SOLUTIONS.—It is very convenient, when certain salts are being frequently called for in mixtures, to keep on hand a concentrated solution of these salts. Thus strong solutions of potassium acetate, or iodide, adjusted so that one fluid drachm of the mixture will contain 15 or 30 grains of the salt, may save time in dispensing solutions.

MAKING POTASSIUM ACETATE.—In a few stores potassium acetate is never purchased, but a solution of the above strength made when needed by treating potassium bicarbonate with acetic acid; thus

3920 grains (8 troy ounces and 80 grains) of potassium bicarbonate dropped slowly into 12 fluid ounces of acetic acid (36 per cent.), and when effervescence has ceased, enough more acetic acid is added to render the liquid neutral, and then the whole carefully diluted with water to measure just one pint; one fluid ounce of this solution will contain four drachms (240 grains) of potassium acetate. Where solutions of this kind are used they should be carefully measured, both when making and dispensing them, since an error in quantity is much more easily made in measure than in weight. Solutions of salts which are disagreeable to handle, as ammonium valerianate, or of salts which dissolve very slowly, as mercuric chloride (also used in very small weights), are convenient for stock-solutions.

Stock-solutions are easily made by circulatory displacement. A conical percolator is tightly stoppered and filled with the solvent, then the salt is tied in a piece of thin cloth and suspended just beneath the surface of the liquid, and the percolator covered. Solution begins immediately and continues until the liquid is saturated or the salt entirely dissolved. A wide-mouth bottle may be substituted for the percolator if desired.

Where an air-blast can be used, a quick and convenient method of making large quantities of solutions is to place the salt and solvent in a bottle or jar and blow air through the liquid which agitates both the salt and the solvent and the former quickly passes into solution. If an aspirator is at hand the same result may be obtained by passing a tube through the stopper of the bottle to near the bottom, then the air is sucked through this tube and the liquid by means of a second tube which passes through the stopper, but does not touch the liquid, the other end of this being connected with the aspirator. A bit of cotton should be placed in the end of the air-tube to filter the air ere it enters the liquid. If the water has also previously been sterilized by boiling, the solution will be less liable to change or to develop fungus growths.

Among the salts suitable for stock-solutions are ammonium chloride (1 in 4), magnesium sulphate (1 in 2), sodium sulphate (1 in 4), potassium bromide (1 in 2), potassium acetate (1 in 2).

Iodides, tartrates and alkaloids (salts of) are not suitable for stock-solutions because the salts quickly decompose when in solution. Most organic bodies are subject to change in this condition and thus the stock-solutions are restricted properly to solutions of metallic nitrates, sulphates, chlorides, and bromides.

Even these solutions will keep better if filtered when first made, for no matter how clear they may look at first, filtration will usually brighten their appearance, and also remove any minute particles which may encourage crystallization.

COMPOUND SOLUTIONS.

In some cases salts which are but slightly soluble, or very slowly soluble, in water, are freely soluble in a solution of another salt.

QUININE SULPHATE.—Quinine sulphate is but slightly soluble in water, but dissolves freely if a little acid be added to the water, being changed into an acid salt; the bisulphate, for instance, when sulphuric acid is used.

DOUBLE SALTS.—Whenever salts are thus dissolved by aid of another salt, a chemical change takes place, commonly a double-salt being formed; but in most cases without change of medicinal properties.

COMPOUND SOLUTIONS OFTEN MORE STABLE.—These solutions are often more stable than a solution of the principal salt, as well as being stronger; as in the case of corrosive sublimate dissolved in ammonium chloride solution. The ordinary solution of corrosive sublimate in water is gradually decomposed. But one containing ammonium and sodium chlorides is not only more easily prepared, but is also permanent.

ANTISEPTIC SOLUTIONS.—The following formula for a solution of corrosive sublimate (1 to 1000) for antiseptic purposes has recently been recommended, making a solution which will keep indefinitely: corrosive sublimate, 1 Gm.; ammonium chloride, 20 Gm.; sodium chloride, 10 Gm.; distilled water, 1000 Cc.

IMPROVING PRESCRIPTIONS.—A knowledge of the best solvent for each salt or chemical is often useful to the pharmacist in manufacturing or dispensing, and may often rectify a faulty prescription. Many physicians depend upon the pharmacist to make such additions to their prescriptions as shall make them more elegant in appearance or taste, yet not alter their medicinal properties.

DANGEROUS PRESCRIPTIONS CORRECTED.—Thus iodine is sometimes directed in aqueous solution, and the pharmacist expected to add a sufficient quantity of potassium iodide to effect solution. Sometimes the addition of a solvent becomes a necessity, as where red iodide of mercury is prescribed in an aqueous mixture. This is insoluble in water, and is a powerful poison, safely taken only in very small doses.

To suspend it in a mixture would not be safe, because it settles very quickly; but the addition of a little potassium iodide will dissolve it, and this solution will remain evenly diffused throughout the mixture, rendering it safe as well as more elegant.

GLYCERIN AS A SOLVENT.—Glycerin has valuable solvent properties in many cases, and being without any decided therapeutic action the pharmacist is usually justified in using it to improve prescriptions. It is particularly valuable in solutions containing tannin, being used in many official tinctures and fluid extracts for this purpose, as well as for a partial substitute for alcohol, which it resembles in solvent properties.

It dissolves all deliquescent salts, some metallic nitrates, chlorides and sulphates, many organic acids (as tannic and gallic acids, etc.), and several metallic oxides, notably oxide of lead (litharge), which it dissolves in large quantities. It is owing to this that a mixture of glycerine and litharge makes a tenacious cement for joining porcelain, glass, or wedge-wood-ware, for filling the handles of pestles, etc. A high temperature greatly increases the solvent power of glycerin.

SALTS AS SOLVENTS.—Sodium citrate, the neutral tartrates, and ammonium chloride possess remarkable solvent powers over many metallic salts. Sodium citrate entirely prevents the precipitation of iron salts in neutral solutions, and alkaline tartrates (as Rochelle salt, potassium tartrates), dissolve iron and copper hydroxides, the insoluble salts of zinc, manganese, nickel, cobalt, chromium, and aluminum; while a boiling solution dissolves barium, strontium, magnesium, and calcium salts, also.

Advantage may be taken of these salts in preventing precipitation, when a smaller quantity will suffice than would be needed to dissolve a salt already precipitated.

The quantity of solvent salt necessary to use in various cases depends, not only upon the character of the salts involved, but often upon the strength of solution desired. For instance, one part of potassium iodide, dissolved in two parts of water, will dissolve two parts of iodine; but if this solution be diluted with water, a portion of the iodine will be precipitated, and a further addition of potassium iodide becomes necessary.

The value of salt-solutions as solvents is recognized in the Pharmacopœia in the scale-salts of iron, in Fowler's, Valangin's, Goulard's, and Lugol's solutions, in syrup of lime, and many others.

The following list and table offers many hints for cleansing chemical and pharmaceutical apparatus, for making solutions for use in the arts and for general prescription-knowledge.

The insoluble salts of *Benzoic Acid* are readily soluble in aqueous solutions of sodium acetate, lead acetate, or sodium nitrate; potassium nitrate, however, will not dissolve them.

Borates are more soluble in solutions of boric acid.

Carbonates are all soluble in solutions of carbonic acid, pressure being sometimes necessary in order to obtain a sufficient quantity of the gas in solution.

The carbonates are by this means converted into bicarbonates, hence it may be said that all bicarbonates are soluble.

Citrates are, many of them, soluble in solutions of sodium, potassium or ammonium citrate.

Ferricyanides and *Ferrocyanides* are soluble in caustic alkalies, both fixed and volatile.

Lactates are much more readily dissolved by boiling than by cold water.

Oleates are soluble in kerosene oil, oil of turpentine and ether.

Phosphates are soluble in phosphoric acid and alkaline phosphates, and

Pyrophosphates are soluble in alkaline pyrophosphates.

Tartrates are soluble in tartaric acid and in caustic alkalies.

TABLE OF COMPOUND SOLVENTS.

Bodies slightly soluble in water, but soluble in non-alcoholic solutions of other bodies.

SALT.	SOLVENT (Salts in Aqueous Solution).
Acid Arsenous	Weak Acids and Alkalies, Glycerin.
" Benzoic	Sodium Benzoate, Sodium Phosphate, Sodium Sulphate.
" Boric	Borax, Hydrochloric Acid, Glycerin, Syrup.
" Carbolic	Hot Water, Glycerin, Oils and Solutions of Rosin Soap, Sodium Acetate, and Valerianate, Ammonium Benzoate, Salicylate, etc.
" Gallic	Potassium Citrate.
" Salicylic	Borax.
Barium Sulphate	Ammonium Nitrate, Alkaline Citrates.
Bismuth Citrate	Ammonia Water.
" Subcarbonate	Ammonium Carbonate.
Borax	Sugar (increases the solubility).
Bromine	Hydrobromic Acid, Potassium Bromide.
Calcium Carbonate	Carbonic Acid Water, Ammonium Chloride.
" Hydrate	Sugar.
" Phosphate	Acids, Ammonium Chloride.
" Sulphate	Nitric and Hydrochloric Acids, Potassium Nitrate, Sodium Thiosulphate, Ammonium Salts.
Cerium Oxalate	Ammonium Chloride.
Chrysarobin	Alkalies.
Cotton	Ammonio-sulphate of Copper.
Iodine	Potassium Iodide.
Iodoform	Fixed and Volatile Oils.
Iron Subcarbonate	Carbonic Acid Water, Sugar.
" Ferrocyanide	Oxalic Acid, Alkalies.
" Oxalate	Oxalic Acid and other acids.
" Oxide and Hydroxide	Sugar.
" Phosphate " Pyrophosphate " Tartrate	Alkaline Citrates and Tartrates.
Lead Iodide	Ammonium Chloride, Potassium Iodide and Acetate, Sodium Thiosulphate.
" Oxide	Lead and Alkaline Acetates.
" Sulphate	Ammonium Acetate.
Lithium Carbonate	Carbonic Acid Water.
Magnesium Carbonate	Carbonic Acid Water.
" Phosphate	Acids.
Mercury Bichloride	Ammonium Chloride, Sodium Chloride.
" Biniodide	Potassium Iodide, Mercury Bichloride, Sodium Thiosulphate.
" Sulphate	Potassium Sulphate.
" Ammoniated	Ammonium Acetate, Carbonate or Nitrate.
Pepsin	Hydrochloric Acid.
Potassium Bitartrate	Borax and Alkalies.
Quinine Sulphate *	Weak Acids, Tinct. Chloride Iron, Huxham's Tincture.
Saccharin	Alkalies.
Silver Cyanide	Potassium Cyanide, Sodium Thiosulphate, Ammonia.
" Iodide	Potassium Cyanide, Alkaline Iodides.
Tragacanth (Bassorin)	Hydrogen peroxide.
Zinc Carbonate " Oxide	Ammonia Water. Ammonium Carbonate.

* When quinine sulphate is ordered in solution, no acid or other solvent being designated, weak sulphuric acid should be used on account of the resulting fluorescence which is not present in other acid solutions.

Solutions of tar oil in soap—the soap being largely in excess—will give a clear solution with water in all proportions, while solutions of soap in tar oil, the oil being in excess, form emulsions with water. Pure carbolic acid at 20° is miscible in any proportion with a saturated (at 15°) solution of sodium acetate, or with a 50 per cent. solution of sodium valerianate. Solutions of phenol in the latter can afterward be diluted with water without becoming cloudy or opaque. Sodium valerianate solution also dissolves cresol in all proportions. Rosin soap also possesses the property of dissolving large quantities of phenol, while cresol dissolves readily in a 15 per cent. solution of oleic soap, one part of the latter being capable of rendering soluble in water five times the amount of cresol. This fact explains the possibility of preparing soluble mixtures containing 50 per cent. of cresol. The salicylates, benzoates, etc., of ammonia also dissolve phenol and cresol, but not to the extent of soap solutions. Solutions of phenol in soap also have the property of dissolving benzine, toluene, oil of turpentine, etc.

PERCENTAGE SOLUTIONS.

Percentage solutions or solutions containing a required percentage of active ingredient are sometimes ordered by the physician. Since percentage means the number of parts in a hundred, the only difficulty in this class of preparations should be in allowing for the contraction in making the solution.

Percentage by Weight.—Thus a 4 per cent. solution of cocaine hydrochlorate would mean, technically, a solution containing four parts of the cocaine in every hundred parts of solution, and to make an ounce of such solution we first calculate the amount of cocaine to use, viz.: 4 per cent. of 456 grains (the weight of a fluid ounce of water), or 18¼ grains, and dissolve this amount in 438 grains (*not* one fluid ounce) of water.

Contraction in Volume.—This will give *slightly less than a fluid ounce* of solution, but the deficiency in a solution as weak as this will be scarcely observable.

25 Per Cent. or Above.—If however a strong solution be desired, as a 25 per cent. solution of a salt, then a larger quantity must be calculated for, because if we take 25 per cent. of 456, which is 114, and use only 342 grains of water (456—114=342) to dissolve this amount, we shall fall considerably short of the required amount, though we should use a 25 per cent. solution.

Making Exact Quantity.—The exact amount by weight which we should have to make in order to get a fluid ounce, could only be ascertained by knowing the specific gravity of such a solution and multiplying the weight of an equal volume of water by this specific gravity in order to get the weight of the required volume of solution.

This is scarcely necessary in practice, since a little judgment will enable one to choose the nearest *round number* which is likely to yield the full volume of solution. The nearest round number to

456 is 500, and calculating 500 grains to the fluid ounce we would require 125 grains of the salt and 375 grains of water, still too small a quantity of water. The next round number is 600 and 25 per cent. of this is 150, leaving 450 grains of water in which to dissolve it, or almost exactly a fluid ounce of water, and we may expect with these quantities (viz.: 150 grains of salt and 450 grains of water) a *little more* than a fluid ounce of solution, since the salt will increase the bulk somewhat when dissolved.

The excess of bulk may be dispensed (as percentage solutions are almost always prescribed alone) or thrown away as may seem best.

If another solvent than water be used, we must also make a correction for the specific gravity of the liquid and first calculate the weight of the required volume of that liquid.

Thus if ether be used (sp. gr. 0.75), we find that a fluid ounce of it will weigh $456 \times 0.75 = 372$ grs., if glycerin (sp. gr. 1.25), a fluid ounce will weigh $456 \times 1.25 = 570$ grains, or if chloroform (sp. gr. 1.50), a fluid ounce will weigh $456 \times 1.50 = 684$ grains.

Then these products (or their near round numbers if a strong solution is to be made) are to be taken as the basis of calculation.

ANOTHER METHOD.—Unfortunately, however, percentage solutions are not always made by weight. It is much easier for the physician in certain cases to calculate the dose if in making the solution the *solids are weighed and liquids are measured.*

DIFFERENCE WITH SOLVENTS.—In the case of aqueous solutions this makes little difference, being only a little less accurate, but with other solvents it alters the proportions of solid solvent very appreciably.

WITH LIGHT SOLVENTS STRONGER.—Thus a 10 per cent. solution of iodoform in ether would, in the first case, contain 10 grams of iodoform in 100 *grams* of solution—about 125 cubic centimeters—while in the second case it would contain 10 grams in 100 *cubic centimeters* of solution, the second method (weighing the solid and measuring the liquid) making a much stronger solution than the first.

WITH HEAVY SOLUTIONS WEAKER.—On the other hand, if chloroform be used as a solvent, the solution would be weaker; if the chloroform be measured for making it by weight we would have 10 grams in 100 grams, about *63 cubic centimeters*, while in the second case it would contain 10 grams in 100 cubic centimeters.

ADVANTAGE OF MEASURING.—Since the physician measures all liquids in dosing, a teaspoonful of solution will contain the same weight of solid whichever solvent is used (the solid being weighed and the liquid measured in making the solution), the bulk being the same in all cases, though the weight and percentage strength varies.

LACK OF UNITY AMONG PHYSICIANS.—The object of the dispenser should always be to supply what the physician desires, but physicians differ in their objects in writing for percentage solutions, sometimes desiring them to be made by weight and sometimes by volume, and it is not always possible to tell from the reading of the prescription which the physician desires. This lack of uniformity is shown in the fact that in the two leading hospitals in Boston, each having a large corps of physicians, one corps desires all percentage solutions to be made by weight, and the other by weighing the solid and measuring the liquid.

IN CASE OF DOUBT.—Since technical usage endorses the first method the pharmacist is always justified, *if in doubt* of the physician's wishes, to *prepare all percentage solutions by weight.*

GASEOUS SOLUTIONS.

Nearly all gases are soluble in water to a considerable extent, nitrogen being an exception—almost insoluble in water, though some of the compounds of nitrogen, as ammonia gas, NH_3, are freely soluble.

Cold water dissolves much more gas than warm, and the amount of gas which will remain in solution is directly proportionate to the pressure. Thus one volume of water will dissolve an equal volume of carbonic acid gas under normal conditions, but if the pressure is doubled the same amount of water will dissolve two volumes of gas.

Solutions of gases under pressure are not often prepared by the pharmacist, since they require special apparatus (with a few exceptions). Familiar examples of such solutions are the aerated table- and mineral-waters usually sold in bottles, and the "soda water" which is stored under pressure in metallic tanks and drawn from the "fountains" as required for immediate consumption.

All of these solutions effervesce as soon as the pressure is withdrawn, and a portion of the gas escapes.

Solutions of gas under normal pressure are often prescribed, and *should be always freshly prepared.*

In writing for these the physician usually prescribes an acid and a carbonate or bicarbonate in the same mixture and leaves it to the intelligence of the dispenser to know that the bicarbonate will be decomposed and to furnish a solution of the gas.

These solutions will always be acid to litmus paper unless an excess of the carbonate is used, because the gas is acid. They are best made in a bottle, and should never be filtered or strained. If a bright and clear solution is desired, the acid and alkaline [or saline] solutions may each be filtered before mixing, but never after the gas has been liberated. If the solution is to contain other volatile or viscid ingredients (syrups, mucilage, etc.), these should be added last, since the former will be partially lost in the effervescence, and the latter retards the escape of gas so much that the effervescence becomes tedious, or else takes place spasmodically and is liable to spurt out some of the liquid. When the quantities of acid or salt are left to the judgment of the dispenser, reference is had to the saturation tables in the back part of the Pharmacopœia.

CARBONIC ACID SOLUTIONS.

USE OF CO_2 IN MIXTURES.—The use of carbonic acid gas as an adjuvant to saline solutions is steadily increasing. Its value lies partly in its cooling and mildly stimulating action upon the stomach and fauces, and also in its efficiency in correcting or disguising the taste of salts, or in preventing oxidation of some easily-changed bodies.

Normal and Effervescing Solutions.—Mixtures may contain it in solution under normal or increased pressure, in the latter case more of the gas being retained in solution.

Effervescing Solutions.—These pressure solutions, of which effervescing solution of Magnesium Citrate, U. S. P., is a type, are always contained in stout, round bottles which should not be too full.

Round *vs.* Flat Bottles.—Flat-sided bottles, even when made of heavy glass, are liable to burst under the pressure, hence even the bottoms of bottles intended for this use are rounded to make them more resistant to the pressure.

Air-Space in the Bottle.—A little air-space in the bottle also allows for a slight increase or decrease of pressure caused by varying temperatures, with less risk of an explosion.

Adding the Carbonate.—In making these solutions the carbonate or bicarbonate is added last, either in crystals which are not allowed to dissolve before inserting and tying in the stopper, or in a solution which is poured slowly down the side of the bottle so as to form a separate layer of liquid, as recommended by Professor E. L. Patch. In the latter case more time is allowed for inserting the stopper and less gas is lost.

Storing.—Bottles containing effervescing liquids are best kept stored upon their sides, in order to keep the cork wetted and swollen, and prevent the gradual escape of gas.

Normal-pressure Solutions.—Solutions containing the gas under normal pressure should be so made as to retain as much of the gas as possible. To this end the water should be *cold* (because cold water dissolves more gas than warm water), and the effervescence should take place in presence of *all* the liquid, the mixture then being bottled as soon as effervescence has ceased. Under these circumstances the liquid will dissolve about its own bulk of carbonic acid. No special bottles are required for these mixtures.

Salts and Salt-solutions.—Prescriptions calling for salicylic acid, sodium bicarbonate and water are a very common type of this class. When made they are essentially a solution of sodium salicylate, saturated (under normal pressure) with carbonic acid gas, the latter being the object sought by the physician as well as the former.

Chlorine Solutions.—Chlorine solutions obtained by the action of hydrochloric acid upon a chlorate are often prescribed for affections of the throat.

Two Kinds.—In ordering a mixture containing these two bodies, the physician may wish either an acidulated solution of potassium chlorate, in which chlorine gas is liberated very slowly, or he may wish a solution containing the full amount of chlorine in solution.

TWO WAYS OF MIXING.—In the first case the chlorate is first dissolved in the water, and the acid added last, while in the second case the dry chlorate is covered with the strong acid and the reaction allowed to proceed until the bottle is filled with the chlorine fumes, the water being then added in portions so as to check the reaction as little as possible, yet dissolve the gas ere it escapes from the bottle.

Mixtures which by reaction give off nitric oxide gas (NO) are sometimes met with. These differ from the other gaseous reactions in that the *nitric oxide should not be retained* in the solution. The gas is liberated from nitrates or nitrites, and is not only irritating, but is an active chemical agent, and may cause further change in other ingredients.

Thus, in mixtures containing spirits of nitrous ether, an acid or acid salt, and potassium or sodium iodide, there will be a reaction between the acid, nitrous ether and the iodide, free iodine and nitric oxide being liberated.

$$\underset{\text{Nitrous ether.}}{C_2H_5NO_2} + \underset{\text{Pot. iodid.}}{KI} + \underset{\text{Pot. bitart.}}{KHC_4H_4O_6} = \underset{\text{Alcohol.}}{C_2H_5OH} + \underset{\text{Potass. Tart.}}{K_2C_4H_4O_6} + \underset{\text{Iodine.}}{I} + \underset{\text{nitric oxide}}{NO}$$

And if there be an excess of iodide present, the nitric oxide, in presence of air, will decompose this also and liberate all the iodine, hence the reaction should be allowed to take place in an open, and preferably shallow vessel, in the presence of as little liquid as possible, so that the gas may all pass off into the air.

In all cases where a nitrate or nitrite is decomposed and liberates nitric oxide, this method of procedure should be resorted to, since a solution of the gas is never desirable for medicinal purposes.

Where the other ingredients are not injured thereby, a little heat may be resorted to, in order to remove the last portions of the gas.

MIXTURES CONTAINING INSOLUBLE BODIES.

TWO CLASSES.—These are of two classes: Those in which an insoluble powder is *added to* the liquid, and those in which the insoluble body is *formed in* the liquid by the interaction of two of the ingredients.

FILTERING.—In the first case, the mixture, of course, should never be filtered; in the latter case it is often a question whether filtration is proper or not. When in doubt, DON'T.

MIXING POWDERS WITH LIQUIDS.—Mixtures of the first class are usually made by triturating the dry powder with a small portion of liquid, until a smooth paste is obtained; then this may be transferred to the bottle, and the mortar rinsed with fresh portions of liquid; or the liquid may all be mixed in the mortar, and afterward transferred to a bottle.

DIFFUSION BY AGITATION AND TRITURATION.—In some cases,—where the powder is somewhat soluble in the liquid, as in case of quinine sulphate, cream of tartar, magnesium carbonate, etc.,—the powder may be evenly diffused by adding to the liquid in the bottle and shaking vigorously, but in most cases trituration in a mortar is necessary to prevent lumping.

POWDERED DRUGS.—If a powdered drug, as rhubarb, for instance, be added to a liquid in a bottle, the oily surface of the powder will prevent the liquid from wetting it evenly, and lumps will form, which cannot be broken by agitation, nor be easily brought under the pestle in the presence of a large proportion of liquid, if afterward transferred to a mortar. A proper start in mixtures of this sort often saves much time.

VERY LIGHT POWDERS.—Very light powders, as powdered charcoal, are difficult to incorporate with liquids because of their tendency to fly out of the mortar. A small amount of liquid added to these requires much trituration to uniformly moisten the powder, during which the powder flies persistently out. If too much liquid be added, the powder floats upon its surface, and cannot easily be wetted. Such powders are best treated by first massing into a stiff paste with glycerin, with which they can easily be incorporated, this paste being afterward triturated with the diluent, and a homogeneous mixture thus obtained.

GELATINOUS SALTS.—Many salts (such as subnitrate of bismuth, phosphate of calcium, magnesium hydrate, etc.), are somewhat gelatinous when freshly precipitated, but become hard and granular, or heavy, when dried. These freshly-precipitated salts are of special advantage in mixtures of this class, because they do not settle as quickly. These are beyond the range of ordinary single-prescription dispensing, but can be prepared in quantities to advantage.

The " Milk of Magnesia " is a familiar example of these, made by precipitating a solution of magnesium sulphate with sodium or potassium hydrate, washing this precipitate by decantation until free from sulphate, then suspending in water. It corresponds essentially to calcined magnesia, but remains suspended in the water for a long time. The Ferri Oxidum Hydratum cum Magnesia of the Pharmacopœia (arsenical antidote) is another illustration of these, and also of the special therapeutic value of such mixtures. A dried ferric hydroxide would not be effective as an antidote to arsenic.

Another advantage in a suspended body is that its taste is not as pronounced as when it is in solution. This is the case with quinine sulphate; when it is suspended in a liquid its bitterness is not very objectionable, but if it be dissolved by an acid, the bitterness is very pronounced. For this reason, *quinine should not be dissolved by addition of an acid unless ordered by the physician.*

MIXTURES CONTAINING CHEMICALLY INCOMPATIBLE BODIES.

INTENTIONAL PRECIPITATION.—The greater diffusibility of undried or freshly-precipitated salts often leads the physician to prescribe in such a way that the insoluble body will be *formed in compounding the prescription* by the admixture of solutions of two incompatible salts or other bodies.

LAW OF PRECIPITATION.—These mixtures are based on the general law of incompatibility, viz.: when two salts can, by interchange of their radicals, form an insoluble salt, the insoluble salt will be formed and precipitated.

FILTERING NOT INTENDED.—Such mixtures, containing an intentional incompatibility should, of course, never be filtered, but dispensed with a shake-label.

AVOID PRECIPITATION WHEN POSSIBLE.—In all mixtures which are liable to form an insoluble body by reaction, the first effort of the dispenser should be to avoid this formation if possible. This may often be done by diluting the antagonistic bodies before mixing, or by the intervention of some viscid body as syrup or glycerin which may retard if not entirely prevent the reaction. The body which is liable to be precipitated should be treated much as a General prepares a weak force to meet the attack of a strong one,—viz.: the weak force is first protected by fortifications and placed in such a position as to receive the attacking party in sections and not all at once.

ILLUSTRATION.—The following presciption—a striking example of incompatibility overcome by skill in mixing—will serve to illustrate this:

℞.	Tinct. Ferri Chloridi	ʒii.
	Spiritus Ætheris Nitrosi	ʒiv.
	Mucilaginis Acaciæ	℥i.
	Syrupi	ʒx.—Mix.

Mucilage of acacia is incompatible with both of the first two ingredients, forming a gelatinous semi-solid with chloride of iron, and being precipitated in a ropy rubber-like condition by alcohol in both. This then, being the ingredient to be protected, if we first fortify the mucilage with the syrup, then add the other ingredients a few drops at a time, shaking thoroughly after each addition and giving time for the mucilage to overcome the attack before more is added, the result will be a bright, clear, ruby-red liquid.

FINE *vs.* COARSE PRECIPITATES.—When the reaction cannot be prevented by skill in mixing, or be materially retarded by the intervention of a viscid liquid, the mixture should be compounded with the intention of obtaining the precipitate in as fine a condition as possible, so that it will diffuse evenly through the mixture on shaking.

The incompatible bodies should be mixed in dilute solutions, and well shaken together.

Oftentimes the pharmacist is justified in either leaving out an incompatible ingredient, *when it has no decided medicinal value in the mixture*, but has been ordered simply as a solvent or adjuvant, or in adding a simple solvent, as alcohol or glycerin, to a mixture in order to hold in solution a body which would be precipitated in an aqueous liquid.

A COMMON QUININE MIXTURE.—The two following mixtures will illustrate this:

℞. Quininæ sulphatis		ʒii.
Acidi sulphurici diluti		ʒi.
Ext. glycyrrhizæ fluid		℥ss.
Syrupi		℥i.
Aquæ destillatæ	q. s. ut. ft.,	℥iv.—M.

Here the diluted sulphuric acid is ordered to dissolve the quinine sulphate, and the fluid extract of licorice to cover its intense bitterness (being one of the best of agents for this purpose), but the prescriber has overlooked the fact that acids will precipitate the glycyrrhizin in the fluid extract of licorice, the real flavoring principle of the root, and thus the very object which he is seeking, a clear and palatable mixture, will be defeated.

How to Dispense It.—To omit the acid is the only remedy for this. The quinine sulphate may be diffused through the mixture, and the licorice will then mask its bitterness. Dispense with a shake-label.

℞. Hydrargyri chloridi corros.		gr. i.
Potassii iodidi		ʒii.
Strychninæ sulphatis		gr. i.
Tinct. cinchonæ compositæ		℥ii.
Aquæ	q. s. ad	℥vi.—M.

Incompatibility Overcome.—The first two ingredients of this mixture form the well-known Mayer's precipitant—double iodide of mercury and potassium—which will precipitate nearly all alkaloids from aqueous solutions, but the precipitates are all soluble in alcohol; consequently this incompatibility may be overcome by using enough alcohol to hold these in solution.

How to Dispense It.—In the above case we may dissolve the corrosive sublimate and potassium iodide in two drachms of warm water, and the strychnine sulphate in two drachms more of water, mix the strychnine solution with the compound tincture of cinchona and add half an ounce of alcohol, then add the iodide solution and shake well.

Change in Quantity.—This makes a three-ounce mixture instead of a six ounce, and the dose should be marked *one-half of that ordered*, but the mixture now contains enough alcohol to hold the strychnine and cinchona alkaloid in solution, and the patient will take scarcely any more alcohol than in the mixture as ordered.

Strychnine should never be dispensed in solutions with iodides or bromides unless alcohol be present.

INFUSIONS AND DECOCTIONS.

These are much less frequently prescribed in America than in England and Europe, where their preparation is a daily task in the large stores.

Where they are frequently demanded conveniences for their preparation are kept at hand, but where only an occasional call is made for them they are more likely to be considered an annoyance.

They should not be considered merely as weak galenical preparations, though they are not as potent as other preparations. They differ materially from tinctures, fluid extracts, wines, etc., not only in strength, but also in taste and appearance, and oftentimes in action. This is because quite different principles are extracted from drugs by water than those which are obtained by alcoholic liquids. *In infusions and decoctions only the water-soluble principles are desired, and a diluted tincture or fluid extract is never a proper substitute.*

We all know the difference between a properly made cup of tea or coffee, and one made by diluting a fluid extract of tea or coffee with hot water. The latter lacks the refreshing qualities as well as the aroma and flavor of the former. So with drugs.

In digitalis, for instance, the infusion contains principles which are lacking in the tincture or fluid extract, and the superior results obtained by use of the infusion has long made it a favorite preparation of this drug.

Drugs containing volatile principles or principles easily injured by heat are best adapted for infusions, while drugs containing albuminous bodies, or principles not readily extracted, are made into decoctions. Cold infusions are prepared by percolation from drugs containing extremely volatile or sensitive principles (as infusion of wild cherry in which hydrocyanic acid is *developed* by cold water) or from drugs containing undesired principles which are not readily extracted by cold water (as infusion of cinchona).

The pharmacopœial directions for preparing infusions is as follows:

"Put the substance" (50 Gms. coarsely comminuted) "into a suitable vessel provided with a cover, pour upon it the boiling water, cover tightly, and let it stand for half an hour. Then strain, and pass enough water through the strainer to make the infusion measure 1000 c.c."

The strength of infusions is thus 5 per cent. (50 Gms. of drug for 1000 c.c. of infusion), unless otherwise specified by the Pharmacopœia or the physician.

Earthenware vessels are best adapted for making infusions, because they are thick walled and hold the heat better than glass or metal. They are also not easily broken.

Infusion mugs are made, consisting of a cup-shaped vessel having a perforated basket or diaphragm of earthenware supported near the top, in which the drug is placed, and the boiling water is poured through this.

The full capacity of the mug should be made each time, the object of having the drug at the top of the mug being to allow of circulatory displacement as the maceration proceeds, thus insuring better extraction. The same result may be secured by tying the drug very loosely in a bag of thin cloth, which is then immersed just beneath the surface of the hot water. In the latter case an ointment pot, coffee cup, earthenware pitcher, coffee pot or any other suitable vessel which can be covered, may be used, and only the desired amount of infusion made each time. A tall vessel of suitable capacity should be selected. Straining is also unnecessary, the process being practically automatic. The bag should be of thin cloth, not too tightly woven, and the drug should be enclosed loosely, not pressed into a ball. The vessel, whether an infusion mug, or what, should first be heated by pouring into it some boiling water, which is allowed to stand a few moments, then thrown out just before the infusion-water is poured in.

Hard water will not make a good infusion, and only rain or distilled water should be used; the quality of the infusion will depend almost as much upon the use of a good soft water, as upon the quality of the drug.

No advantage is gained by macerating over-time, but deterioration may result from it, as in making tea or coffee, when an astringent or bitter taste is developed by prolonged heating. Complete extraction is not always desired, but only the extraction of certain principles.

Infusions should never be filtered. They spoil quickly, and should therefore be made fresh, and in small quantities. In a few cases (Infusion of Digitalis, Gentian Compound, etc.) a small proportion of alcohol is added to the infusion for the purpose of preserving it; but this should never be done without the sanction of the physician.

Concentrated infusions, made 4 or 6 times the strength of the official, are objected to in some cases for this reason. They are nearly always made to contain alcohol as a preservative, and this may be objectionable even in the small quantity which exists after diluting the infusion. Probably the best method of preserving infusions, concentrated or otherwise, is to proceed according to the rules of sterilization. First sterilize the bottle by the use of boiling water, which is allowed to stand in the bottle for some time; then pour in the infusion *while hot*, filling the bottle to the neck, and cork immediately. In this way infusions, made by the hot process, may be preserved for weeks, without material change. Concentrated infusions, if preserved in this manner, should be stored in small bottles, and the entire contents of a bottle diluted and used when opened.

They may be stored in large bottles, and the contents withdrawn as desired, by the method proposed by Prof. Almen, of Sweden.

The bottle is fitted with a stopper having two perforations. Through one of these perforations a vent-tube passes, reaching to just inside the bottle; the outer end of the tube is plugged loosely with absorbent cotton. The short end of a glass-syphon is passed through the other perforation, the long end being provided with a tap, made of a closely-fitting piece of rubber tubing and a pinch-cock.

The contents of the bottle are thus withdrawn through the syphon, and the air which enters the bottle is sterilized by filtering through the cotton. The apparatus requires to be sterilized each time before refilling, by means of boiling water.

Decoctions are directed to be made as follows: "Put the substance" (50 Gms. coarsely comminuted) "into a suitable vessel provided with a cover, pour upon it the cold water, cover it well, and boil for fifteen minutes. Then let it cool to about 40° C. (104° F.), express, strain the expressed liquid, and pass enough cold water through the strainer to make the product measure 1000 Cc.

The general strength of decoctions is thus the same as infusions, but the method of preparation differs. Decoctions are made by putting the drug into *cold* water, which is then brought to a boil, and the boiling continued for fifteen minutes, then allowed to cool and strained. Better extraction is thus obtained than if the drug were placed directly in boiling water. In the latter case albuminous bodies in the drug would be suddenly coagulated, and entangle some of the principles which it is desired to extract. This is avoided by the gradual heating. These albuminous bodies are not likely to be found in drugs adapted for infusion.

The apparatus used may be the same as that for infusion, with the double advantage of preventing any burning of the drug by having it suspended in the top of the liquid. This is quite likely to occur where the drug is allowed to settle at the bottom of the vessel. Metallic vessels are more desirable for decoctions than for infusions, owing to the necessity of heating by direct flame; but iron should not be used, because it produces a black coloration with tannins. With care, earthenware vessels are almost as convenient, and more cleanly.

Previous maceration of the drug in cold water is advantageous, but a prolonged boiling is injurious, because the principles are altered thereby. Violent ebullition is also to be avoided; a gentle simmering being all that is necessary.

A tall vessel is also better than a shallow one; and boiling is hastened by covering the vessel.

Since boiling water extracts vegetable principles more easily than cold water, some of these may be thrown out of solution on cooling; straining is therefore performed at a definite (tepid) temperature, and any principles afterward deposited are diffused by shaking.

Decoctions are seldom clear and should not be filtered.

The precautions in the use of water, and preservation, alluded to under infusions, apply also to decoctions.

COLLYRIA AND HYPODERMIC SOLUTIONS.—Solutions intended for use in the eyes or for hypodermic injections are generally simple in character, but require the most scrupulous care in their preparation.

A few specks of dust in the bottle, or a small bit of undissolved salt or other matter may cause intense pain and lead to serious results. Only distilled water should be used in the preparation of these solutions, and it is well also to rinse the bottle which is to contain the solution with distilled water before filtering the liquid into it. If more salt is ordered in a collyrium than can be dissolved in the quantity of solvent prescribed, a cold saturation should be made and the undissolved salt filtered out.

Likewise in making alum-curds, by shaking alum with milk or with the whites of eggs until coagulation ensues, powdered alum should not be used because it cannot be removed completely from the coagulum, and if retained the sharp edges will irritate the inflamed surface.

In preparing solutions for hypodermic use it should be borne in mind that these are to be injected directly into the circulation and the fluids should therefore be not only free from mechanical irritants, but also as free from germs (bacteria) as possible.

Some writers have advocated the sterilization of all such solutions and their containers, by subjecting them to the heat of boiling water for twenty minutes or more, but some bodies often prescribed in this form are injured by heat. Such are morphine, atropine, eserine, etc.

In one of the large hospitals in Boston, all hypodermic solutions are made with 0.5 per cent. solution of carbolic acid.

Thymol (1 grain in 4 fluid ounces) and corrosive sublimate (0.1 per cent. solution) have also been recommended, but such powerful antiseptics should not be used without the physician's knowledge and permission.

Many solutions of alkaloids do not keep well in distilled water and need a preservative agent to prevent fungous growths or a decomposition. Less active medicinal agents will suffice for this, and acetanilid, salicylic acid and chloroform have been recommended. Of these three the last is to be preferred, and the solutions may often be better prepared with chloroform water as a solvent instead of distilled water. Since chloroform is so very slightly soluble, its use in this manner would rarely, if ever, be objectionable.

Alcohol Objectionable.—Alcohol should not be used in hypodermic solutions where it is possible to avoid it, because of the physiological and irritant action which it produces. Its place can usually be supplied by glycerin or oils which are unobjectionable.

Glycerin.—A hypodermic injection of musk, for instance, may be prepared by adding tincture of musk to half its volume of glycerin, evaporating on a water-bath until all the alcohol has been volatilized, then adding enough glycerin to make, when cold, a volume equal to the tincture employed. In the case of bodies insoluble in glycerin, a bland oil (olive or expressed almond oils preferred) may be used, as in the following prescription, special care being taken that the oil is bright and clear and free from any trace of rancidity:

℞.	Guaiacoli	5 G.
	Eucalyptoli	12 G.
	Iodoformi	4 G.
	Olei Olivæ	q. s. ad. 100 Cc.

M. Ft. solution. Sig.—For hypodermic use.

Mr. N. W. Yeadle has made an excellent suggestion for the sterilization of bottles which are to contain hypodermic solutions.

Just before using, he partly fills the bottle with a hot two per cent. solution of potassium permanganate, which is shaken well around the sides, then the bottle is rinsed thoroughly with distilled water.

Solutions placed in bottles so sterilized are stated to keep for months without change, and the process is applicable to all kinds of solutions. If the solution is made with oil, the last few drops of water remaining in the bottle are removed by rinsing with a little alcohol followed by ether.

LOTIONS, LINIMENTS, ETC., present no special difficulties, being practically mixtures for specific purposes.

Lotions frequently contain insoluble bodies which should be in a condition to diffuse easily when the liquid is shaken. Gums are sometimes added to emulsify camphors and resinous bodies, but should be used sparingly. The application of a thin mucilage to the skin is not agreeable where it is allowed to dry. Better results are obtained as a rule by means of very fine powders or precipitates.

Liniments may be oily, saponaceous or alcoholic liquids. The first partake of the nature of soft ointments and are applied by rubbing. The second are both stimulating and soothing. They are sometimes made extemporaneously by the admixture of an oil and an alkali, as in soap and lime liniments. The oil and alkali should be mixed at once instead of gradually, and vigorously shaken.

Alcohol favors the union of the oil and alkali and is frequently added for this purpose. Oleic acid also promotes saponification, and the addition of a few drops sometimes aids in the preparation of such.

When an alcoholic liquid is ordered with an alkali and an oil, the alcoholic body, or a portion of it, may be added to the alkali before shaking with the oil, but care must be taken not to dilute the alkali too much before saponifying the oil.

Alcoholic liniments are stimulating or anodyne, and are used mostly for painful affections, as sprains, bruises, neuralgias, etc. They present no difficulties unless an insoluble salt is ordered, or an aqueous fluid is directed to be incorporated. Sometimes corresponding alcoholic liquid can be substituted for the aqueous, in the latter case, as in solutions of iodine and ammonia.

Liniments should be plainly marked "For External Use" and dispensed in a poison bottle. Lotions which are to be used as injections are dispensed in the ordinary vials and marked plainly, but not marked poison unless so ordered on the prescription.

A red label is used for these by preference.

MIXTURES.

A. Simple Solutions.

1.

℞. Chloroform . . . .
Distilled water, each a sufficient quantity.
Sig.—Chloroform Water, U. S. P.

"Add enough chloroform to a convenient quantity of distilled water, contained in a dark amber-colored bottle, to maintain a slight excess of the former, after the contents have been repeatedly and thoroughly agitated. When chloroform water is required for use, pour off the needed quantity of the solution, refill the bottle with distilled water and saturate it by thorough agitation, taking care that there be always an excess of chloroform present."

Make 4 ounces, using 0.5 Cc. of chloroform.

2.

℞.	Camphor	8 Gm.
	Alcohol	5 Cc.
	Precipitated Calcium Phosphate	5 Gm.
	Distilled Water, a sufficient quantity to make	1000 Cc.
M.	Sig.—Camphor water.	

"Triturate the camphor with the alcohol and precipitated calcium phosphate, then with the water gradually added, and filter."
Make one-tenth the quantity.

3.

℞.	Oil of Cinnamon	2 Cc.
	Precipitated calcium phosphate	4 Gm.
	Distilled Water, a sufficient quantity to make . . .	1000 Cc.
M.	Sig.—Cinnamon water, U. S. P.	

"Triturate the oil of cinnamon with the precipitated calcium phosphate, add the distilled water gradually, under continued trituration, and filter."
Make one-tenth the quantity.

4.

℞.	Olei Menthæ Viridis	0.2
	Aquæ Ferventis	100
	Fiat solutionis.	
	Sig.—"Spearmint water."	

Drop the oil upon a 12 Cm. filter-paper, crush together so that the oil may be thoroughly absorbed, then tear into bits and drop into the hot water. Allow to stand until cold and decant or filter.

5.

℞.	Acaciæ	34 Gm.
	Chloroformi	
	Aquæ Dest. āā q. s. ad. . .	100 Gm.
M.	Ft. solut.	
	Sig.—"Mucilage of acacia."	

Wash the acacia with cold water and let it drain. Shake 100 Cc. of water with 1 Cc. of chloroform, allow the excess of chloroform to settle, and add enough of the clear decanted solution to the acacia to make the mixture weigh 100 Gm. Place in a 100 Cc. bottle, and invert occasionally until the acacia is dissolved, then strain.

6.

℞. Lime . . . . 12 Gm.
Distilled water, a sufficient quantity.
Sig.—Lime water, U. S. P.

"Slake the lime by the gradual addition of seventy (70) cubic centimeters of distilled water, then add three hundred and sixty (360) cubic centimeters more of distilled water, and agitate occasionally during half an hour. Allow the mixture to settle, decant the liquid and throw it away. Then add to the residue thirty-six hundred (3600) cubic centimeters of distilled water, agitate thoroughly, wait a short time for the coarser particles to subside, and pour the liquid, holding the undissolved lime in suspension, into a glass-stoppered bottle. From time to time shake the bottle, so as to keep the solution saturated."

Pour off the clear liquid when it is wanted for use.

Make 600 Cc. (or one-sixth of the above quantity) and keep the liquid as cold as possible without freezing. *Do not filter.*

7.

℞. Tincture of Ferric Chloride 20 Cc.
Diluted Acetic Acid . . 30 Cc.
Solution of Ammonium Acetate . . . . 200 Cc.
Aromatic Elixir . . . . . 100 Cc.
Glycerin . . . . 120 Cc.
Water, a sufficient quantity to make . . . . 1000 Cc.
M. Sig.—Basham's mixture, U. S. P.

"To the solution of ammonium acetate (which should not be alkaline) add, successfully, the dilute acetate acid, the tincture of ferric chloride, the aromatic elixir, and the glycerin, and, lastly, enough water to make the product measure one thousand (1000) cubic centimeters. This preparation should be freshly made when wanted."

Make four fluid ounces.

8.

℞. Solution of Lead Subacetate 30 Cc.
Distilled Water, a sufficient quantity to make . . . . 1000 Cc.
M. Sig.—Lead water, U. S. P.

"Mix the solution of lead subacetate with enough distilled water, previously boiled and cooled, to make the product measure one thousand (1000) cubic centimeters. Keep the solution in well-stoppered bottles."

Make four fluid ounces. The solution should be clear. Only distilled water, free from gases, can be used in this preparation.

9.

℞. Tannic Acid . . . . . . 20 Gm.
Glycerin . . . . 80 Gm.
M. Sig.—Glycerite of Tannic Acid, U. S. P.

"Weigh the tannic acid and glycerin, successively, into a tared porcelain capsule, avoiding contact with metallic utensils, and apply the heat of a water-bath until the acid is completely dissolved. Then transfer the solution to a bottle."

Make one-tenth the quantity.

10.

℞. Camphor, in coarse powder . 200 Gm.
Cotton Seed Oil . . . . . 800 Gm.
M. Sig.—Camphorated oil, U. S. P.

"Introduce the camphor and the cotton seed oil into a suitable flask, and apply a gentle heat, by means of a water-bath, loosely stoppering the flask during the operation. Agitate from time to time, until the camphor is dissolved."

Make 50 grams

11.

℞. Soap, in fine powder . . . 70 Gm.
Camphor, in small pieces . 45 Gm.
Oil of Rosemary . . . . 10 Cc.
Alcohol . . . . 750 Cc.
Water, a sufficient quantity to make . . . . 1000 Cc.
M. Sig.—Soap liniment, U. S. P.

"Introduce the camphor and the alcohol into a suitable bottle, and shake until the camphor is dissolved. Then add the soap and oil of rosemary, and shake the bottle well for a few minutes. Lastly add enough water to make one thousand (1000) cubic centimeters, and again shake until the liquid becomes clear. Set it aside, in a cool place for twenty-four hours."

Make 100 *Cc.*

12.

℞. Ammonium Carbonate, in translucent pieces . . . 34 Gm.
Ammonia Water . . . . 90 Cc.
Oil of Lemon . . . . . 10 Cc.
Oil of Lavender Flowers . 1 Cc.
Oil of Nutmeg . . . . . 1 Cc.
Alcohol . . . . 700 Cc.
Distilled Water, a sufficient quantity to make . . . 1000 Cc.

Sig.—Aromatic Spirit of Ammonia, U. S. P.

To the ammonia water, contained in a flask, add one hundred and forty (140) cubic centimeters of distilled water, and afterwards the ammonium carbonate reduced to a moderately fine powder. Close the flask and agitate the contents until the carbonate is dissolved. Introduce the alcohol into a graduated bottle of suitable capacity, add the oils, then gradually add the solution of ammonium carbonate, and afterwards enough distilled water to make the product measure one thousand (1000) cubic centimeters. Set the liquid aside during twenty-four hours in a cool place, occasionally agitating. Keep the product in glass stoppered bottles, in a cool place. Make 100 Cc. The liquid should be nearly clear without filtration. If any considerable amount of salt remains undissolved after twenty-four hours, shake frequently until it dissolves.

13.

℞. Tinct. Ferri Chlorid. . . . . . ʒ ij
Spt. Ætheris Nitros. . . . . . ʒ iv
Mucilag. Acaciæ . . . . . . ℥ i
Syrupi q. s. ut ft. . . . . . . ℥ iij
M. Sig.—Coch. parv. t. i. d. post cibo.

Mix the iron with two drachms of syrup and the spirit of nitre with three drachms of syrup. Mix the mucilage with the remainder of the syrup and gradually add, first the diluted spirit of nitre, then the diluted tincture. May also be mixed by adding the spirit and tincture very slowly to the mucilage previously mixed with the syrup.

14.

℞. Sodii Bicarbonatis . . . . . . ʒ iv
Tinct. Zingiberis . . . . ʒ i
Tinct. Gent. Comp. . . . . . ʒ vi
Aquæ Menth. Virid. . . . . . ℥ iij
M. Sig —Capiat cochleare parvum post prandium.

15.

℞. Potassii Bromidi . . . . . gr. xv
Spiritus Ammon. Aromat. . ʒ j
Syrupi . . . . ʒ ij
Aquæ . . . . ad. ℥ ij
M. Ft. haustis. Sig.—Detur statim.

16.

℞. Tinct. Iodi. . . . . ʒ ij
Glycerini . . . . ʒ vi
Aquæ . . . . ℥ i
M. Ft. solut. Sig.—"Iodine lotion."
Mix in the order written.

17.

℞. Iodi. . . . . ʒ i
Spiritus Camphoræ . . . . . . ʒ iv
Acidi Carbolici . . . . ʒ ss
Aquæ Ammoniæ . . . . . . ʒ iv
M. Sig.—For inhalation.

Dissolve the iodine and carbolic acid in the spirit of camphor, and slowly add the aqua ammonia to this. (A clear colorless solution results.)

18.

℞. Potassii Chlorat. . . . . ʒ i
Acid Salicylici . . . . ℈ i
Tinct. Ferri Chlor. . . . . . . ʒ i
Glycerini . . . . ℥ i
Aquæ . . . . ℥ iv
M. Ft. gargar.
Sig.—"Salicylated gargle."

Dissolve the salicylic acid in the glycerin by aid of a gentle heat, and the chlorate in the water. Mix the two solutions and add the tincture of iron.

19.

℞. Sodii Boratis 1.0
Aquæ Camphoræ 30.0
M. Ft. collyr. Sig.—Eye water.

Dissolve *crystallized* borax in the camphor water.

(Powdered borax is often effloresced and will sometimes precipitate the camphor as well as leave a residue which will not dissolve.)

20.

℞. Ammonii Chlorid. 0.250
Zinci Sulphatis 0.500
Camphoræ 0.150
Aquæ Destillat 40.0
Alcoholis 6.0
M. Ft. collyr. Sig.—Eye drops.

Dissolve the camphor in the alcohol, and the salts in the water; mix the two solutions and shake until the liquid has become clear, then filter.

(This preparation, with the addition of 0.040 gm. of Spanish saffron, macerated in the liquid for twenty-four hours, then filtered, is often prescribed under the name of "Collyrium Astringens Luteum.")

21.

℞. Acid Borici . . . . gr. xij
Zinci Chloridi . . . . gr. iij
Aquæ Camphoræ . . . . . . ℥ ii
Aquæ Destillatæ . . . . . . ℥ ii
M. Ft. collyrium.

22.

℞. Quininæ Sulphatis . . . . . gr. xx
Acidi Lactici . . . . m. xx
Aquæ Destillatæ . . . q. s. ad. m. C.
M. Ft. solut.
Sig.—"For hypodermic use."

23.

℞. Ergotinæ . . . . gr. xv
Acid Carbolici . . . . . . gr. iss
Aquæ Destillat . . . . . . m. lxxv
Solve et filtra.
Sig.—For hypodermic injection.

24.

℞. Ætheris . . . . ℥ iss
Chloroformi . . . . ℥ i
Tinct. Iodi . . . . ℥ ss
Tinct. Camphoræ . . . . . ℥ ss
Olei Picis Liquid . . . . . ʒ ii
M. Sig.—Inhale as vapor.

25.

℞. Ætheris . . . . ℥i
Ol. Terebinth . . . . ʒiv
Acid Benzoic. . . . . ʒiv
Bals. Tolutani . . . . ʒij
M. Ft. solut. Sig.—For inhalation.

26.

℞. Thymoli . . . . gr. xviij
Acid Carbolici . . . . . . ʒiiiss
Ol. Sassafras.
Ol. Eucalypti.
Ol. Terebinthinæ.
Ol. Picis Liquid . . . . . āā ʒii
Ætheris . . . . ʒi
Alcoholis . . . . q. s. ut ft. ℥iij
M. Sig.—For inhalation.

27.

℞. Acid Salicylici 1.0
Acid Lactici 1.0
Acid Acetici Glac. 1.0
Collodii 20.0
M. Ft. solut.
Sig.—Corn and wart collodion.

28.

℞. Saponis . . . . ʒi
Glycerini . . . . ℥i
Tinct. Myrrhæ . . . . . . ♏xxiv
Alcoholis . . . . ℥v
Misce, fac solutionem et adde.
Olei Gaultheriæ . . . . . . ♏xx
Olei Caryophylli . . . . . ♏j
Olei Menthæ Piper . . . . ♏v
Liq. Carmini (N. F.) . . . q. s.
M. Sig.—Tooth wash.

29.

℞. Cydonii Contusi . . . . . ʒi
Aquæ Bullientis . . . . . ℥ivss
Ft. mucilago et adde.
Glycerini . . . . ʒvi
Sodii Boratis . . . . . . gr. xxiv
Spiritus Odorati (U. S. P., 1880) . . . . ℥ss
M. Sig.—Toilet lotion.

(Make the mucilage by macerating the quince-seed in the hot water for three to four hours, then strain.)

30.

℞. Tinct. Benzoini Comp. . . . . ʒi
Glycerini . . . . ʒvii
M. Ft. solut.

B. Compound Solutions.

31.

℞. Arsenous Acid . . . . . 10 Gm.
Diluted Hydrochloric Acid 50 Cc.
Distilled Water, a sufficient quantity to make . . . 1000 Cc.
M. Sig.—Valangin's solution, U. S. P.

"Mix the diluted hydrochloric acid with two hundred and fifty (250) cubic centimeters of distilled water, add the arsenous acid, and boil the mixture until all the arsenous acid is dissolved. Filter the solution and pass enough distilled water through the filter to make the product measure one thousand (1000) cubic centimeters. Mix thoroughly."

Make 100 Cc.

32.

℞. Arsenous Acid, in fine powder . . . . 10 Gm.
Potassium Bicarbonate . . 20 Gm.
Compound Tincture of Lavender . . . . 30 Cc.
Distilled Water, a sufficient quantity to make . . . 1000 Cc.
M. Sig.—Fowler's Solution, U. S. P.

"Boil the arsenous acid and potassium bicarbonate with one hundred (100) cubic centimeters of distilled water, until solution has been effected. Then add enough distilled water to make the solution; when cold, measure nine hundred and seventy (970) cubic centimeters, and, lastly, add the compound tincture of lavender. Filter through paper."

Make 100 Cc.

33.

℞. Lime . . . . 65 Gm.
Sugar . . . . 400 Gm.
Water, a sufficient quantity to make . . . . 1000 Cc.
M. Sig.—Syrup of Lime, U. S. P.

"Triturate the lime and sugar thoroughly in a mortar, so as to form a homogeneous powder, then add the mixture to five hundred (500) cubic centimeters of boiling water, contained in a bright copper or tinned iron vessel, boil for five minutes, constantly stirring, and then strain. Dilute the strained liquid with an equal volume of water, and filter through white paper. Then evaporate the filtrate, in a tared capsule, to seven hundred (700) grammes, allow it to cool, add to it enough water to make the product measure one thousand (1000) cubic centimeters and mix thoroughly. Keep the syrup in well-stoppered bottles."

Make 100 Cc. The syrup should be white, or nearly so.

34.

℞. Hydrarg. Biniodidi 0.400
Potassii Iodidi 6.000
Aquæ 180.000
M. Ft. Solut. Sig.—2 Cc. per dose.

To make the red iodide of mercury dissolve 0.240 Gm. of *corrosive sublimate* in 20 Cc. of hot water, and *6.3* Gm. of potassium iodide in 20 Cc. of water and mix the two solutions. Dilute with the remaining water.

$$(HgCl_2 + 2\ KI = HgI_2 + 2\ KCl.)$$

[0.24 Gm. of $HgCl_2$ and 0.30 Gm. of KI are required to make 0.40 Gm. of HgI_2.]

35.

℞. Hydrargyri Biniodidi . . . . gr. ij
Syr. Sarsaparilla Comp. . . . ℥iij
M. Sig.—One teaspoonful 3 times a day.

The red iodide must be dissolved by aid of a few grains of potassium iodide (about 10 grains) and water (one drachm). It would be dangerous to dispense exactly as written.

36.

℞. Quininæ Sulphatis 2.0
Acidi Sulphurici Dilut. . . . . q. s.
Aquæ 60
M. Ft. solut. Sig.—Coch. med. omnia hora.

Mix the quinine with half the water, add acid drop by drop, until a clear solution is obtained and then add the rest of the water. State on the label how much acid was used.

37.

℞. Tinct. Ferri Chlorid . . . . . . ʒ i
Quininæ Sulph . . . . ℈ i
Acid Sulphuric Dil. . . . . . q. s.
Aquæ . . . . q. s. ad. ℥ ij
M.

No acid is needed, the quinine being soluble in the tincture of iron.

38.

℞. Iodi . . . . gr. iss
Potassii Iodidi . . . . . . gr. iij
Syrupi Aurantii . . . . . . ℥ i
Aquæ . . . . ℥ iij
M. Ft. solutionis.

Dissolve the potassium iodide in two drachms of water and the iodine in this solution. Add the syrup, then the remainder of the water.

39.

℞. Sodii Boratis 3.0
Mellis 30.0
Misce fiat linctus.
Sig.—For sore mouth.

Honey acts upon borax in the same way as does glycerin, but less energetically.

Free boric acid and sodium metaborate is formed in the above by action of the glucose upon the borax.

40.

℞. Tinct. Tolutanæ . . . . . . ʒ ij
Syrupi Senegæ . . . . ʒ iv
Acid Acetici . . . . ℥ iss
Syr. Pruni Virgin ad . . . . . ℥ iv
M. Sig.—A teaspoonful as required.

Add the tincture to the acid, then mix with the syrups. Acetic acid resembles alcohol in solvent powers.

41.

℞. Acid Gallic . . . . ʒ i
Potass. Citrat. . . . . ʒ iss
Aquæ . . . . ℥ iv
M. Ft. solut.

The gallic acid is entirely dissolved by the potassium citrate solution.

42.

℞. Olei Picis Liquidi . . . . . . ʒ ij
Magnesii Carbonatis . . . . . ʒ ij
Aquæ . . . . Oi
Misce, filtra et adde.
Iodi . . . . gr. x
Potassii Iodidi . . . . ʒ ss
M. Ft. solut.
Sig.—Use with inhaler.

Triturate the oil of tar with magnesium carbonate, add the water gradually and filter. Dissolve the potassium iodide in about half an ounce of this filtrate and the iodine in this solution, and mix with the rest.

43.

℞. Sodii Salicylatis . . . . ʒ ii
Tinct. Ferri Chlorid . . . . . ʒ ii
Acidi Citrici . . . . gr. v
Glycerini . . . . ʒ vi
Ol. Gaultheriæ . . . . ♏ iv
Liq. Ammonii Citratis q. s. ad . ℥ ii
M. Ft. solutio. S. A.
Sig.—Salicylated Iron mixture.

Dissolve the sodium salicylate and citric acid in the solution of ammonium citrate. Add the tincture of iron to the glycerin, then mix the two solutions; finally add the oil of wintergreen and shake well. (Salicylates are incompatible with tincture of iron, but precipitation is prevented by the ammonium citrate.)

C. Gaseous Solutions.

44.

℞. Ammonii Carbonat 5.0
Acidi Acetici Diluti 100.0
M. Ft. solutio.
Sig.—" Spirit of Mindererus."

Select clear pieces of ammonium carbonate, weigh carefully, and add gradually to the acid contained in a capacious vessel.

45.

℞. Potassium Bicarbonate. . . 8 Gm.
Citric Acid . . . . 6 Gm.
Water, a sufficient quantity to make . . . . 100 Cc.
Mix. Sig.—Solution of Potassium Citrate, U. S. P.

"Dissolve the potassium bicarbonate and the citric acid, each, in forty (40) cubic centimeters of water. Filter the solutions separately, and wash the filters with enough water to obtain, in each case, fifty (50) cubic centimeters Finally, mix the two solutions, and, when effervescence has nearly ceased, transfer the liquid to a bottle. This preparation should be freshly made, when wanted.

46.

℞. Magnesium Carbonate . . 15 Gm.
Citric Acid . . . . 30 Gm.
Syrup of Citric Acid . . . . . 60 Cc.
Potassium Bicarbonate . . . . 2.5 Gm.
Water, a sufficient quantity to make about . . . . 350 Cc.
Mix. Sig.—Solution of Citrate of Magnesia, U. S. P.

" Dissolve the citric acid in one hundred and twenty (120) cubic centimeters of water, and, having added the magnesium carbonate, stir, until it is dissolved. Filter the solution into a strong bottle of the capacity of about three hundred and sixty (360) cubic centimeters, containing the syrup of citric acid. Then add enough water to nearly fill the bottle, drop in the potassium bicarbonate, immediately close the bottle with a cork, and secure it with twine. Lastly, shake the mixture occasionally, until the potassium bicarbonate dissolves."

47.

℞. Acidi Salicylici.
Sodii Bicarbonatis . . . . . aa ʒ ij
Aquæ . . . . ℥ iij
M. Sig.—" Salicylate of Soda Solution."

Place the acid in a pint mortar, rub to a paste with water and slowly add the sodium bicarbonate.

In the above reaction about two and a half pints of CO_2 are liberated and the effervescence is too violent to control in a three-ounce bottle. The solution gradually darkens owing to the excess of alkali present.

48.

℞. Potassii Chloratis . . . . . . ʒ i
Acidi Hydrochlorici . . . . . ʒ i
Aquæ Destillatæ . . . . ℥ iv
M. Sig.—" Throat mixture."

Compound in two ways.

(*a*)—Place the chlorate in bottle, add the acid, agitate for a moment, then add the water gradually.

(*b*)—Dissolve the chlorate in the water and add the acid to this solution.

49.

℞. Potassii Chloratis . . . . . . ʒ ij
Acidi Hydrochlorici . . . . . ʒ ss
Spiritus Gaultheriæ . . . . . ʒ iiss
Syrupi . . . . ℥ iss
Aquæ . . . . ℥ iv
M. Sig.—" For ulcerated throat."

(The presence of syrup and flavoring in this shows that it is not intended for a solution of chlorine gas.)

50.

℞. Sodii Boratis . . . . ʒ ss
Sodii Bicarbonatis . . . . . . ʒ ss
Acidi Carbolici (cryst.) . . . . gr. vi
Glycerini . . . . ʒ ii
Aquæ . . . . ad. ℥ iv
M. Ft. solut.
Sig.—"Dobell's solution, N. F."

Dissolve the salts in about half the water, add the glycerin and the carbolic acid and lastly enough water to make four fluid ounces.

51.

℞. Acid Salicylic . . . . ʒ ij
Ammon. Carbonat . . . . . . ʒ vi
Syrupi . . . . ℥ iij
Aquæ . . . . ad. ℥ viij
M. Sig.—Ammonium salicylate.

(Note the color.)

52.

℞. Ammon. Chlorid . . . . . . ʒ i
Ammon. Carbonat . . . . . . ʒ i
Vini Ipecac . . . . ʒ i
Syrupi Scillæ . . . . ʒ vii
Syrupi . . . . ℥ j
M. Sig.—*Pro tusse.*

Use powdered ammonium chloride, and triturate the salts well with the syrup of squill, add the wine, and when effervescence has ceased add the syrup.

D. Mixtures.

53.

℞. Potassii Bromidi . . . . ʒ ij
Aquæ Camphoræ . . . . ℥ ij
M. Ft. solut.
Sig.—"Bromide mixture." *Shake.*

Place in a bottle and shake until the bromide is dissolved. Do not filter.

54.

℞. Hydrarg. Chlorid Corros. . . gr. vi
Aquæ Bullientis . . . . . . ʒ ij
Liquoris Calcis . . . . ℥ iv
S. A. Sig.—"Yellow wash." *Shake.*

Dissolve the corrosive sublimate in the boiling water, in a test tube, add to the lime water and shake.

55.

℞. Hydrarg. Chlorid Mitis . . gr. xvi.
Glycerini . . . . ʒ ss
Liquoris Calcis . . . . . . ℥ iv
M. Sig.—"Blackwash." *Shake.*

Triturate the calomel slightly with the glycerin and add the lime-water, constantly stirring.

56.

℞. Zinci Chloridi 1.00
Hydrarg. Subchloridi 0.50
Liquoris Calcis 240.00
M. Ft. lotionis. Sig.—"Zinc and Mercury wash."

Make the zinc chloride for this by carefully measuring 5.5 Cc. of diluted hydrochloric acid, to which add about 1.0 Gm. of zinc oxide, then warm gently and filter through a very small filter. Add this solution to the calomel and lime-water previously mixed. If the zinc chloride be added to the lime-water first, a *white* lotion results; if the calomel is added first, a *black* lotion will be obtained.

57.

℞. Cupri Sulphatis . . . .
Zinci Sulphatis . . āā . . . . ʒi
Liq. Plumbi Subacet . . . . . ʒiss
Acid Acetic Dilut . . . . . . ʒxiij
M. Et filtra. Sig.—"Villate's solution, N. F."

Dissolve the zinc and copper salts in the diluted acetic acid, add the solution of subacetate of lead and agitate thoroughly. Filter through a small filter. To the filtrate add one drachm of starch, shake well and again filter.

58.

℞. Zinci Sulphatis	0.52
Plumbi Acetatis	0.325
Tinct. Catechu Comp. . . .	4.0
Tinct. Opii.	2.0
Aquæ	100.0

M. Sig.—Inject as directed. *Shake.*

Dissolve the zinc sulphate in 60 Cc. and the lead acetate in 30 Cc. of water. Mix the two solutions gradually with shaking. Then add the tinctures in order, and finally rinse the graduate with the remaining 10 Cc. of water.

59.

℞. Acid Sulphurici	
Acid Nitrici . . āā	5.0
Olei Terebinthinæ	15.0
Alcohol	25.0

M. Ft. lotionis.

Place the oil in a capacious porcelain capsule or mortar, under a hood or out of doors. Mix the acids and slowly add to the oil at arms' length. When the reaction is over and mixture has cooled, add the alcohol and bottle.

(This is liable to take fire if the acids are added too fast.)

60.

℞. Acid Nitric	
Chloroformi	
Creosoti . . āā	5

M.

Mix the nitric acid and creosote in an open dish under the hood or in the open air, and when reaction has ceased and the mixture cooled add the chloroform.

61.

℞. Ferrous Sulphate, in clear crystals	6 Gm.
Myrrh, in small pieces .	18 Gm.
Sugar	18 Gm.
Potassium Carbonate . .	8 Gm.
Spirit of Lavender . . .	60 Cc.
Rose Water, a sufficient quantity to make . . .	1000 Cc.

M. Sig.—Griffith's mixture, U. S. P.

"Rub the myrrh, sugar, and potassium carbonate, in a mortar, with seven hundred (700) cubic centimeters of rose water, at first very gradually added, so that a uniform mixture may result. Transfer this to a graduated vessel, add the spirit of lavender, then the ferrous sulphate, previously dissolved in about fifty (50) cubic centimeters of rose water, and, lastly, enough rose water to make the product measure one thousand (1000) cubic centimeters. Mix the whole thoroughly. This preparation should be freshly made, when wanted."

Make four fluid ounces of the mixture. (This mixture, *without the iron*, keeps well, and is frequently so prepared in quantity. When required for use, 3 grains of granulated sulphate of iron are added to each ounce of mixture and well shaken for a few moments.)

62.

℞. Bismuthi et Ammonii Citratis.	ʒiij
Acidi Nitrici Diluti	q. s.
Aquæ	ad. ℥iv

M. Sig.—Teaspoonful as directed.

On adding diluted nitric acid to the bismuth salt, previously dissolved in the water, bismuth citrate is precipitated in a very fine gelatinous condition, which remains suspended for a long time. An excess of acid should be avoided—better a slight deficiency than an excess. In the above the salt may be dissolved in 2½ fluidounces of water, and 19 drachms of this precipitated with diluted nitric acid, then the inder of the solution added. From 4 to 10 drachms of acid are required.

63.

℞. Ferri et Potassii Tartratis. . 4.0
Potassii Bromidi 4.0
Syrupi 15.0
Aquæ Destillatæ . . . . . ad. 60.0
M.

The first two ingredients are incompatible. Dissolve the iron salt in 25 Cc. of water and add the syrup. Dissolve the bromide in the remainder of the water and mix with the iron solution. This begins to precipitate after standing an hour (or less), but the decomposition is less rapid than if the two salts are placed together in the bottle.

64.

℞. Pulv. Camphoræ . . . . . . gr. xv
Sodii Boratis . . . . gr. x
Alcoholis. . . . . ℥ss
Aquæ Rosæ . . . . ℥iiiss
M. Ft. lotio.

Dissolve the camphor in the alcohol and the borax in the rosewater.
Add the first solution to the second, and dispense with a skake-label.

65.

℞. Aquæ Ammoniæ . . . . . ʒss
Spiritus Camphoræ . . . . ♏xxij
Sodii Chloridi . . . . . . ʒij
Aquæ . . . . ad. ℥iv
M. Sig.—" Sedative water." N. F.
Shake.

Dissolve the salt in about two fluidounces of water, add the ammonia and the camphor, and enough water to make four fluidounces. .

66.

℞. Tinct. Benzonii 10.0
Aquæ Destillatæ 150.0
M. Sig.—" Lac Virginis."

Pour the tincture slowly into the water, with constant shaking. This is used (diluted with water), as a toilet wash, and gum should not be used for emulsifying it. If the tincture is added slowly, a milky mixture results.

67.

℞. Sodium Bicarbonate . . . 35 Gm.
Fluid Extract of Rhubarb 15 Cc.
Fluid Extract of Ipecac . 3 Cc.
Glycerin . . . . 350 Cc.
Spirit of Peppermint . . . 35 Cc.
Water, a sufficient quantity
to make . . . . 1000 Cc.
M. Sig. — Rhubarb and Soda mixture, U. S. P.

Dissolve the sodium bicarbonate in about four hundred (400) cubic centimeters of water. Then add the fluid extracts, the glycerin, and the spirit of peppermint, and, lastly, enough water to make one thousand (1000) cubic centimeters.
Make 4 fluid ounces.

67a.

℞. Pure Extract of Glycyrrhiza 30 Gm.
Syrup . . . . 50 Cc.
Mucilage of Acacia . . . 100 Cc.
Camphorated Tinc. of Opium 120 Cc.
Wine of Antimony . . . . 60 Cc.
Spirit of Nitrous Ether . . 30 Cc.
Water, a sufficient quantity
to make . . . . 1000 Cc.
M. Sig.—Brown mixture, U. S. P.

" Rub the pure extract of glycyrrhiza, in a mortar, with five hundred (500) cubic centimeters of water, until it is dissolved. Transfer the solution to a graduated vessel containing the other ingredients, and rinse the mortar with enough water to make the product measure one thousand (1000) cubic centimeters. Mix the whole thoroughly."
Make 100 c.c. (Do not use *powdered* extract, but *pure* extract of licorice.)

67 b.

℞. Saponis Hispan . . . . ℥iv
Sodii Carbonat . . . . ℥ii
Sodii Boratis . . . . ℥i
Aquæ Ammoniæ . . . . . . ℥vii
Alcoholis . . . . ℥iii
Ætheris . . . . ℥ii
Aquæ . . . . . . q. s. ad. Cong. j
M. Ft. solut. Sig.—Cleansing fluid.

67 c.

℞. Compound Chalk Powder . 200 Gm.
Cinnamon Water . . . . 400 Cc.
Water, a sufficient quantity
to make . . . . 1000 Cc.
M. Sig.—Chalk mixture, U. S. P.

"Rub the compound chalk powder, in a mortar, with the cinnamon water, and about two hundred (200) cubic centimeters of water gradually added, to a uniform mixture; transfer this to a graduated vessel, and rinse the mortar with enough water to make the product measure one thousand (1000) cubic centimeters. Mix the whole thoroughly. This preparation should be freshly made, when wanted."

Make four fluid ounces.

67 d.

℞. Quininæ Sulph. 2.0
Ext. Glycyrrhiz. Fld. 10.0
Syr. Zingiberis 20.0
Aquæ 30.0
M. Sig.—ʒi ante cibum.

67 e.

℞. Chloralis . . . . ʒj
Camphoræ . . . . gr. xv
Syr. Zingiberis . . . . ℥ss
Aquæ . . . . ℥iss
M.

Pulverize the camphor and triturate with the syrup. Dissolve the chloral in the water and mix the two liquids. Do not triturate the chloral and camphor together.

67 f.

℞. Pulv. Rhei . . . . ʒj
Pulv. Cinnamomi . . . . . . ℈ij
Magnesiæ . . . . ʒij
Aquæ . . . . ℥iv
M. Sig.—Rhubarb and magnesia mixture.

Triturate the solids with the water gradually added.

68.

℞. Zinci Oxidi . . . . ʒij
Spiritus Camphoræ . . . . . ℥iij
Liq. Plumbi Subacet . . . . ʒiss
Glycerini . . . . ℥ss
Aquæ . . . . ℥viij
M. Ft. lotio. Sig.—"For local use—shake."

Triturate the zinc oxide to a smooth paste with the glycerin, add the water, and, lastly, the camphor and lead solution.

69.

℞. Iodoformi 3
Amyli 1
Glycerini 20
Aquæ 12
M. Ft. enema. Sig.—Inject as directed.

Triturate together the iodoform and starch, add the glycerine and water gradually, heat to 133° C., constantly stirring.

D. Decoctions and Infusions.

70.

℞.	Wild Cherry, in No. 20 powder	40 Gm.
	Water, a sufficient quantity to make	1000 Cc.

M. Sig.—Infusion of wild cherry, U. S. P.

"Moisten the powder with sixty (60) cubic centimeters of water, and macerate for one hour; then pack it firmly in a conical glass percolator, and gradually pour water upon it until the infusion measures one thousand (1000) cubic centimeters."

Make four fluid ounces.

71.

℞.	Cinchona, in No. 40 powder	60 Gm.
	Aromatic Sulphuric Acid	10 Cc.
	Water, a sufficient quantity to make	1000 Cc.

M. Sig.—Infusion of cinchona, U. S. P.

Make four fluid ounces.

"Mix the acid with five hundred (500) cubic centimeters of water, and moisten the powder with thirty (30) cubic centimeters of the mixture; pack it firmly in a conical glass percolator, and gradually pour upon it, first, the remainder of the mixture, and afterwards water, until the infusion measures one thousand (1000) cubic centimeters."

72.

℞.	Digitalis, bruised	15 Gm.
	Alcohol	100 Cc.
	Cinnamon Water	150 Cc.
	Boiling Water	500 Cc.
	Cold Water, a sufficient quantity to make	1000 Cc.

M. Sig.—Infusion of digitalis, U. S. P.

"Upon the digitalis, obtained in a suitable vessel, pour the boiling water, and allow it to macerate until the mixture is cold. Then strain, add the alcohol and cinnamon water to the strained liquid, and pass enough cold water through the residue on the strainer to make the product measure one thousand (1000) cubic centimeters."

Make 100 Cc.

73.

℞.	Senna	60 Gm.
	Manna	120 Gm.
	Magnesium Sulphate	120 Gm.
	Fennel, bruised	20 Gm.
	Boiling Water	800 Cc.
	Cold water, a sufficient quantity to make	1000 Cc.

M. Sig.—Black draught. U. S. P.

"Upon the senna and fennel, contained in a suitable vessel, pour the boiling water and macerate until the mixture is cold. Then strain with expression, dissolve in the infusion the magnesium sulphate and manna, and again strain. Lastly, add enough cold water through the strainer containing the senna and fennel to make the infusion measure one thousand (1000) cubic centimeters."

Make four fluid ounces.

74.

℞.	Sarsaparilla, cut and bruised	100 Gm.
	Sassafras, in No. 20 powder	20 Gm.
	Guaiacum Wood, rasped	20 Gm.
	Glycyrrhiza, bruised	20 Gm.
	Mezereum, cut and bruised	10 Gm.
	Water, a sufficient quantity to make	1000 Cc.

M. Sig.—Compound decoction of Sarsaparilla, U. S. P.

"Boil the sarsaparilla and guaiacum wood for half an hour in a suitable vessel with one thousand (1000) cubic centimeters of water. Then add the sassafras, glycyrrhiza, and mezereum, cover the vessel well, and macerate for two hours. Finally strain, and add enough cold water, through the strainer, to make the product measure one thousand (1000) cubic centimeters."

Make three fluid ounces.

75.

℞. Acidi Benzoici . . . .
Sodii Boratis . . . aa . . . . ʒ ij
Infusi Buchu . . . . ℥ vj
M. Sig.—Dessertspoonful in half a glass of water every three hours.

76.

℞. Chondri . . . . gr. lxxij
Aquæ . . . ad . . . . . ℥ vi
M. Fiat mucilago. Sig.—Mucilage of Irish moss, N. F.

Select the moss, wash it with cold water, them place it in a capacious vessel, add 6 fluid ounces of water, and apply heat until the water has boiled gently for 15 minutes. Then strain, and add enough water through the strainer to make the liquid measure, when cold, 6 fluid ounces. If boiled in an open dish, water must be added from time to time to supply that lost by evaporation.

77.

℞. Chondri . . . . ʒ i
Aquæ . . . . q. s.
Glycerini . . . . ℥ iss
M. S. a.

Wash the moss with water, then place in a suitable dish and pour upon it a quart of water. Apply heat and boil until the whole is reduced to about 6 fluid ounces. Strain while hot, add the glycerin, and pass enough water through the strainer to make 8 fluid ounces. (If bottled immediately this keeps well.)

78.

℞. Chondri 2.0
Aquæ Destillatæ 75.0
Misce coque et cola, denique adde
Aquæ Bullientis q. s. ad . . . 75
Glycerini 30
Alcoholis 15
M. Sig.—*Permanent* mucilage of Irish moss.

Select the Irish moss and boil half an hour in a capacious vessel, being careful not to scorch nor to allow to boil over. Keep up the volume with hot water while boiling.

CHAPTER V.

EMULSIONS.

An emulsion may be defined as an intimate mixture of immiscible fluids, or a fluid and an insoluble solid, by means of some intermediate agent.

They are milky-appearing mixtures, usually somewhat viscid, and often separate into two layers on standing. The term is usually applied to mixtures of oil or fatty bodies with water, but is also applied to intimate milky mixtures of fluids which are insoluble in each other (as chloroform, benzine, etc., with water), or to the suspension of an insoluble powder in water by means of an emulsifying agent.

Among the many branches of extemporaneous pharmacy, perhaps none is more of a bugbear to the average dispenser than the making of emulsions. If he be ignorant of the principles and rules governing emulsification, he quickly comes to look upon them as unstable mixtures of uncertain composition obtained by chance or unlimited muscle used in triturating or agitating.

The making of an emulsion, with a proper emulsifying agent, is, however, almost as positive and certain an operation as the making of a 50 per cent. solution of a salt, or of any other simple mixture.

Let us first consider the theory of emulsification, then the practical operations involved in making emulsions of different kinds.

If we place half an ounce of a fixed oil, as cod-liver oil, in a two-ounce bottle, add to it half an ounce of water and shake vigorously, the oil is broken up into globules and diffused through the water, and the mixture has an opaque appearance. On discontinuing the agitation, however, the oil and water quickly separate into layers again. This is due to two causes: the lack of adhesion between the globules of oil and water, and the difference in specific gravity.

If now we place in another two-ounce bottle half an ounce of mucilage of acacia, turn the bottle so as to flow the mucilage around the inner sides, then add half an ounce of oil and shake vigorously, we obtain a whiter and more opaque mixture than before, which remains permanent for a period varying with the condition of the oil, the density of the mucilage, and the vigor of the shaking which we have given to it.

Here we have broken up the globules of oil as before, but we have also coated each globule, while in a fine condition, with a film of mucilage, which forms a medium of adhesion between the oil and the water in the mucilage, and an emulsion ensues, although the difference in specific gravity is greater than in the first case.

The foundation of an emulsion, then, consists in breaking up the cohesion of the oil as much as possible and getting it into fine globules, which are then coated with a gummy or albuminous substance, as a pill is coated, whereby adhesion is established between the globules of oil and the water and a homogeneous mixture results. If the globules of the oil are not small enough, the cohesion of the oil will gradually reëstablish itself, particle will coalesce with particle, until at length a more or less complete separation of the oil has taken place.

The permanence of an emulsion consists in obtaining the globules of oil in so fine a condition that even a very thin mucilage can prevent their coalescing. These globules are ordinarily too small to be seen with the naked eye, but in emulsions made with a thick mucilage, as mucilage of tragacanth, or mucilage of Irish moss, the globules of oil may be distinctly visible to the eye and yet the emulsion remain permanent, owing to the viscosity of the mucilage which envelopes them. Such emulsions, however, will not bear very much dilution.

The most difficult part of emulsion-making lies in getting the emulsion started. Thus, in making a pint of 50 per cent. emulsion it would be extremely difficult, if not impossible, to do it all in one operation, but by emulsifying a portion or the whole of the oil with a portion of the water and the emulsifying agent, we get a *primary emulsion* which can be diluted with oil, water or other solutions as desired. Good emulsions often separate into layers after standing, but without showing any separated oil. An emulsion should not be condemned for this, because the separation is due not to faulty manipulation in making the emulsion, or to improper ingredients or proportions therein, but to excess of dilution, and a little shaking will quickly rediffuse it.

The same thing occurs in milk—the best type of a natural emulsion,—in which the true emulsion portion separates as cream. When separation of this *emulsion* occurs, we obtain the fat as butter.

In triturating an emulsion, no pressure is needed, but a rapid motion is essential. Five minutes of very rapid trituration will accomplish more in emulsifying an oil or balsam, than an hour of slow trituration. Indeed, if after five minutes or less of rapid trituration an oil does not emulsify it is good evidence of some fault in the ingredients used or of their proportions, and a satisfactory emulsion cannot be expected without alteration of the ingredients. This refers, of course, to small quantities of emulsion, involving a pint or less of oil. Large quantities require longer trituration.

The pestle should be held loosely between the thumb and first two or three fingers, and the motion imparted to it by means of the fingers and wrist, as well as those of the arm and shoulder. This will be found much less tiresome than when the pestle is grasped firmly with the whole hand, and the motion imparted from the arm and shoulder alone. The mortar should be of a capacity three to four times that of the quantity of emulsion which is being made, but the emulsion should be slopped up upon the sides as little as possible. An egg-beater is often a very convenient instrument for making small quantities of emulsions. Glass mortars are not suitable, the surface being too smooth. The emulsion may be stirred in either direction, or alternately. Alternating, or stirring first in one direction then in the other, is not desirable, however, except as a relief to the muscles, since emulsification takes place a little quicker when stirred in one direction only.

Of late years emulsions containing 90 or 95 per cent. of oil have appeared upon the market. These are solid, cheesy bodies, not particularly agreeable to the palate, and they do not keep well. Some of them are soaps, or a combination of soap with the oil. Apparently the only advantage which these possess is that they may be quickly and easily diluted to any required strength, but this is quite offset in the average store by the losses occasioned through separation of the strong emulsion.

All emulsifiable bodies do not emulsify with equal ease. Fixed oils, as cod-liver oil, castor oil, seed oils, etc., emulsify more readily than volatile oils, as turpentine oil, the fragrant oils, etc. Many bodies, as creosote, camphor, some oleoresins, phosphorus, etc., cannot easily be emulsified alone, but can readily be made into an emulsion if first dissolved in a fixed oil, which is then emulsified. Almond oil (sweet) is an excellent solvent for this purpose, being bland and seldom rancid. *All emulsions are easily separated by over-agitation, heat, foreign bodies, etc.*

It is well known that butter is made from milk by long-continued agitation. In the same way oil may be separated from a good emulsion by over-manipulation. Do not stir an emulsion longer than is necessary to thoroughly emulsify the oil. Heat will sometimes prevent the union of an emulsion. This is not liable to occur, though, except in cases where artificial heat has been employed.

Neutral salts, acids and acid salts, alcohol, glycerin, etc., are incompatible with emulsions. Small amounts of any of these may be combined (in solution) with an emulsion, if carefully manipulated. The oil should be thoroughly emulsified and the emulsion diluted as much as the formula will allow, then the salt solutions, alcoholic liquids, etc., added last and slowly. If separation begins, a few drops of water flowed down the pestle and quickly stirred in may restore it. Acids and acid salts are the most troublesome to add, particularly if the emulsion is made with a gum. Emulsions made with tincture of quillaja will mix with these easier. Alkaline salts sometimes assist in emulsions, but it is safer to add these last when gum is present, as in case of neutral salts, since alkali salts sometimes act in the opposite way upon gum-emulsions.

Volatile bodies, as chloroform, ether, etc., should be emulsified by shaking in the bottle to prevent loss by evaporation, but non-volatile bodies are best emulsified in a mortar.

(Emulsion No. 109, offers a good object-lesson in the difference between the two methods.)

EMULSIFYING AGENTS.

Emulsifying agents are chiefly albumious, mucilaginous or saponaceous in character.

ALBUMINOUS AGENTS.—The albuminous agents are characterized by ease of manipulation, wide range of power, and palatability, but they do not keep well, and emulsions made with them soon spoil unless preserved by some antiseptic.

In milk and yolk of egg we have good examples of emulsions with an albuminous agent; milk being an emulsion of butter fat with *casein*, and yolk of egg an emulsion of a peculiar fat with *vitellin*.

Both *Milk* and *Yolk of Egg* are used as emulsifying agents, and are unexcelled as such except as regards keeping qualities. The propensities of milk to "sour" and of egg to become "stale" are well known, and these propensities are not changed by combining with them other fats or oils. But for emulsions which are to be taken immediately, nothing equals these agents for ease of manipulation or palatableness.

It has already been stated that it is much easier to dilute an emulsion already formed with additional oils or water, than to form an emulsion primarily.

Both milk and yolk of egg being natural emulsions, we would, therefore, expect that they would be easy of manipulation when used as emulsifying agents. Not only is this true, but they also emulsify successfully a larger variety of fatty bodies than other agents.

Milk, as ordinarily obtained, is seldom used except as a diluent. In this capacity it serves well for covering the taste of sharp or acrid bodies, as tinctures of capsicum, ginger, etc., and for many salts, chloral, etc. It is too weak of itself to be used to any extent as an emulsifying agent. The ordinary condensed milk of the market serves in this capacity admirably. This contains some sugar, which, however, does not interfere. In using it, the condensed milk is diluted with an equal bulk of water, then the oil is added in small portions, constantly triturating. An emulsion containing 84 per cent. of oil has been obtained by combining 6¾ ounces of cod-liver oil with 5 drachms of condensed milk, previously diluted with 5 drachms of water. This emulsion was of the consistency of lard, and kept well for a month.

Weaker emulsions may be obtained from the same mixture of condensed milk and water, by emulsifying a sufficient quantity of oil, then adding water gradually until the required bulk is obtained. These weaker emulsions do not keep as long as the stronger ones.

Glycerite of yolk of egg is an excellent form of the second to use. The oil should be added in portions to the glycerite in a capacious mortar, with constant trituration, and lastly the diluent may be added in the same manner. Both of these agents are used with excellent results for other bodies more difficult to emulsify than oils, such as creosote, chloroform, terebene, oleoresins, balsams, resinous tinctures, etc.

The appearance of the emulsion will depend largely upon the condition of the egg. When quite fresh, yolk of egg yields a creamy-white emulsion which shows no tendency to separate, but with old eggs, though they may show no signs of becoming stale, the emulsion is decidedly yellow, and in some cases may be deeply so.

For ease of manipulation, for palatableness, and for general utility, yolk of egg and condensed milk stand first among emulsifying agents. Their tendency to spoil, however, condemns them for general use, since emulsions made with either seldom remain palatable for more than three or four days, and they are but little used. They have a special value, however, in emulsions of chloroform, creosote, and other antiseptic bodies, the preservative properties of which will prevent any change for several weeks.

Casein has been recommended as an emulsifying agent. It is, however, not easily obtained, and when procured possesses no advantage over acacia.

It should be comparatively fresh, since it decomposes on standing. The moist (freshly precipitated and undried) casein, with a little sodium bicarbonate, gives the best results.

The dried casein is best prepared from skimmed (by centifrugal force) milk, since it is almost impossible to separate the fat from it when it is prepared from unskimmed milk. The skimmed milk can be easily obtained in all large cities and is also much cheaper. The casein is obtained by first adding ammonia water to the milk (about two fluidounces to a gallon) and allowing to stand 24 hours. Any creamy layer which has separated is then removed, and the casein precipitated from the serum by a slight excess of acetic acid. The magna is then collected and pressed, mixed with one-tenth its weight of sodium bicarbonate and dried at a gentle heat. (Too high a heat destroys it.) When thoroughly dried it is powdered and mixed with enough sugar of milk to make a 10 per cent. mixture of casein.

This mixture may be used for emulsifying in the same manner and proportions as powdered acacia, but does not yield as good results.

Pancreatin is a digestive body obtained from the pancreas of the hog. It consists of an albuminous body similar to casein, and four fermentative bodies, one of which has the power of digesting or decomposing fats and oils. It is always used in alkaline solutions, being decomposed by acids.

It may be used as an emulsifying agent in two ways: either by making a strong aqueous solution with which the oil is gradually combined, as in mucilage of acacia, or by warming the aqueous solution, at about 125° F., with the oil until the latter is partially digested.

By the latter method the oil is partially decomposed, and the resulting mixture is not properly an emulsion, although having the appearance of one. If heated too high the pancreatin will be decomposed.

Pancreatin is not a uniform body, and its emulsifying and digesting powers will be found to vary considerably.

Good pancreatin should emulsify eight to ten times its weight of cod-liver oil by the first method. It is not a good agent for emulsifying volatile oils.

ALBUMINOUS AND MUCILAGINOUS AGENTS.—A few bodies suitable for emulsifying are both gummy and albuminous in character.

Most prominent among these are certain seeds and Irish moss.

Seeds.—Most seeds contain a fixed oil associated with gummy and albuminous matter, and form an emulsion when deprived of their skins and beaten up with water. Pumpkin seed is sometimes dispensed in this manner. The skins may be removed by plunging first into hot water for a minute, then into cold, whereby the skin becomes loosened and may be slipped off. This is called "blanching" the seeds.

In almonds—a favorite seed for emulsions—there exists, in connection with the gum, a principle called *emulsin*, which assists in forming a smooth emulsion. This is partially destroyed by boiling water, and a better way of blanching almonds, when time will allow, is to soak the seeds for half an hour, or until the skins are loosened, in lukewarm water. Almonds have the advantage of adding flavor as well as emulsifying.

In rubbing the seeds to a pulp a little water should be first added (about one part to ten parts of seed), since the pressure may force oil out of them if sufficient water is not present. The seeds should then be rubbed to a smooth, creamy paste, free from all lumps or gritty particles.

After diluting until quite fluid the liquid may be strained if necessary. Seeds which contain a large proportion of gum may be used as emulsifying agents.

Mucilage of Irish Moss has come into favor in recent years as an emulsifying agent. It is not much used alone, but possesses many advantages in economy and compatibility when used in combination with other emulsifying agents. It requires much more trituration than other agents, and does not yield as white and creamy an emulsion, commonly showing fine oil globules. The emulsion, however, does not separate for some time when well made. This oily appearance can be obliterated by the addition of a very small quantity of tincture quillaja or liniment of soft soap. Neither the mucilage nor emulsions made from it keep well. The albuminous matter quickly ferments and putrefaction commences, giving off ill-smelling gases. This can be retarded for a long period or prevented altogether by substituting glycerin and alcohol for about a quarter of the water used in making the mucilage, or by substituting alcohol for a part of the water in diluting the emulsion, as suggested by the National Formulary.

Glycerin appears to aid rather than hinder its emulsifying powers. The mucilage of the National Formulary is quite thin. A much whiter and better emulsion can be made with a mucilage 50 per cent. stronger.

Emulsions with Irish moss can also be made easier and of a better appearance by addition of a little primary emulsion made with acacia or other emulsifying agent to the mucilage. Thus, in making a pint of emulsion, if half an ounce of the oil be emulsified first with ʒi acacia, and this emulsion mixed with the mucilage of Irish moss, the oil afterward added will emulsify quicker and be whiter in appearance. The addition of two or three drops of solution of potassa to the mucilage, just sufficient to neutralize the acid present, also improves its emulsifying powers. A 90 per cent. emulsion of cod-liver oil can be made by using a mixture of equal parts of mucilage of Irish moss and condensed milk. The mucilage of Irish moss for this should be double the strength of the National Formulary mucilage, or 24 grains of moss to an ounce of mucilage. This emulsion does not keep as well as the 84 per cent. emulsion made with condensed milk and water. In making mucilage of Irish moss, only bright succulent pieces should be selected and the boiling continued for at least fifteen minutes. It should be boiled very gently in a capacious vessel to prevent frothing over. Irish moss is more easily combined with tincture of iron and acid than the mucilaginous agents.

Gelatin is recommended chiefly as an emulsifyer of petroleum oils. It resembles mucilage of Irish moss in properties and keeping qualities. Its best recommendation is its low cost. It may be used combined with alkaline salts or soft soap, in veterinary practice, etc.

Mucilaginous Agents.—Gums or mucilaginous bodies are, as a class, the best for general use in emulsions.

They are capable of emulsifying well all bodies desired in emulsions, and the resulting emulsion keeps well under ordinary conditions. All true gums can be used as emulsifying agents. They form very fine, white emulsions.

Alkalies and borax must be added very cautiously to gum emulsions, since they tend to saponify the oil and break the emulsion. Borax also coagulates gums, but this can be prevented by the addition of sugar.

Gum-resins (ammoniac, asafœtida, myrrh, etc.) form natural emulsions when mixed with water. They consist of a gum associated with an oleoresin, and are never used as emulsifying *agents*, but are excellent types of gum-emulsions. When made from the whole drug they are milky in appearance, but if the powdered drug be used a dirty-brown mixture results, which quickly deposits a granular sediment, and leaves an almost clear, watery liquid. This is because the commercial powders are made from garblings, and these are further injured by long heating, which drives out all of the volatile oil, and completely changes the character of the drug.

Gum-resins cannot be powdered in large quantities without loss of their most valuable constituents.

Small quantities of powder may be obtained for immediate use by taking advantage of the fact that extreme cold makes them brittle, and rubbing slowly in a well-chilied mortar and in cold air. The powder thus obtained will cake together again when it becomes warm.

The emulsions can be easily formed at ordinary temperatures by rubbing the *selected* pieces of drug with successive portions of water until all lumps are obliterated.

Acacia is the emulsifying-agent *par excellence* for general use. Emulsions made with it are attractive in appearance, palatable and permanent. Its range of power is exceeded only by the albuminous agents mentioned. Emulsion of chloroform, oleoresins, resinous tinctures, etc., can be made readily with acacia, but separates into layers quicker than when made with yolk of egg.

Either dry acacia or mucilage of acacia can be used for emulsions. Both have their advocates in point of preference, but dry acacia has proved itself a quicker and more certain agent to use, at least in the hands of novices. This is probably due to the fact that dry acacia must always be used in definite proportions, as must also the water first added. Two rules are in common use for making emulsions with dry acacia.

Rule 1.—For one part of gum use four parts of fixed oil (or *two* parts of *volatile oil*), and once and a half as much water as gum.

Rule 2 varies only in using twice as much water as gum. Exceptions to these may be met with in that the proportions of oil to gum vary with different oils; most fixed oils being emulsified well in proportion of four of oil to one of gum; while most volatile oils require one of gum to two of oil. Occasionally, however, a fixed oil is found which requires one-third its weight of acacia, or a volatile body which requires an equal weight. The amount of dilution to which the primary emulsion is subject also affects the proportions. In all cases, once-and-a-half *or* twice as much water as gum must be used for the primary emulsion.

Suppose we wish to make a pint of 50 per cent. (by volume) emulsion of cod-liver oil.

This will require ℥viii of oil, and by the rules every four parts of oil (or ℥iv) will require one part (or ℥i) of gum; then the ℥viii of oil requires ℥ii of gum. Carefully weigh, then, the ℥ii of powdered acacia, place it in a *dry* mortar, having a capacity of Oiii or Oiv, and pour upon it the *f*℥viii of cod-liver oil. Triturate lightly until the acacia is diffused evenly through the oil, which will be accomplished in about a minute, if both acacia and mortar were dry.

Now lift the pestle, and having carefully measured *f*℥iii of water (Rule 1), pour it all upon the oil in the centre of the mortar, then triturate rapidly until a perfectly white creamy mixture results, showing no globules or color of oil, and which has a crackling sound when triturated. This is called a *primary emulsion*. Then add to this slowly, with constant trituration, water enough to make a pint of emulsion. This emulsion is of the color and consistence of thick cream, and is permanent.

Failure sometimes results in using this formula, from lack of care in measuring or weighing. *Approximate amounts will not do.* The acacia must be weighed accurately, and both the oil and water measured accurately and in clean graduates. Do not measure water or aqueous liquids in an oily graduate. The primary emulsion must always be made by means of oil, gum and *water; it cannot be made by using syrup, or a solution of a salt in place of the water.* Such solutions and other liquids can be incorporated with a primary emulsion, but cannot be used in making it. A failure has never been known to occur when these precautions have been observed.

The 50 per cent. emulsions of the market, however, seldom if ever contain as much acacia as this. In making them, advantage is taken of the fact that the primary emulsion will emulsify an additional amount of oil, if properly combined, without "breaking." This enables us to make this emulsion, using only half the amount of acacia in the formula just given.

Thus, instead of mixing *f*℥viii of oil, ℥ii of acacia and *f*℥iii of water for our primary emulsion, we may take half of the required amount of oil, or *f*℥iv of cod-liver oil, ℥i of powdered acacia and *f*℥iss of water, and make a primary emulsion as before. Then to this primary emulsion add the remainder of the oil, in portions of ℥ii or ℥iii at a time, alternating with portions of water ℥i or ℥iss each, and triturating each portion until thoroughly emulsified before adding the next. Finally, enough water is added, in portions, to make the finished emulsion measure a pint.

This requires but little more skill than the first method, and only half as much acacia, and makes a considerable saving in cost. Some prefer to use lime-water, in place of the water, after making the primary emulsion. This has a saponifying action upon the oil, and yields an emulsion which does not as readily separate into layers.

In using mucilage of acacia, the mucilage is placed in a dry mortar, and the oil added in small portions, each portion being thoroughly emulsified before adding the next. One ounce of mucilage will easily emulsify two ounces of cod-liver oil, with the addition of a little water near the end of the emulsification.

Often a failure is made in this through the breaking of the emulsion while adding the last portions of oil. A little calculation will show the cause. One ounce of mucilage having a specific gravity of 1.25 will weigh an ounce and a quarter, and contain 34 per cent. of gum, or about 200 grains. This amount of gum will emulsify, according to the rule, about ℥xiii of the oil. Then, after adding ℥xiii of oil to the mucilage, the remainder of the oil should be alternated with portions of water, as in making the 50 per cent. emulsion.

Mucilage of acacia, when used for emulsions, must always be fresh. The slightest trace of sourness may prevent its forming an emulsion.

When other emulsifying agents are prescribed in combination with acacia, a mucilage may be made with the combined emulsifiers, and the oil gradually incorporated, or a primary emulsion may be made with the acacia and a part of the oil, to which are added first the other agents, then the remainder of the oil, with a little water if needed.

Acacia can be used to advantage in emulsifying resinous tinctures when mixed with aqueous fluids. The amounts to use will vary somewhat with the strength of the tincture and the amount of dilution.

Tincture of Benzoin, simple or compound, can generally be emulsified with half its volume of mucilage, while tincture of guaiac ammoniated requires nearly or quite its own volume of mucilage.

The mucilage should be diluted with water to prevent precipitation of gum in the mucilage by the alcohol in the tincture, then the tincture added gradually with constant trituration.

The addition of a little gum or mucilage to mixtures containing resinous tinctures, though not directed on the prescription, is usually justifiable, and in the line of elegant pharmacy.

Wax, spermaceti, etc., may be emulsified by melting in a hot mortar, adding an equal weight of powdered acacia, then one-and-a-half times as much *hot* water, and triturating until a primary emulsion is formed, which may afterward be diluted with warm water. Yellow wax should be used, as it makes a better emulsion than the white. Copaiba requires one-third to one-half its weight of acacia.

Tragacanth is, next to acacia, the most popular emulsifying agent. It is a type of the "insoluble gums," and consists of a small proportion of true gum which dissolves in water and forms a very tenacious mucilage, and a large proportion of *bassorin*, or insoluble gum, which swells enormously in water, but does not dissolve.

Thus a mucilage of tragacanth if made by treating one part of the gum with twenty parts of water is a thick, gelatinous semi-solid, which is capable of occluding a large amount of oil, the bassorin being an obstacle to coalescence rather than a coating for the oil. It forms dense emulsions, which are not as white and creamy as those made with acacia, and will not bear as much dilution. Tragacanth is capable of emulsifying 40 to 50 times its weight of oil, but it is not often used alone, as the emulsions are too thick to be agreeable. It is frequently combined with acacia as a means of cheapening the emulsion, and also to prevent separation into layers by thickening it. Various proportions of tragacanth and acacia may be made into a mucilage into which the oil is stirred, as in using mucilage of acacia.

Tragacanth is specially useful for suspending heavy powders, like bismuth subnitrate, etc., in mixtures.

Dextrin has been recommended by the National Formulary. Only white dextrin should be used, and this is difficult to obtain of good quality. Owing chiefly to this difficulty emulsions made with dextrin are not very common.

Extract of Malt is sometimes used as an emulsifying agent, and may be classed among the gummy agents, since it contains gum and some dextrin. The thick semi-solid extract is used for this purpose, the oil being added gradually to it in a mortar with trituration. It yields a brownish emulsion, which quickly separates into layers, but does not separate oil. Its taste is enhanced by the malt, and probably the action of the diastase upon the oil is of value. It should not be used unless directed, however, since extract of malt has a therapeutic action of its own which may be undesirable.

SAPONACEOUS AGENTS.—These are of two kinds, the saponin emulsions, and the soaps. Emulsions with this class of agents are best made by shaking in a bottle.

Tincture of Quillaia.—Quillaia, or soaptree bark, contains a principle called saponin, which has the property of emulsifying oils and other bodies. It is this same principle which causes the frothing in preparations of sarsaparilla and senega.

Tincture of quillaia is one of the easiest emulsifying agents to use, and has a wide range of power, forming good emulsions with nearly all of the emulsifiable bodies. Even mercury may be emulsified (?) with it by gentle shaking. The usual *modus operandi* is to place the tincture in a dry bottle and add the oil to it in portions, shaking vigorously after each addition. The National Formulary gives a formula for preparing an emulsion in this way containing eighty-five per cent. of cod-liver oil, one part of the tincture emulsifying 8½ parts of oil. Volatile oils require a much larger proportion of the tincture, sometimes an equal volume.

Quillaia is especially useful in emulsions containing free acid, which interferes seriously with other emulsifying agents. Its acrid taste and irritating properties, however, which are noticeable in an emulsion, are a decided objection to it.

Tincture of Senega may be used in place of tincture of quillaia, and is less acrid. This is specially useful when an expectorant can be given with the oil, but should not be used where this is contraindicated.

Soaps and Alkalies.—A soap is a chemical combination of an alkali base with a fat or oil, the acids from the fat being combined with the alkali and a chemical salt or soap is formed. Soaps are decomposed by water, liberating an alkaline body which has the property of saponifying or "emulsifying" additional portions of oil. Alkalies act in the same manner by first forming a soap with part of the oil, which then serves to "emulsify" more oil.

These are not true emulsions, and are not tolerated by pharmaceutical ethics for internal use. They serve an excellent use in sprays, liniments, veterinary practice, etc. Soft soap and liniment of soft soap are convenient forms to use in making these mixtures. Alkalies will not emulsify volatile oils because these do not form soaps.

Linimentum Ammoniæ and Linimentum Calcis are good illustrations of these mixtures or soaps, made directly from alkali Liniment of soft soap is sometimes added surreptitiously to gum-emulsions to prevent separating or to recombine oil already separated. If much has been added a frothing may be noticed when the emulsion is shaken.

Emulsions made with soap are incompatible with acids, which not only break the emulsions but also decompose the soap.

Resin soaps are said to give the best results as emulsifyers.

Emulsions of Copaiba are often ordered made with an alkali. This forms a smooth emulsion which stands well. The alkaline action is specially desired, and the emulsion is rendered more compatible with alcoholic bodies than when gum is used.

EMULSIONS.

79.

℞. Ammoniac . . . . 40 Gm.
Water, a sufficient quantity
to make . . . . 1000 Cc.
M. Sig.—Emulsion of ammoniac, U. S. P.

"Rub the ammoniac in a warmed mortar, with nine hundred (900) cubic centimeters of water, at first very gradually added until a uniform emulsion results. Then strain the mixture into a graduated vessel, and wash the mortar and strainer with enough water to make the product measure one thousand (1000) cubic centimeters." Make four fluid ounces.

80.

℞. Sweet Almond . . . . . 60 Gm.
Acacia, in fine powder . 10 Gm.
Sugar . . . . 30 Gm.
Water, a sufficient quantity
to make . . . . 1000 Cc.
M. Sig.—Milk of almond, U. S.P.

"Having blanched the almond, add the acacia and sugar, and beat them in a mortar, until they are thoroughly mixed. Then rub the mass with nine hundred (900) cubic centimeters of water, at first very gradually added, until a uniform mixture results. Strain this into a graduated vessel, and wash the mortar and strainer with enough water to make the product measure one thousand (1000) cubic centimeters. Mix the whole thoroughly."

Make four fluid ounces. Blanch the almond by soaking in warm water until the skins are loosened.

81.

℞. Amygdalæ Dulcis 20.00
Olei Ricini 30.00
Sacchari 15.00
Aquæ . . . . . . q. s. ad. 100.00
M. Ft. haustus. Sig.—Sumatur statim.

82.

℞. Hydrarg. Bichlorid . . . . . gr. iv
Acid Hydrochloric . . . . . ʒj
Amygdal Amaræ . . . . . ʒiv
Glycerin . . . . ʒiij
Tinct. Benzoini . . . . . . ♏xv
Aquæ Amygdal Amaræ . . . ℥iv
M. S. A. Sig.—"Freckle lotion."

Blanch the almond and beat into a paste with the glycerin, to which gradually add ℥iii of the water. Place in a bottle and add the tincture of benzoin in very small proportions, constantly agitating. Lastly add the remainder of the water, in which the corrosive chloride and the acid have been dissolved.

83.

℞. Acaciæ Pulveris . . . . 10.
Sacchari Pulveris . . . . . . 30.
Olei Morrhuæ . . . . 60.
Aquæ . . . . q. s. ad. 120.
M. Fac. emulsionem. Sig.—Capiat ʒi pro doso.

(*a.*) Make a primary emulsion with the acacia, 40 Cc. of oil and 15 Cc. of water, add the remainder of the oil in portions, alternating with portions of water, and lastly add the sugar dissolved in the remainder of the water.

(*b.*) Make a mucilage with the acacia and 20 Cc. of water; in this dissolve the sugar, and then add the oil in portions, thoroughly emulsifying each before the next is added. Lastly add the water.

84.

℞. Olei Jecoris Aselli . . . . . . 32.
Olei Gaultheriæ . . . . 30.
Fiat Emulsionis . . . . 64.
M. Sig.—"Acacia Emulsion."

Make according to the rule for emulsions, using 8 Gm. of powdered acacia. Also make using 4 Gm. of powdered acacia.

85.

℞. Olei Jecoris Aselli 30.0
Mucilaginis Acaciæ 15.0
Olei Gaultheriæ 0.5
Aquæ Menthæ Viridis 15.0
M. Sig.—8 Cc.

Place the mucilage in a mortar and gradually add 20 Cc. of cod-liver oil, triturating thoroughly after each addition. Then add the remainder of the oil in portions of 2 or 3 Cc., alternating with 1 to 1½ Cc. of spearmint water; lastly add the oil of wintergreen and the remainder of the spearmint water.

86.

℞. Olei Morrhuæ . . . . ℥i
Glyceriti Vitellæ . . . . . . ʒiiss
Aquæ q. s. ad. . . . . ℥ii
M. Sig.—"Glyconin mixture."

Add the oil gradually to the glycerite, with constant stirring; lastly, add the water.

87.

℞. Fresh Yolk of Egg . . . . 45 Gm.
Glycerin . . . . 55 Gm.
M. Sig.—Glyconin, U. S. P.

"Rub the yolk of egg, in mortar, with the glycerin, gradually added, until they are thoroughly mixed."
Make ten grammes.

88.

℞. Olei Morrhuæ . . . . ℥i
Mucilaginis Chondri (N. F.). . ʒv
Aquæ . . . . ʒiij
M. Sig.—"Carrageen mixture."

Place the mucilage in a pint mortar and triturate with the oil, added very slowly and in portions, taking care that each portion is well emulsified before adding the next. Lastly, add the water.

89.

℞. Olei Morrhuæ 30.0
Mucil. Chondri 15.0
Aquæ Amygdal Amar. 15.0
M. Signa.—Tablespoonful.

Use the "permanent" mucilage of Irish moss for this.

90.

℞. Olei Morrhuæ . . . . ʒvij
Tinct. Quillajæ . . . . ʒij
Syrupi . . . . ʒi
M. Sig.—"85% Emulsion, N. F."

Place the tincture in a dry bottle, gradually add the oil, and emulsify; lastly, add the syrup.

91.

℞. Olei Morrhuæ . . . . ℥i
Mucilag. Dextrini (N. F.) . . . ʒv
Aquæ . . . . ʒiij
M. Sig.—"Dextrin Emulsion."

Make in same way as carrageen emulsion.

92.

℞. Olei Morrhuæ . . . . . . ℥ij
Ext. Glycyrrhizæ Pulv. . . ʒss
Confect. Amygdal . . . . gr. xij
Spt. Lavand. Comp. . . . ʒi
Spt. Menth. Pip. . . . . . ♏xxxv
Syr. Tolut. . . . . ʒvij
M. Sig.—Black mixture.

Triturate together the extract of licorice and confection of almond, mix well with the syrup of tolu, and add to this slowly the cod-liver oil with constant trituration. When all is emusified add the spirits in portions. This forms a dense, black, permanent emulsion, in which the taste of the cod-liver oil is quite effectually masked.

(The confection of almond is made by mixing 6 Gm. blanched almonds, 1 Gm. of powdered acacia and 3 Gm. of sugar. This was formerly official as a basis for the preparation of emulsion of almond (by simply triturating with water), but it does not keep well.

93.

℞. Olei Morrhuæ . . . . ℥ij
Pulv. Tragacanthæ . . . . . gr. xlv
Aquæ . . . . ℥ij
M. Fiat emulsio.

94.

℞. Acaciæ 4.4
Tragacanthæ 6.3
Olei Morrhuæ . . . . . 240.
Aquæ . . . . 120.
Syrupi . . . . . q. s. ad. 480. M.

Mix the acacia and tragacanth with 60 of oil, add 24 of water, and triturate until primary emulsion is formed. To this add the remainder of the oil and water, and lastly the syrup.

95.

℞. Tragacanthæ Pulv. . . . . . ʒi
Acaciæ Pulv. . . . . ʒiss
Marantæ . . . . ʒi
Olei Morrhuæ . . . . ℥vi
Aquæ . . . . ℥vi
Spiritus Chloroformi . . . . ʒi
Saccharini . . . . grs. iii
Olei Cinnamomi . . . . . . ♏ix
M. Fac. emulsionem.
Sig.—Ut dictum.

Put the powders in a dry mortar, rub to a smooth paste with a little oil, add the remainder of the oil, mix well, then add all of the water and triturate quickly until emulsified.

Dissolve the saccharin and oil of cinnamon in the spirit and incorporate.

96.

℞. Spiritus Camphoræ . . . . . . ʒij
Spiritus Chloroformi . . . . .
Tinct. Lavand. Comp. . āā . ʒi
Mucil. Tragacanth . . . . . . ℥i
Aquæ . . . . ℥iij
M. Sig.—Sedative mixture.

97.

℞. Olei Ricini . . . . ℥i
Acaciæ Pulv. . . . . ʒiii
Olei Amygdalæ Amaræ . . . ♏ii
Olei Caryophylli . . . . ♏i
Liquoris Saccharini . . . . . ♏iv
Aquæ . . . . q. s. ad. ℥iv
M. S. A. Sig.—Pro alvo.

98.

℞. Olei Morrhuæ . . . . ℥iv
Acaciæ Pulveris . . . . ℥ss
Olei Cinnamomi . . . . . . ♏iv
Olei Amygdalæ Amaræ . . . ♏iv
Saccharini . . . . gr. ii
Aquæ . . . . q. s. ad. ℥viii
M. Ft. emulsio.

99.

℞. Olei Morrhuæ . . . . ℥ii
Vitelli . . . . ℥i
Sodii Chloridi . . . . gr. xii
Liq. Saccharini . . . . ♏iii
Olei Caryophylli . . . . . . ♏iv
Aquæ . . . . q. s. ad. ℥iv
M. F. emulsio.

100.

℞. Olei Morrhuæ . . . . ℥iii
Liq. Pancreatici . . . . . . ʒiv
Mucilaginis Acaciæ . . . . . ʒiv
Olei Gaultheriæ . . . . ♏xv
Syr. Calcii Lactophosph. . . . ℥i
M. Ft. emulsio.
Sig.—"Pancreatic Emulsion."

Mix the pancreatic solution with the mucilage, add the oils gradually, and emulsify, and lastly, add ℥i of simple syrup, in which 15 grains of commercial calcium lactophosphate have been dissolved.

(The official syrup of calcium lactophosphate contains free acid, which is incompatible with the bicarbonate in the pancreatic solution.)

101.

℞. Acaciæ Pulveris . . . . . .
Tragacanthæ Pulv. . . . . .
Marantæ . . . . aa . . . . ℥ss
Pepsini Saccharati . . . . . ʒi
Olei Morrhuæ . . . . ℥iv
Olei Cinnamomi . . . . . . ♏iv
Olei Sassafras . . . . ♏iij
Olei Amygdalæ Amar. . . . ♏j
Olei Gaultheriæ . . . . ♏ii
Glycerini . . . . ʒiv
Syr. Hypophosph. cum. Ferro ʒv
Acid Phosphorici Dilut . . . ʒiij
Aquæ Destillatæ . . q. s. ad. ℥viij
M. Fac. emulsionem.
Sig.—"Phosphatic emulsion."

Mix the gums, arrowroot and pepsin with ℥i of oil, add ʒvi of water and emulsify thoroughly, then add alternately the remainder of the oils and the water. Lastly, add the syrup and the acid previously mixed with the glycerin.

102.

℞. Misturæ Olei Terebinthinæ . . 60.0
(Each cl. to contain 1 Cc. Oil Turpt.)
Sig.—1½ cl. ante edente.

Use acacia in proportion of 0.5 Gm. to each Cc. of oil.

103.

℞. Olei Terebinthinæ 8.0
Pulv. Tragacanthæ 1.0
Syrupi 15.0
Aquæ . . . . . . q. s. ut. ft 60.0
M. Ft. emulsio.

Place the oil in a dry bottle, add the tragacanth, shake, add 15 Cc. of water and shake vigorously until an emulsion results. Add the remaining ingredients gradually.

104.

℞.	Ol. Terebinthinæ	℥i
	Ovi Recentis	♏︎j
	Olei Limonis	ʒi
	Acid Acetici	ʒv
	Aquæ Rosæ	℥iiss

M. Sig.—"Stokes' liniment." *Shake.*

Triturate the egg and oils together in a mortar until they are thoroughly mixed, then incorporate the acid and rose-water.

105.

℞.	Chloroform	40 Cc.
	Expressed Oil of Almond	60 Cc.
	Tragacanth, in very fine powder	15 Gm.
	Water, a sufficient quantity to make	1000 Cc.

M. Sig.—Chloroform emulsion, U. S. P.

"Introduce the tragacanth into a perfectly dry bottle of sufficient capacity, add the chloroform, and shake the bottle thoroughly, so that every part of the surface may become wetted. Then add about two hundred and fifty (250) cubic centimeters of water, and incorporate it by vigorous shaking. Next add the expressed oil of almond, in several portions, shaking after each addition, and when the oil has been thoroughly emulsified, add enough water, in divided portions, shaking after each addition, until the product measures one thousand (1000) cubic centimeters."

Make four fluid ounces.

106.

℞.	Chloroformi	ʒss
	Tinct. Tolutanæ	ʒi
	Mucil Acaciæ	ʒii
	Syrupi	ʒiv
	Aquæ Menthæ Viridis q. s. ad	℥ii

M. S. a. Sig.—"Chloroform mixture."

Place the mucilage and two drachms of syrup in a bottle, and *gradually* add, with vigorous shaking, the chloroform and tincture of tolu previously mixed. When completely emulsified, add the remainder of the syrup and the spearmint water, with constant shaking.

107.

℞.	Pulv. Acaciæ	℥i
	Olei Lini	ʒxv
	" Cinnamomi	gtt viij
	" Gaultheriæ	gtt xv
	Glycerini	ʒvi
	Syrupi	ʒx
	Spiritus Frumenti	℥ij
	Acid Hydrocyan Dil.	gtt x
	Chloroformi	ʒv

M. Sig.—Compound linseed emulsion.

108.

℞.	Ovi	No. iv
	Sodii Chloridi	gr iv
	Glucosi Syr.	℥ii
	Mucilag. Amyli	℥iv
	Lactis	℥iv

M. Ft. enema. Sig.—Nutrient enema.

109.

℞.	Copaibæ	4.0
	Mucilag. Acaciæ	6.0
	Olei Gaultheriæ	0.260
	Tinct. Lavand. Comp.	4.0
	Aquæ Destillatæ	45.0

M. Sig.—ʒii t. i. d. post edente.
Compound by two methods.

(*a*) Place the mucilage in the bottle, flow around the sides, add the copaiba and oil, shake well, add 5 Cc. of water, shake and gradually add the remainder of the water and lastly the tincture, shaking after each addition. Label "Bottle method."

(*b*) Place the mucilage in a mortar, add the oil, then the copaiba in portions, triturating actively, then the water gradually and lastly the tincture. Label "Mortar method."

110.

℞. Copaibæ	8.0
Liquoris Potassæ	2.0
Olei Gaultheriæ	0.186
Glycerini	15.0
Aquæ Cinnamomi q. s. ut ft.	60.0

M. Sig.—4 p. r. n.

Place the solution of potassa, with 4 Cc. of cinnamon water, in a 60 Cc. bottle, add the copaiba gradually, shaking well, then the oil, glycerin and balance of the cinnamon water in order.

111.

℞. Ceræ Albæ	
Cetacei	
Saponis Pulveris	
Sodii Boratis . . . āā	1.0
Amygdalæ Dulcis	15.0
Alcoholis	15.0
Aquæ Amygdalæ Amaræ	60.0

Misce et cola. s. a. Sig.—"Toilet cream."

Blanch the almonds by soaking in warm water (about 40° C.), for half an hour, and after removing the skins bruise in a large mortar and rub to a smooth paste with 20 Cc. of bitter almond water, then dilute with 20 Cc. of more of the water.

Melt the wax and the spermaceti and mix with the soap and borax in a small *warm* mortar, and gradually add 20 Cc. of *warm* bitter almond water. When cold mix the two emulsions, and add the alcohol. Strain through cheese-cloth.

112.

℞. Creosoti	1.0
Acaciæ	5.0
Sacchari	10.0
Aquæ	ad. 60.0

Miscentur s. a. Sig.—Creosote mixture.

113.

℞. Creosoti	2.0
Lactis Concentrat	20.0
Ol. Cinnamomi	0.65
Aquæ	ad. 100.0

M. Ft. emulsion. Sig.—"Creosote emulsion."

Triturate the condensed milk with an equal bulk of water, add the creosote and oil, triturate thoroughly, and incorporate the water gradually.

114.

℞. Emulsionis Terebinthinæ Canadensis 2%	100.0

Sig.—"Fir balsam emulsion."

This can be made with acacia (2 Gm.), mucilage of acacia (6 Cc.), tragacanth (0.5 Gm.), glyconin (8 Cc.), or any of the other emulsifying agents.

"Chian" and other hard turpentines or balsams must first be dissolved in an equal or double volume of ether, and this mixture emulsified in the usual manner.

115.

℞. Petrolati	℥j
Acaciæ	℥ss
Aquæ	ad. ℥ii

M. Ft. emulsio. Sig.—"Petrolatum emulsion."

Use soft petrolatum and make according to rule.

116.

℞. Terebeni	
Ol. Gossyp. Sem. . . āā	♏clx
Pulv. Acaciæ	ʒvi
Pulv. Sacchari	ʒii
Aquæ . . . . . q. s. ut fiat.	℥iv

M. Ft. emulsio. Sig.—"Terebene emulsion."

117.

℞. Terebeni . . . . ♏clx
Acaciæ Pulv. . . . . gr. lc
Ol. Menth. Pip. . . . . . . ♏xx
Ext. Glycyrrhizæ Fld. . . . . ℥i
Glycerini . . . . ʒii
Aquæ . . . . q. s. ad. ℥ij
M. Ft. emuls. Sig.—Terebene emulsion.

Mix the terebene, oil and acacia in a dry mortar, add 135 minims of water and stir until the emulsion forms.

Add the glycerin and the remainder of the water gradually, and lastly, the fluid extract of licorice. (C. E. Dotey, Ph. G.)

118.

℞. Paraldehydi . . . . ℥viij
Vitelli . . . . No. vj
Olei Cassiæ . . . . ʒss
Sacchari Pulv. . . . . ʒi
Aquæ . . . . ad. ℥xvi
M. Sig.—Paraldehyde emulsion.

119.

℞. Solution of Lime.
Linseed Oil, of each, one volume.
Mix them by agitation.
Sig.—Carron oil, U. S. P.
Make two fluid ounces.

120.

℞. Ammonia Water . . . . . 350 Cc.
Alcohol . . . . 50 Cc.
Cotton Seed Oil . . . . . . 600 Cc.
Mix.
Sig.—Volatile Liniment, U. S. P.

"Mix them by agitation in a bottle, which should be well stoppered. This liniment should be freshly prepared, when wanted."

Make two fluid ounces.

121.

℞. Olei Ricini. . . . .
Aquæ Ammoniæ. . . . . . .
Ammonii Carbonat . . aa . . ʒi
Alcoholis . . . . ℥iv
Aquæ ut ft. . . . . ℥viij
M. S. A.
Sig.—"Volatile Shampoo."

122.

℞. Saponis . . . . ʒij
Potassii Carbonat . . . . . . ʒss
Tinct. Quillajæ . . . . ʒij
Alcohol . . . . ℥i
Ol. Lavandul. . . . . ♏iij
Aquæ . . . . ℥i
M. Sig.—"Shampoo Liquid."

123.

℞. Whale Oil Soap . . . . . . 1 oz.
Kerosene Oil . . . . 2 Pints.
Boiling Water . . . . 1 Pint.
Mix. Label "Kerosene insecticide."

Dissolve the soap in the boiling water, add the kerosene, and churn them together by means of a large force syringe until completely emulsified.

(This is a standard insecticide. It is diluted with 3 to 10 parts of water and sprayed upon trees or shrubbery.)

124.

℞. Sodii Boratis . . . . . gr. xxv.
Saponis Pulv. . . . . . gr. xv
Olei Theobromatis . . . ʒ ij
Olei Cocois . . . . . . ♏xv
Aquæ Rosæ ad. . . . . ℥ v
M. Sig.—Cocoa Milk.

Triturate the oils and solids in a warm mortar, with ʒ iii of rose-water, until thoroughly mixed, then dilute gradually with the remainder of the rose-water. Almond oil may be substituted for the cocoanut oil, if desired.

125.

℞. Olei Terebinth. . . . . . . ʒ iv
Olei Olivæ . . . . ℥ ii
Saponis . . . . ℥ i
Sodii Chloridi . . . . ʒ iv
Aquæ Ferventis . . . . Oi
M. Ft. enema.

Dissolve the soap in the warm water, mix the oils, and shake with the soap solution until thoroughly mixed.

126.

℞. Acetanilidi 3.0
Mucilag. Acaciæ 30.0
Syrupi 30.0
M. Ft. mist. Sig. — Dose, one teaspoonful.

127.

℞. Camphoræ 1.00
Pulveris Acaciæ 2.00
Decoctionis Lini 250.00
Ovi Vitelli . . . . No. j
M. Ft. enema. Sig.—Inject as directed.

Powder the camphor finely, add the acacia and yolk of egg, mix well and stir in the decoction of flaxseed gradually.

128.

℞. Camphoræ 0.5
Acaciæ . . . . q. s.
Aq. Destillatæ . . . . . . 100.
Syr. Althæa . . . . 20.
M. Ft. emulsio.

Reduce the camphor to a very fine powder by aid of a little alcohol, mix with 0.5 Gm. of gum and add the syrup gradually. Lastly add the water.

129.

℞. Camphoræ 1.0
Tragacanthæ 1,0
Syrupi 10.0
Aquæ 50.0
M. Ft. emulsio.

130.

℞. Salol 10.0
Acaciæ Pulv. 5.0
Aquæ 25.0
M. Ft. emuls. Sig.—Salol emulsion.

Melt the salol on a water bath, mix with the acaciæ in a warm mortar, then add 7.5 Cc. of *warm* water and triturate rapidly. When well emulsified add the remainder of the water.

131.

℞. Salol	ʒ i	
Pulv. Acaciæ	ʒ i	Triturate the salol with the powdered gums and water, gradually added.
Pulv. Tragacanthæ	gr. x	Then add the syrup, and finally the tincture.
Tinct. Tolutanæ	ʒ iiss	
Syrupi Tolutani	℥ i	
Aquæ . . . . . q. s. ad	℥ iij	

M. Sig.—"Salol emulsion."

132.

℞. Sulphonal	ʒ i
Acaciæ	
Tragacanthæ . . āā	gr. x
Syrupi	℥ i
Aquæ	℥ ij

M.

133.

℞. Potassii Chloratis	ʒ i
Tinct. Cinchonæ Comp.	ʒ iv
Tinct. Guaiaci Ammon.	ʒ iv
Acaciæ Pulveris	q. s.
Mellis	ʒ iv
Aquæ q. s. ad.	℥ iv

M. S. a. Sig.—Gargle.

134.

℞. Resinæ Guaiaci	gr. xxiv	
Acaciæ Pulveris	gr. xij	Triturate the solids together and add the cinnamon water gradually.
Sacchari	gr. xxiv	
Aquæ Cinnamomi	℥ ii	

M. Sig.—"Guaiac mixture." *Shake.*

CHAPTER VI.

CONFECTIONS, ELECTUARIES, JELLIES.

Confection (Lat. *Confectio-onis*), a paste or mass composed of medicinal agents with saccharine and flavoring matter, intended to be eaten, or dissolved in the mouth. Small lumps, of a size approximating some familiar object, are directed to be taken at a time. They are dispensed in jars, wide-mouthed bottles or impervious boxes.

Conserves (Lat. *Conserva-æ*), a confection containing only *fresh* (undried) medicinal agents. These must contain enough saccharine matter to act as a preservative.

Electuary (Lat. *Electuarium-ii*), a confection containing *dried* medicinal agents.

Jelly (Lat. *Gelatinum-i*), a glutinous, translucent substance, intermediate between a liquid and a solid, intended (*a*) either to be swallowed from a spoon or (*b*) for external application. The latter are often opaque. (See under plasmas.)

CONFECTIONS.—This term now includes both the true conserves and the electuaries, the latter terms being used rarely.

These preparations are less frequently demanded than formerly, having been displaced by lozenges. A class of preparations called "*pastes*" were also in use, which differed from the confections in containing gum, and in being of a firmer consistence, more like the pastilles or tabellæ of the present.

Jujube paste was made by dissolving 3 ounces of acacia in 4 fluidounces of water, adding 3½ fluidounces of syrup, evaporating to a very thick consistence and adding toward the last 1 fluidounce of orange-flower water. The warm mass was then run into shallow pans to cool and stiffen, medicinal agents, flavoring, coloring, etc., being added while still fluid. This is cut into sheets or squares and forms the so-called "jujubes" of pharmacy.

They are still somewhat in demand in France.

The true confections were made by beating the moist drug (fresh rose-petals, etc.) with sugar until a smooth mixture is obtained, a little excipient being added at the last if needed.

Electuaries offer no difficulties in preparation. The dry powders are mixed in the usual manner by trituration or sifting, then the excipient is worked in so as to form a mass.

Honey or syrups are the most common excipients. For laxative electuaries the pulp of prunes, tamarinds, figs, currants, etc., are agreeable massing agents, and aid, to some extent, in the action of the electuary.

These are prepared by steaming the fruits until they are well softened, then rubbing through a sieve to remove the skins and seeds. Currant and prune pulps are particularly agreeable as excipients.

Jellies for internal use are confined almost entirely to the administration of fixed oils, wherein they have the advantage of diminishing the adhesion of these to the mouth, and thereby lessening their taste and nauseating qualities.

Castor oil or cod-liver oil may be administered in this way. The following formula for the preparation of these is taken from Parrish's Pharmacy:

Take of the fixed oil, ...	1 ounce.
Honey and syrup, each, . . .	½ fluid ounce.
Powdered gum arabic, ...	2 drachms.
Russian isinglass, ...	40 grains.
Aromatic water (bitter almond, orange flower, cinnamon, etc.),	6 fluid drachms.

Dissolve the isinglass by aid of heat in one-half ounce of the water, triturate the other ingredients into a homogeneous mixture with the remaining portion of the water in a warm mortar, then form an emulsion by adding the solution of isinglass, stir as it cools, and set aside to gelatinize.

Isinglass is the best base for oils, while gelatin, Irish moss, starch, salep, and tragacanth, are used for aqueous and alcoholic bodies, or for insoluble powders.*

In order to obtain perfectly clear and transparent jellies filtration is usually necessary, and gelatin or Irish moss must be used. The other agents give opaque jellies, and do not admit of filtration.

When sugar is added, as is usually the case, it may serve as a vehicle for diffusing insoluble bodies, or such as are incompatible with aqueous fluids, as volatile oils, tinctures, etc.

When flavored with fruit juices less gelatin is needed, as the pectin in the juice gelatinizes when boiled. The "Art of Dispensing" directs these to be made by combining the juice with half its weight of sugar, boiling, skimming and straining.

To 100 parts of the hot juice are now added 2 parts of gelatin, and, after dissolving the latter, the jelly forms on cooling.

* For proportions needed to jellify see pages 198 and 199.

CONFECTIONS, JELLIES, ETC.

135.

℞. Red Rose, in No. 60 powder 80 Gm.
Sugar, in fine powder . . . 640 Gm.
Clarified Honey . . . . . 120 Gm.
Stronger Rose Water . . . 160 Cc.
Mix.
Sig.—Confection of Rose, U. S. P.

"Rub the red rose with the stronger rose water, previously heated to 65° C. (149° F.), then gradually add the sugar and honey, and beat the whole together until a uniform mass results."
Make one-twentieth the quantity.

136.

℞. Senna, in No. 60 powder . 100 Gm.
Cassia Fistula, bruised . . 160 Gm.
Tamarind . . . . 100 Gm.
Prune, sliced . . . . . . 70 Gm.
Fig, bruised . . . . . . 120 Gm.
Sugar in fine powder . . . 555 Gm.
Oil of Coriander . . . . . 5 Gm.
Water, a sufficient quantity
to make . . . . 1000 Gm.
Mix.
Sig.—Confection of Senna, U. S. P.

"Place the cassia fistula, tamarind, prune and fig in a close vessel with five hundred (500) cubic centimeters of water, and digest for three hours, by means of a water-bath. Separate the coarser portions with the hand, and rub the pulpy mass, first through a coarse hair sieve, and then through a fine one, or through a muslin cloth. Mix the residue with one hundred and fifty (150 cubic centimeters of water,. and, having digested the mixture for a short time, treat it as before, and add the product to the pulpy mass first obtained. Then, by means of a water-bath, dissolve the sugar in the pulpy liquid, and evaporate the whole, in a tared vessel, until it weighs eight hundred and ninety-five (895) grammes. Lastly, add the senna and the oil of coriander, and incorporate them thoroughly with the other ingredients while they are yet warm."
Make one-twentieth the quantity.

137.

℞. Olei Morrhuæ . . . . ℥v
Ichthiocollæ . . . . ʒii
Sacchari . . . . ℥iss
Olei Amygdalæ Amaræ . . . . ♏iv
Olei Pimentæ . . . . ♏iv
Olei Cinnamomi . . . . ♏ii
Aquæ . . . . ℥iv
M. Sig.—"Cod-Liver Oil Jelly."

Place the oil, isinglass and water in a capsule, heat upon a water-bath until the isinglass melts, then add the sugar, previously triturated with the essential oils, remove from the heat and stir as it thickens. When cold a firm jelly results.

138.

℞. Confectio Opii (U. S. 1860) .
Opium . . . . ʒivss
Aromatic Powder . . . . . . ℥vi
Clarified Honey . . . . ℥xiv
Mix.

139.

Conserva Amygdalarum. (Conserve of Almond.)

℞. Sweet Almond	. . .	30 Grammes
Powdered Acacia	. . .	5 Grammes
Powdered Sugar	. . .	15 Grammes

Blanch the almonds, and incorporate thoroughly with the other ingredients.

(This is a convenient mixture for the quick preparation of emulsion of almond, U. S. P., which may be made by triturating the above with enough water to make 500 Cc. It keeps fairly well in closely stoppered bottles, and may be made almost permanent if the almonds are dried at a low heat, after blanching and bruising them.)

140.

℞. Iodoformi	gr. iij
Ætheris	℥i
Carbon. Ligni	℥i
Glycerini . . . . . . q. s. ad	℥iss

M. Ft. Elect.

Sig.—For Diarrhœa.

Dissolve the iodoform in the ether and mix with the powdered charcoal. Allow ether to evaporate and then make into a paste with glycerin.

141

℞. Potassii Chloratis	ʒiv
Ext. Glycyrrhizæ Pulv.	ʒiv
Pulveris Cubebæ	ʒii
Olei Gaultheriæ	gtt v
Confect. Rosæ	℥i
Glycerini	q. s.

M. Ft. Electuarium.

Sig.—Take a piece about the size of a pea.

142.

℞. Sulphuris	℥ii
Potassii Bitartratis	℥i
Sacchari	℥i
Syrupi Fusci	q. s.

M. Fiat Electuarium.

Sig.—"Sulphur and Cream of Tartar."

143.

℞. Tinct. Ferri Chlorid	ʒii
Mucilaginis Acaciæ	
Syrupi . . . . āā	ʒvij
Tinct. Vanillæ	♏xv

M.

Sig.—"Iron Jelly."

Mix the mucilage, syrup and vanilla and add the tincture of iron. If the mucilage is fresh, the mixture sets into a ruby-red, transparent jelly, but an old mucilage requires a larger proportion of mucilage. This jelly is liquefied by acids.

CHAPTER VII.

PILLS.

The word "pill" comes from the Latin *Pilum*—a ball, and the diminutive **Pilula**, a little ball, is the term used in prescription-writing to denote a pill or pills. A pill may be defined as a mass of medicinal matter, round or ovoid in form, intended for internal administration. A pill should weigh, exclusive of coating, from one to five grains, none being less than one grain unless specially ordered.

A **Bolus** is a large pill, commonly more than five grains. When very large they are preferably made oval-form. They are more generally prescribed in veterinary practice, and should always be just firm enough to keep their shape without being hard.

Dragees are sugar-coated boli.

Granules are sugar pellets impregnated with medicinal matter which is applied in liquid-form and absorbed by the pellets; these are afterward dried. They are restricted mostly to homœopathic practice, and are sometimes called pellets.

Parvules are very small sugar-coated pills, usually containing powerful remedies in small doses and colored red or pink to distinguish them from granules.

Compressed pills are more properly tablets, and will be treated under that head.

Aggregation pills are made by the gradual accumulation of medicinal ingredients upon a prepared nucleus. They are treated of under the head of sugar-coating.

Concentric pills consist of successive layers of medicinal matter, each of which has a different medicinal action from the others, and is separated by a coating of sugar, keratine, etc. They are intended for combinations of drugs, one of which is best absorbed in the stomach and another in the intestines, the latter forming the inner ring or nucleus, and being coated with keratine, salol or collodion, while the outer dissolves in the stomach. They have been also proposed for administering bodies which unite if mixed, as the ingredients of Blaud's pills, the two being separated by a coating of suitable material. They are very troublesome to make and are seldom demanded.

THE importance of pill-making in pharmacy is suggested by the popular phrase often used to designate a pharmacist—"a pill-maker."

Not only is the making of pills important, but the knowledge and skill which the pharmacist exhibits in making various pills may commonly be taken as a criterion of his knowledge and skill in general pharmacy.

The operator who treats all pill-masses alike, uses the same excipient and methods in each case, shows a woful lack of knowledge or judgment, and usually of both. The science of pill-making involves a knowledge of chemistry, materia medica, and pharmaceutical physics, and cannot be thorougly learned without this knowledge. Skill in manipulation is also necessary, and can only be acquired by practice coupled with judgment.

Study and practice then are the only avenues by which the pharmacist can hope to become master of the art of pill-making.

The object of prescribing medicines in pill-form is two-fold; to cover the taste of disagreeable remedies, and, in some cases, to give them in a concentrated form.

Any medicine which may properly be administered in solid form, and the dose of which is not too bulky, may be prescribed in the form of pills. Many drugs are too bulky to administer in this way, and some, such as the salts of bismuth, cerium, etc., do not have as good a therapeutic action if taken in this form. A few salts, as the bromides of potassium, sodium, etc., have an irritant action, and should always be administered in solution.

Many salts are so easily dissolved as to present special obstacles to the forming of good pills, and many liquids are prescribed in pill-form which render the problem more complex. It is in the ingenuity and judgment displayed in the handling of such special cases, and in the combinations of difficulties that the skill of the operator is best shown.

Special precautions are sometimes to be observed in weighing and mixing the ingredients of pills. Solid extracts should be weighed upon a piece of paper upon which a little lycopodium has been sprinkled and the whole counterpoised. This prevents sticking of the extract to the paper and avoids loss. If the extract be hard or tenacious, unless dry enough to be powdered, it should be softened by trituration with a little water or diluted alcohol (strong alcohol is in most cases not so good for this purpose), taking care to add only enough to make a thick liquid with the extract. This will now be in a condition to mix readily with powders or other extracts. Potent remedies, the alkaloids, active principles, etc., are first mixed with other powders, or if mixed with extracts they may first be dissolved in a few drops of the liquid used to soften the extract to insure complete admixture. Resinous extracts are softened by triturating in a warm mortar or working on a warm plate, which should not be hot.

The ingredients of the pills having been thoroughly mixed, they are next to be formed into a stiff paste or dough for shaping into pills.

This is called a *pill-mass*.

The body added to form the mass is called the *excipient*.

A good pill mass is *plastic*, *adhesive*, but not sticky, and *not easily changed* under ordinary conditions, except by drying.

When well made it is easily moulded and does not adhere to the hands or utensils.

When formed into pills, these should dissolve or crumble when placed in warm water for a few minutes.

The choice of a mortar is important in making a pill-mass. A wedgewood mortar with a broad base and a small pestle having an extra long and stout handle, should be chosen.

Triturating the mass will be found much less easy and effective than kneading it.

By holding the pestle so that the end of the handle rests upon the fleshy portion of the hand near the wrist, the mass can be easily and rapidly worked and nearly the entire weight of the operator imposed upon it without fatigue. The heat generated in working is often an important factor in forming the mass. The warmth of the hands is often well taken advantage of also, by kneading in the hands.

Some operators prefer to use a glass or porcelain slab and a broad and stiff spatula or putty-knife in forming the mass. This has the advantage of forcing more material under the action of the knife at one time and more rapid work may be done upon particular masses, but it has many disadvantages, being restricted in range and more laborious.

An iron plate or griddle well smoothed and polished, is a good adjuvant to the pill utensils, being easily and quickly warmed, and serving an excellent use, when warm, in working resinous or tenacious masses.

The mass should be worked very thoroughly and a free use made of the spatula to keep the mixture under the pestle. The sides of the mortar and pestle should be scraped frequently while the mass is being formed. A stiff spatula is better here than a limber one. The stubs of broken spatulas, the broken and ragged edges being ground off and rounded, are especially useful in pill-making.

The mass being formed, we have next to divide and shape it into pills.

It is first taken from the mortar or tile as completely as possible and worked in the hands into a short cylinder, then by means of a broad spatula or wooden roller it is rolled on the tile or pill machine until its length corresponds to the number of divisions upon the tile or machine representing the number of pills we wish to make.

Care must be taken here to keep the "pipe," as it is called, of uniform diameter throughout, and the ends must be squared up frequently by pressing them up with the spatula.

The pipe is then placed upon the divisions and cut into sections.

If cut upon a tile, care must be taken to hold the spatula at right angles to the pipe, and to cut all evenly or there will be a difference in the sizes of the pills. The sections of pipe are then rounded roughly in the fingers and finished by rolling under the finisher. In absence of a pill-finisher a large specie cork may be used, or the clean cover of an ointment box, the sides of the cover having been cut down so as not to touch the tile when resting upon the pills.

A duplex finisher is to be preferred to a single finisher, as being better adapted to pills of different sizes.

When rounding the pills in the fingers, they should be pressed, not folded into shape, to avoid showing a crease in the pills. Such creases are difficult to eradicate.

If the pills show a tendency to crumble or show folds when finishing, a smooth surface may be obtained by placing a single drop of water, syrup or diluted alcohol upon a warm tile, and rolling the pills in this under the finisher.

A small, thin, iron plate is very convenient for this purpose, since it can be more easily and quickly warmed than glass or porcelain.

CONSPERGENT OR DUSTING POWDERS are used to prevent the mass from sticking to the machine or to prevent the pills from adhering to each other in the box.

They should be used sparingly in all cases, and particulary when the pills are to be coated.

Many masses can be made into pills without the use of a dusting powder, but most masses require a little.

Lycopodium is most frequently used.

The spores of lycopodium have on the surfaces miscroscopic ridges or hairy projections which cause the spores to cohere in a manner similar to Burdock burrs, and form a chain-like coating around the pill if it be too moist. Thus a little lycopodium will accomplish as much as a considerable quantity of another absorbent powder, and the excess can readily be poured off.

Powdered licorice root is often used. This is a good absorbent and has the advantage of a pleasant taste. The peeled or Russian powdered licorice should be selected for this purpose, being brighter in color and more palatable.

For white pills, a white dusting powder is to be preferred. Powdered starch answers well for this purpose. Powdered orris root may also be used, or talcum.

For pills containing odorous ingredients, such as valerianate of zinc, creosote, etc., or such as are particularly nauseous, an aromatic dusting powder is often agreeable. Orris root or cinnamon or a mixture of these are pleasant additions to the pill-box. Avoid the use of aromatic powders which contain a large proportion of natural oil, such as cardamom, fennel, nutmeg, etc.

These are apt to become sticky.

EXCIPIENTS.—The choosing of an excipient is a matter of considerable importance. It is this which determines whether the pills shall be too large or as small as possible, soluble or so slowly disintegrated as to be of little value, permanent or easily changed by action of the air. It is here that the operator's knowledge of chemistry, materia medica and physics becomes of practical use.

The excipient should be harmless in its action upon the system, and should not be incompatible with any of the ingredients of the pill. It should have a preservative power upon the mass.

The best excipient is that which most quickly and easily makes a good mass and a small pill which is easily disintegrated.

In many cases a combination of excipients is best in order to obtain small pills, one in order to dissolve the substance and reduce the bulk, the other to impart adhesiveness and plasticity to the mass. This point is often overlooked in the quest for a "universal excipient," which can never be found. Many of these so-called universal excipients will make a plastic mass for a large variety of pills, but they add materially to the size of the pills instead of decreasing them, as can often be done.

Excipients may be divided into three classes, liquid, dry and adhesive excipients.

Liquid Excipients form the most important class and are most frequently used.

They are used for all bodies which are soluble to some extent in the ordinary solvents, including vegetable powders and their extracts, soluble salts, etc. Some of these are soluble in water, and some only in alcohol or oils, etc., and the choice of excipient is controlled by these considerations. *The excipient should have some solvent power upon the solid* which is formed into a mass. Thus, we cannot form camphor into pills by use of water because the water has not the solvent power to soften and render adhesive the camphor, but if we use a little castor oil the camphor is partially dissolved, the remainder rendered soft and plastic and the mass can be rolled into pills.

On the other hand, not all good solvents make good excipients. Alcohol and ether are good solvents for camphor, but very poor excipients for it, because they are too volatile, and the solutions are limpid and possess no adhesive properties. A solvent excipient should either be somewhat viscid and sticky of itself, or it should make a solution by action upon the pill-ingredients which will possess enough of these properties to bind the remaining solids in a plastic mass.

These excipients should be added cautiously and well worked in, or the mass may suddenly become too soft. When first added the mass may appear quite dry and crumbling after a moment's trituration, but on continued kneading the solvent power of the excipient becomes manifest, more liquid is formed than was added in the first place, owing to the fact that a portion of the solid has entered into solution, and a good mass may be formed without further addition of excipient.

It is generally a saving of time and labor, and oftentimes a better mass is secured by adding all of the required excipient at once, but this plan calls for considerable experience and judgment. The novice who attempts it is almost sure of getting in too much and spoiling his work. Practice will enable one to judge quite closely, particularly in the use of excipients to which one is accustomed. The excipient is best dropped upon the blade of a spatula and transferred to the *end* of the pestle (not the side), from whence it can most easily be distributed through the mass.

A free use of a spatula should be made in keeping the ingredients in the bottom of the mortar and in removing what has caked upon the end of the pestle. The spatula which is used for this purpose should not be dipped into the excipient jar, or this will become contaminated.

The most important of the liquid excipients are glucose, honey, syrup, water, tinctures, alcohol, glycerin, oils, soap and water, treacle and soft extracts.

Glucose, *honey*, evaporated to half its original bulk, *syrup*, and *water* are adapted for those bodies soluble in water and for many vegetable powders. Sometimes water is used first to partially dissolve and reduce the bulk, then glucose to make the mass.

Glucose or honey is better than syrup, being more viscid and adhesive.

Glucose usually contains a trace of dextrin, formed during the process of manufacture, which adds to its value as an excipient. It has been improperly called "Syrup of Dextrin."

Honey contains a little wax and gummy matter which makes it more adhesive.

It will not make a white pill, however, and possesses no advantage over glucose.

The commercial glucose is very thick and for most masses is best diluted, when it adds less to the bulk of the pill. A mixture of about four parts of glucose and one part of syrup keeps well and is sufficiently limpid for most purposes.

Water is little used alone as an excipient, but is valuable as an aid, as when soap is used, or in some cases with glucose, to obtain a smaller pill than could be made with glucose alone.

Alcohol and alcoholic tinctures are often used with resinous bodies.

When resins of jalap, podophyllum, etc., are prescribed in pills, the respective tinctures of those drugs may be used as an excipient. They possess the advantage over alcohol alone of being more sticky and making a more adhesive mass. Tinctures of powerful drugs, as cannabis indica, nux vomica, etc., should not be used, since even the small amounts needed will add materially to the medicinal activity of the pill.

Alcohol and tinctures, however, are not in special favor as excipients, because they make a tough mass which crumbles unless worked up quickly, and the pills are apt to become very hard. These qualities may be partially obviated by use of a little glycerin with the alcohol.

Soap is better to use with resinous bodies, although it makes a larger pill.

It increases the solubility of the pill and keeps the mass soft.

The water must be added cautiously to these masses, since a very small excess will make the pills so moist that they cannot be handled. The greatest objection to soap is its incompatibility with metallic salts, and with acids.

Glycerin, by reason of its wide solvent power, is much used as an excipient.

Owing to its hygroscopic nature it is little used alone, but is much used in combination with gums or starch.

It prevents the pills from becoming too hard or insoluble, but should not be used when pills are to be gelatin-coated.

A good excipient, which serves for quite a wide range of masses, may be made by sifting into glycerin 4 per cent. of powdered tragacanth, and allowing to stand twenty-four hours.

This resembles the official *mucilage of tragacanth*, which is especially valuable as an excipient for salts and insoluble bodies.

Treacle or molasses may be substituted for honey as an excipient, but is not as good and is seldom used.

Sometimes the tonic *extracts* are prescribed as excipients, particularly extract of malt, extract of dandelion and extract of gentian.

These make good masses with many bodies, and are often intended for a therapeutical adjuvant to the pill. They materially increase the size of the pill, and are seldom chosen for excipients when not prescribed by the physician. They are liable to become slightly acid from oxidation of the sugars or albuminous matter, first to alcohol, then to acetic acid. When this has occurred they are unfit for use as excipients for pills containing carbonates, bicarbonates or any body upon which the acid can act.

A strong alcohol is much less liable to oxidize to acid than a weak one, hence this trouble is seldom met with in extracts containing more than 20 per cent. of alcohol.

ADHESIVE EXCIPIENTS are required for such bodies as are insoluble in the ordinary solvents, and are held in shape solely by the tenacity of the excipient. Such are the salts of bismuth, arsenous acid, reduced iron, mercury, etc.

These present few difficulties, the choice depending mainly upon the relative sizes of the pills obtained. In many cases an excipient which will increase the size of the pills is desirable. It is seldom that a pill is desired smaller than a one-grain quinine-pill, and this may be taken as a standard of size for potent remedies or heavy bodies which require to be built up.

Mucilage of tragacanth is the chief excipient of this class.

Tragacanth responds quickly to the action of water and swells enormously, which causes the pills to disintegrate. The mucilage is a thick mass, well adapted to massing dense bodies, and contains enough glycerin to prevent the mass from becoming hard.

Mucilage of acacia, on the contrary, is a liquid which makes a much smaller pill, but the pills will grow so hard in a short time that they are practically insoluble. Acacia dissolves very slowly, and hence pills containing it are less quickly disintegrated, even when glycerin is added. On the whole, the use of acacia or mucilage of acacia as an excipient is not to be commended.

Mucilage of tragacanth or other gums should not be used too freely, because if too much is added, the mass becomes elastic, rubber-like, and the pills cannot be well rounded.

Confection of Rose is a favorite excipient with many. This owes its adhesive powers to the sugar and honey which it contains, and possesses no advantage over these. The presence of the rose is objectionable in some cases because of its astringency, or because of possible reactions with the tannic acid which it contains. It should not be used with pills which are laxative in their action, or with those containing iron salts.

Powdered extract of licorice, with glucose, evaporated honey, or other liquid excipient, is often used.

Resin ointment, petrolatum or Canada Balsam, are sometimes used as excipients where aqueous or alcoholic excipients are to be avoided.

These are little used, being confined chiefly to pills of nitrate of silver, permanganate of potassium, or very deliquescent salts.

Most of the so-called "universal excipients," formulas for which are published frequently, belong properly to this class.

The following are examples of these:

Amylum, 10 G.; Glycerin, 90 G. Rub together in a mortar, then heat to 290° F. until the starch granules are dissolved.

Tragacanth, 4 G.; Glycerin, 96 G. Triturate together, and allow to stand twenty-four hours.

Glucose, 120 G.; Glycerin, 30 G.; Powdered Acacia, 6 G.; Benzoic Acid, .065 G.; mix. (Remington.)

Dry or Absorbent Excipients.—These are used to stiffen liquid or soft bodies so that they may be formed into a mass.

They are often the most difficult excipients to select, especially where comparatively large quantities of liquid are prescribed in pill form. Oftentimes both an absorptive powder, and a liquid excipient must be used in order to obtain a plastic mass, and the pills, which result, are very large.

Where the liquid can be evaporated this may suffice, but many liquids do not admit of this, and it is often difficult to find a body which will combine with these to make a good pill-mass without forming too large a pill.

Magnesia has the property of absorbing large quantities of some liquids and making a gelatinous mass, and is often used in pills containing large quantities of liquids.

The light magnesia should be used for this purpose—not the heavy. If the light magnesia be mixed with fifteen times its weight of water, and allowed to stand half an hour, it sets to form a jelly which cannot be poured from the vessel. When mixed with some balsams, oleoresins, or volatile oils, it unites with the acids of those bodies to form salts, and usually a small proportion of magnesia is sufficient to make a plastic mass. It acts best when a little water is present with the oil or balsam.

The copaiba mass of the U. S. Pharmacopœia is made in this way,—allowing the mass to stand twenty-four hours before rolling into pills. This is done in order to give time for completion of the reaction.

A serious objection to the use of magnesia lies in the fact that if too much be used the mass forms a very hard cement-like body, which is insoluble, and in order to avoid this considerable time is required for the mass to stiffen. When the exact amount of magnesia required is known, the reaction may be hastened by slightly warming, taking care to avoid loss of volatile constituents by too high or too long-continued heating.

Were it not for this tendency in magnesia to form medicinal pebbles instead of pills when used in excess, it would be a valuable material at the pill counter, but considered in this light it should be used very cautiously, if at all.

Not more than one part of magnesia to ten of liquid should be used in any case.

Soap has a considerable absorptive power for oils and certain chemicals. Animal soap, commonly called curd soap, is much better for this than vegetable or castile soap, being harder and more tenacious. Oftentimes a good mass may be made with this without the use of water, either by massing or by digesting. A good creosote pill may be made by digesting equal parts of creosote and curd soap (or a larger proportion of castile soap) in a stoppered, wide-mouth bottle until they combine, then allowing the mass to cool before rolling. This method was recommended by Mr. Martindale, of London. Soap is also useful as an addition to vegetable powder for massing oils, etc.

Crumb of Bread (Mica Panis) is an excellent absorbent for oils, and has for many years been recommended for use as an excipient.

It serves fairly well for pills, but is seldom at hand in a fresh condition in the pharmacies, and does not possess sufficient advantages over other excipients to be sought avidiously. It does not make a very adhesive mass, and has mostly passed into disuse.

It is best used when one day old.

Flour, either wheat or rye flour, makes a good substitute for crumb of bread when used in connection with aqueous fluids. The gluten makes plastic dough, the absorbent powers of which are interestingly shown at the Waltham watch factory, where dough is used to remove the excess of oil from the minute-screws by which the watch-works are held together, a little trick which, though simple, has been the means of saving many thousands of dollars to the company. It removes the excess of oil thoroughly, yet leaves them lubricated and in a condition to resist rust. Flour may often be substituted for starch as an excipient, with advantage.

Powdered licorice root is one of the best inert drying powders, and is largely used. The greatest objection to it is that too much may be required, so that the pills are unduly large. With small amounts of liquids it may be used in nearly all cases.

Powdered Extract of Licorice is particularly useful in connection with powdered licorice root.

The commercial article contains a large quantity of starchy and other insoluble material (commonly 35 to 40 per cent.) which is absorptive, and a better mass may be secured than when the powdered root is used alone.

Ordinarily about half as much of the powdered extract is used as of the root.

Tragacanth has a strong affinity for aqueous water, but is not of so much value with oils or balsams unless a little water be added also. Tragacanth consists of a small proportion of a soluble gum, and large proportion of Bassorin, a peculiar gummy body which swells enormously in water, but does not dissolve. It is this body which gives to tragacanth its sponge-like property, but it responds only to aqueous solvents.

Acacia is sometimes substituted for tragacanth in order to bind a mass together, but is more objectionable unless mixed with glycerin to prevent the pills from becoming insoluble.

Powdered Althæa is an excellent form of gummy excipient to use. This consists chiefly of gum and starch, and does not harden as acacia or tragacanth alone do.

It is much used in some sections.

Precipitated Phosphate of Calcium is the best of the inorganic powders, except magnesia. Its usefulness in this respect is limited, and it is employed rather as a diluent.

It is almost insoluble in neutral liquids, and has little or no medicinal action when taken into the system in the solid form.

Manna is seldom used. It is useful as a protective, owing to its saccharine character. It may be used advantageously with salts containing water of crystallization which have a tendency to liquefy when triturated, or in those in which water is set free by chemical reaction, as in the Blaud's pills, etc.

Manna not only takes up the water, but protects the salt, and makes a fairly good mass.

Cacao Butter may be used for pills containing much oil or soft resin. The oil is usually added to the melted butter, stirred in thoroughly, and the mixture chilled until it stiffens.

The quantity of oil which can thus be incorporated is limited only by the consistence of the mass so obtained. Pills made of cacao butter cannot be handled much, and should be kept in a cool place.

Wax will absorb much more oil, and the pills made from it are more permanent.

The yellow wax is better to use, since the white contains small quantities of foreign fats which are liable to become rancid, and it has a greater tendency to crumble.

Objections are made to wax that even when mixed with a considerable proportion of oil, the fusing-point of the mixture is above the heat of the body, and the mass is insoluble in the stomach, consequently the pill will pass through the system without disintegrating.

It is claimed, however, that if the wax be first mixed with starch this will not occur, and a mixture is recommended as a stock-excipient of equal parts of wax and starch, or flour. In making it the wax should first be obtained in thin shavings, dried for a few days in a warm place, then triturated lightly in a cold mortar.

It is important that the mortar be well chilled, and kept so by being placed in a basin of ice water.

Creosote, carbolic acid, volatile oils, balsams, oleo-resins, etc., can now be incorporated with this base and rolled into pills.

This mixture of powdered wax and starch is rather difficult to make, and the same result may be obtained by melting the wax, then adding half its weight in flour or licorice-root, and *half* the balsam or oil, then when nearly cold incorporating the remainder of the balsam (or oil). Balsams and liquid oleo-resins usually require about one-third their weight of wax (together with the flour or licorice root), and oils and other similar bodies require one-half to two-thirds their weight in wax in order to form a good mass. Much depends upon the consistency of the oil or balsam, in determining the proportions to be used.

Classification of Pills.

The following classification of pills according to their ingredients is a modification of that made some years ago by Mr. Joseph Ince, Lecturer on Pharmacy at the School of Pharmacy of the Pharmaceutical Society of Great Britain.

The classification is made for the purpose of discussing special difficulties and the best excipients for each class, but it should be born in mind that the excipients mentioned are but for that class only, and that combinations of ingredients from the different classes call for the exercise of judgment in order to select the best for the combination at hand.

Class I.—Powdered Drugs and Vegetable Extracts.

These offer very few difficulties, and with most of them any of the liquid excipients will make a good mass, since most vegetable powders are adhesive when wet. If the drug is of a resinous or oily nature, soap or an alcoholic tincture of the drug, or glycerin, are to be preferred. In all cases it should be remembered that powdered drugs *absorb moisture slowly*, and time is required to obtain a satisfactory mass. The mass may be made quite soft at first, and will stiffen as the pills are being rolled. If the mass be too hard the pills are liable to crumble and require remassing.

The same applies to extracts, but in a less degree. Since extracts are required to be of a "pilular consistence" they are sometimes ready to be rolled immediately, but more often they are either too hard, and require to be softened with alcohol or water, or are too soft and may be evaporated on a hot plate, or stiffened by incorporating powdered licorice, etc.

Sometimes a little gum becomes necessary, when althæa or tragacanth are to be preferred.

Aqueous extracts are sometimes found in a condition of partial fermentation, acetic acid and carbonic acid gas being slowly formed. Such require to be evaporated on a hot tile, before being incorporated into pills, lest the pills afterward fall apart from pressure of the gas or reaction of acid with other ingredients. The heat stops the fermentation and drives out all of the gas. These extracts (and ten of the official solid extracts are aqueous) should never be used in pills containing carbonates, unless first tested and proved to be free from acid. The acetic extracts should also be avoided in such pills.

Class II.—Aloes, Resins, and Gum-resins.

This class would include all inspissated juices, as opium, etc., and non-oleaginous exudations. They are all solid but non-fibrous bodies, largely soluble in mixtures of alcohol and water, and make small, easily soluble pills.

Soap and water head the list of excipients for these, about one part of soap to six to twelve parts of drug being required according to its character. Soap increases the solubility of resinous bodies and the mass remains soft. Solution of potassa was formerly used to a considerable extent with these, forming a soap with the resin, but the medicinal properties are somewhat altered by such treatment, and its use is now universally condemned.

Compound decoction of aloes, with or without soap, is a favorite excipient in England for this class, and makes an excellent mass. Soap liniment might serve in that capacity were it not for the objectionable odor of the lavender which it contains.

When soap is incompatible with other ingredients, glycerin, mucilage of tragacanth, oil, or glucose, may form a good mass.

Alcohol makes a tough mass which hardens rapidly.

The powdered gum-resins should never be used. The whole gum-resins are easiest powdered in small quantities by thoroughly chilling and rubbing in a *cold* mortar.

Class III.—Oils, Oleo-resins, and Hydrocarbons.

This class includes the liquid balsams, and all liquid bodies which do not admit of evaporation, and therefore require to be solidified by absorption, or in some other manner. They are the most troublesome of all the pill ingredients to form into *small* pills. Were the size of the resulting pills of no importance they could be easily managed, but the inexorable rule to "make the smallest pill possible" (down to one grain), demands oftentimes seeming impossibilities. The selection of the excipient which will yield the smallest pill, together with a proper mass, is no light task. Thin liquids are more troublesome than viscid, and volatile oils more than fixed.

Magnesia is the most efficient excipient and the most objectionable, and should never be used except as a last resort. When used, time should be allowed for it to set, and this may be hastened by applying a little heat.

Failure sometimes results with it, owing to the fact that no aqueous moisture is present, and it is always safe to sprinkle a few drops of water upon it before incorporating with the oil or other liquid.

Wax comes next in efficiency, and is less objectionable, particularly when used in combination with starch or some vegetable powder.

From half to an equal weight of wax is needed for oils and other fluids, according to the viscosity.

Sometimes a little tragacanth or extract of licorice is needed to make the mass more adhesive.

The mixture of wax and flour, with which the liquid may be incorporated by trituration, usually makes a good mass. When the mass is made by mixing the liquid with melted wax, it is well to chill the mixture afterward, remembering that a freshly congealed fat or wax is never as firm as one which has stood for some time in a cool place. It is well also to add only half the liquid to the melted wax at first, and after incorporating this the remainder may be incorporated also. In this way lumping, caused by the too sudden cooling of the wax, is avoided. Such lumps are hard to eradicate.

Cacao butter has been recommended as a substitute for wax, but pills made with it must be kept in a cool place.

Thin and mobile fluids do not mass as well with these as viscid bodies, and with thin liquids a smaller pill may be made by use of flour or althæa and syrup, than with wax.

Soap makes an excellent excipient for the fixed oils and balsams, or oleoresins, but is less efficient with volatile oils and the hydrocarbons. When used in a mass containing an oil and solid bodies, it should be first mixed with the oil alone, then this mixture added to the other ingredients.

When added to the entire mass the results are not as good. In all masses containing both liquids and solids, the first aim should be to get the liquid into suitable condition, and while allowing for the absorptive or solidifying powers of the other ingredients, the attention is first devoted to the massing of the liquid.

Absorbent powders are often preferred when so much is not required as to make an unduly large pill. A mixture of two parts of licorice root with one of licorice extract has considerable binding as well as absorptive powers. This makes a good mass where not more than one minim of liquid is to be contained in a pill. Sometimes other vegetable powders are used when they agree with the medicinal action of the pills. Flour and althæa are the best of the white absorbent powders. All of these require some aqueous fluid to develop their adhesiveness, which should be added.

An ingenious method for making liquid bodies into pills has been proposed by Mr. William Kerchumann, who proposes to make first an emulsion with acacia, to which is added magnesia, and after standing twelve hours borax is added to coagulate the gum and make a mass.

This is interesting from the principles which it involves, but is open to the usual objections to magnesia and alkalies as excipients.

Another method which is particularly convenient for massing volatile oils, etc., which are frequently ordered in pill form, is to keep in stock a jelly containing a definite proportion of oil, and making the mass from this with licorice or althæa.

A paste made from 5.5 parts of gelatin, 2.5 parts of sugar and 12 parts of water, will gelatinize an equal weight (20 parts) of creosote, carbolic acid or an oil, and if preserved in a bottle covered with a layer of diluted alcohol, will keep almost indefinitely. Two parts of this jelly are used for each part of oil or creosote ordered, and a mass is quickly made by incorporating a sufficient quantity of licorice or althæa powder.

CLASS IV.—CHEMICAL BODIES.

These are of two kinds, the organic chemicals and the inorganic. They require much judgment and a knowledge of chemical reactions and compatibilities. When crystalline bodies are to be incorporated in pills, they should first be finely powdered, and in case of powerful remedies it is advantageous to dissolve them in water or glycerin, and add this solution to the mixture, taking care that no more liquid is used than will make a good mass.

In this way the crystalline structure is destroyed, and the potent remedy thoroughly diffused through the mass with a minimum of labor.

The oxidizing agents, as permanganate of potassium, silver salts and the salts of mercury, require special precautions, which are treated under their separate heads.

ORGANIC CHEMICALS.—The most important of these in pill-making are the alkaloids.

When the powerful alkaloids are to be massed, such as strychnine, atropine, etc., special care should be exercised in weighing and mixing them. The safest and quickest way of mixing them is either to add them to the other ingredients in solution, as already suggested, or to mix first with an equal bulk of another powdered ingredient, which mixture is then diluted with the remainder, gradually added, so that a uniform admixture is assured. Pills containing these should be made to weigh about one grain each, some inert body like starch or licorice being used as a diluent when needed.

Quinine pills are perhaps the most common of the alkaloidal pills, the sulphate being generally used. No difficulty is found in massing quinine with the usual liquid excipients, glucose, glycerin, mucilage or glycerite of tragacanth, etc., all giving a plastic and adhesive mass. If a white pill is desired, only a white or colorless excipient may be used, and the most scrupulous cleanliness observed, both with the hands and the utensils. Even then a very free use of starch as a dusting-powder is usually necessary.

The use of acids as excipients for these has often been suggested, the purpose being to obtain smaller pills. Tartaric acid, in the proportion of one grain to six to ten grains of the quinine, citric acid in about the same proportions, lactic acid and dilute mineral acids in quantities sufficient to mass, are usually recommended. These all make a mass which is very plastic and easy to work at first, but which loses its plasticity very rapidly and becomes hard and immobile.

Rapid work is required, both in massing and rolling these, in order to finish the pills before the mass has set.

Synthetic Remedies.—These are mostly organic, and include such bodies as antipyrine, acetanilid, salol, etc.

The choice of an excipient for these depends almost entirely upon their solubilities.

Those soluble in water may be massed with glucose, mucilage or glycerite of tragacanth, honey, etc. These would also make a good mass with many which are very slightly soluble in water.

Such as are insoluble in water may be massed with glycerin, or a viscid oil, either with or without soap,—preferably with.

The adhesive excipients may also be used with these, but will make a larger pill, in most cases.

Camphor, Phenol, Thymol, Chloral, etc.—These make little trouble when massed alone, but when mixed together or with resinous bodies they partially or completely liquefy. When this takes place, the liquid is best absorbed by means of flour or licorice, and massed with syrup or glucose.

When partial liquefaction occurs, the mass may often be made by simply beating the ingredients together in a warm mortar, without the use of any excipient. In such cases alcohol or ether should not be used to powder the camphor, lest the mass be too soft.

If it is necessary to powder the camphor a little chloroform may be used, and then after triturating the camphor to a powder the latter should be thoroughly dried before mixing with the other ingredients.

Soap with oil or water makes a good excipient for these when needed. Carbolic acid, chloral, etc., may also be massed with althæa and glucose, or licorice and mucilage of tragacanth.

Other organic bodies are treated according to their general characteristics. Organic acids mass well with glycerin, but when the acid is very soluble in the glycerin, as tannic acid, the pills must be finished quickly, because the mass soon hardens.

Glycerin forms a good general excipient for many organic bodies.

Inorganic Chemicals.—Iron and mercury and their salts are most frequently prescribed in pills, but certain salts of potassium and silver are also used, and occasionally the salts of the other metals. Most salts require the addition of a vegetable powder to make an adhesive mass, and in the case of hygroscopic or deliquescent salts, to also absorb the moisture in the excipient and air, which would otherwise soften or liquefy the salts on standing. Powdered licorice-root or extract, or althæa are best to use for this purpose in the absence of any other vegetable constituents of a mass.

Very deliquescent salts, like potassium acetate, require to be massed with a moisture-repelling excipient. Canada balsam, cacao butter, resin cerate, or hard petrolatum answer well for this purpose.

If the salts are crystalline they should first be very finely powdered, then mixed with the vegetable powder or with extracts.

Glycerin should not be used for massing metallic oxides or basic salts, because it forms a hard, stone-like cement with many of these. In general, glycerin is a poor excipient for metallic salts or bodies, though it may be used in some cases.

Soap is incompatible with all the metallic salts except the salts of potassium and sodium, forming insoluble metallic soaps, hence it should never be used in masses containing these.

Iron and Iron Salts are much used in pill-form, and offer some peculiar difficulties. There are three classes of these: (*a*) Those containing metallic iron or ferrous salts; (*b*) Those in which a reaction occurs in making the mass; and (*c*) Those which contain ferric salts.

(*a*) When metallic iron, as reduced or "alcoholized" iron, is made into pills a good binding agent is needed, and since this is a heavy powder a bulky excipient is often to be preferred. Extract of licorice (one to ten) and glucose, or manna and syrup, make an excellent mass. Confection of rose or mucilage of tragacanth are also good excipients.

When ferrous sulphate is to be made into pills the dried salt, Ferri Sulphas Exsiccatus, U. S. P., should be used. This makes a better and less changeable mass than the crystals.

If the crystals are ordered, the dried salt may be substituted in the proportion of three grains of dried sulphate for each five grains of the crystals. This should not be done, however, if the pills belong to class *b*.

Ferrous sulphate may be massed in the same manner as reduced iron.

(*b*) Ferrous carbonate is a very desirable form of iron, but cannot be kept in a dry condition, and hence is obtained for pills by a reaction, which takes place between crystallized ferrous sulphate and sodium or potassium carbonate in making the mass.

In making masses of this character only the best materials should be used, since a ferrous sulphate which is slightly oxidized will not yield a bright-green ferrous carbonate, and the mass should be exposed to the air as little as possible to prevent oxidation after the carbonate is formed. When these precautions are taken a bright-green mass, the color of true ferrous carbonate, results, but with an impure ferrous sulphate, or with an undue exposure to air, the mass is darker, and may be almost black. Exposure to light is beneficial.

Two forms of this are official—Vallet's mass, massa ferri carbonatis, and Blaud's pills, pilula ferri carbonatis—the difference between the two being that in the first case the alkaline sulphate, which is formed by the reaction, is removed by washing, while in the second case it remains as an ingredient of the pills.

In making Vallet's mass, solutions of ferrous sulphate and sodium carbonate are mixed while hot, and the resulting precipitate of ferrous carbonate is washed with distilled water, which has been boiled to expel all dissolved air and mixed with syrup to further protect the precipitate from change, until the sodium sulphate is removed, then the precipitate is quickly drained in a covered funnel and added to a mixture of honey and sugar and evaporated to a pilular consistence. It is during this draining and evaporation that the greatest change takes place, and great care is required to obtain a greenish mass,—it often becoming black.

The process is rendered easier if the salts are mixed while the solutions are hot, in order to get a more dense precipitate, which is then washed by a hot saccharine solution instead of cold, and finally the drained precipitate mixed with the sugar and added to the honey which has previously been evaporated to half or two-thirds its original bulk. By this means the evaporation of the mass is much quicker and the salt is exposed much less.

In the Blaud's pill, crystallized sulphate of iron is used because this dissolves much more quickly and consequently reacts more promptly than the dried sulphate. The mass is made by moistening the potassium carbonate with glycerin and water, then adding the ferrous sulphate mixed with sugar, which is used to protect the ferrous carbonate which is formed, and beating into a mass, which rapidly becomes a deep green. The tragacanth and althæa are then incorporated and the mass divided into pills. During the reaction water is liberated from the ferrous sulphate, which aids the reaction and also softens the mass, and it will be found that if the full quanity of water and glycerin which the Pharmacopœia directs are added to the potassium carbonate the final mass will be too soft and an absorbent powder must be added to stiffen it, thus enlarging the pills. Four-fifths of the liquids (or 8 drops each instead of 10) will yield a good mass in most cases. Bicarbonate of potassium should never be used in making these or similar pills, because carbonic acid gas will be given off during the reaction, causing the mass to swell. The mass must then be allowed to stand for some time until the reaction is complete, making an undue exposure, or if rolled into pills quickly these are liable to be forced apart by the escaping gas.

Pills of iodide of iron are another instance of a reactionary mass, the iodide of iron in this case being formed by direct union of reduced iron and iodine in contact with water. An excess of iron is used because the salt is less easily decomposed or changed in the presence of metallic iron, and sugar is also added as a further protective. The mass (the other ingredients having been added) is then evaporated on a water-bath, with constant stirring, and finally divided into pills which are then varnished with toluene to prevent all access of air. It is much easier to get a satisfactory mass of iodide of iron than one of carbonate of iron, regarding the final condition of the ferrous salt.

The finished pills each contain a trifle less than one grain of ferrous iodide and one-half grain of reduced iron.

(*c*) The Ferric salts which are used in pills are mostly the oxide, hydrated oxide, soluble oxide, or the scale salts, as the citrate, phosphate, etc. The oxide and hydrated oxide are seldom used and present no difficulties, requiring simply an adhesive excipient.

The soluble oxide (saccharated oxide of iron or Eisenzucker) and the scale salts are quite soluble and care must be taken not to add too much excipient. It should be remembered that there are two forms of citrate of iron, one designed for pills which is very soluble, but slowly so, and the ammonio-citrate or "soluble citrate" which is quickly soluble.

The latter is not well adapted to massing, though a good pill can be made from it with glucose or syrup if used cautiously. A single grain too much of excipient in a small mass will, however change a firm mass into a semi-liquid paste. Similar results will follow in massing the soluble oxide and the citrate of iron if too much excipient be used, though not as easily. Masses made with aqueous excipients are also hygroscopic, and require to be kept from contact with the air either by coating or by storing the pills in tight containers, with an excess of licorice powder, etc.

For these reasons the fatty excipients, as petrolatum, simple ointment, Canada balsam, cacao butter, etc., are recommended for making these pills, a slight excess having no solvent action upon the salt and therefore doing no harm, and the pills are not hygroscopic. These excipients do not make as firm and plastic a mass as glucose, mucilage of tragacanth, etc., but are otherwise unobjectionable.

Mercury and Mercury Salts.—Pills containing metallic mercury are made by first emulsifying the mercury with some viscid body in order to finely subdivide it, a mixture of honey of rose and glycerin being used in the official process. The dense emulsion is then stiffened into a mass by incorporating inert powders, licorice and althæa being used for that purpose. This forms an excellent mass, but it must not be triturated or worked very much or the mercury will separate and collect on the surface in little globules which cannot be reincorporated. The same is true of other preparations containing finely divided mercury, as mercury with chalk, a good mass may be obtained by use of mucilage of tragacanth, but the mass must not be worked any more than is really necessary lest the mercury separate.

Mass of mercury (blue mass) is often incorporated with other cathartics and extracts.

It is best triturated first with the dry powders, then excipient (glucose, honey or glycerin) is added and the mass rolled. The mercury is more liable to separate from a mass than from dry powders.

Mercury salts need to be handled very carefully in order to avoid reduction. Contact with metals, even as slight as in the use of a steel spatula or the cutting of the mass upon the brass plates of a pill-machine, is sufficient to reduce many of the salts of mercury when moist; consequently these should not be used for masses containing mercury salts. The mass should be worked in a Wedgwood mortar, using a horn or rubber spatula, and the pipe cut upon a rubber machine or pill-tile.

An illustration of the ease with which mercury salts are reduced occurred in a manufacturing establishment a few years ago, when calomel pills, made with starch and glucose as excipients, unaccountably lost their bright, white appearance and became gray.

Acting upon the supposition that this was due to carelessness in working or handling the mass, another lot of several thousand was made, using great care in selecting the materials and working the mass. These darkened in the same manner after standing a few days. An investigation was then made, and the trouble found due to minute traces of iron in the starch from the iron mills in which it was ground. Starch ground in burr-stone mills was obtained, and calomel pills made with this remained white.

Some of the mercury salts are also reduced by rubbing, particularly when dry, and it is always wise to moisten them with a little water or excipient before incorporating them with intractable bodies, to avoid any possibility of reduction. If they are to be mixed with a powder, as starch, licorice, etc., the moistening is unnecessary, but the powders should be triturated very lightly.

Probably the best excipient for these pills, when they are to be dispensed without coating, is that proposed by Mr. Thomas Wiegand,—a glycerite of tragacanth, made by triturating 4 gm. of powdered tragacanth with 96 gm. of glycerin, and allowing to stand over night.

In place of this, glycerite or mucilage of tragacanth may be used. Glucose is said to reduce pills of calomel, but probably much depends upon the glucose in question, since pills made with this have shown no signs of change on keeping. Manna has been highly recommended for massing these, and may be used without the addition of a vegetable powder.

Phosphorous Pills.—When phosphorus is to be incorporated in pills, it should always be added to vegetable powders in solution.

The best solvents for this purpose are chloroform and carbon bisulphide. Special precautions must be observed in weighing the phosphorus, since it begins to oxidize as soon as it is exposed to the air, if dry. It should be weighed under water, and care be taken that water is not weighed as phosphorus nor phosphorus as water. In order to avoid these errors, a capsule or watch-glass, containing a little water, is first counterpoised upon the balance; then a piece of phosphorus of the judged size (which has been cut under water in another dish, then dried by pressing in dry filter-paper) is dropped into it and weighed. If too heavy, it is removed from the water, the capsule and its contents again counterpoised (for in taking out the bit of phosphorus enough weighed water will have been removed to make a serious error in the ultimate weight of phosphorus, unless corrected), then a smaller piece is dried, dropped into the water, and weighed as before. This operation must be repeated until the desired weight of phosphorus is obtained.

The weighed phosphorus must then be thoroughly dried with filter-paper or absorbent cotton, before dropping into the solvent, for a little moisture may hinder solution.

The solution should always be made in a small (homœopathic) vial or test-tube, selecting one, if possible, which will just hold the liquid without leaving much air space.

If free contact of air is allowed while the solution is taking place, part of the solvent may be lost; and what is worse, the phosphorus will be partially oxidized, and then a clear solution cannot be obtained.

This will also occur if the liquid be violently agitated in a vial or tube which it only half fills.

The solution having been obtained, it is then poured upon the dry powder in the mortar, stirred lightly to moisten the powder evenly, and also to favor evaporation, but avoiding the spreading of the paste about the sides of the mortar; and when the liquid has nearly evaporated and fumes begin to come off, the liquid excipient (glycerin, glucose, syrup, etc.) should be added and incorporated as quickly as possible. All the liquid excipient should be added at once when the amount needed is known. The aqueous excipient will prevent further oxidation of the phosphorus, but the pills should be coated with tolu as soon as finished.

When phosphorus is prescribed alone in pills, licorice, althæa, flour, starch, or any inert powder may be used for distributing the solution upon. When other powders enter into the composition of the pill these will serve the same purpose, extracts or fluids being added last. The Pharmacopœial pill contains too much gum, and the mass is tough and elastic. Such pills are very hard to shape, and show creases where the mass has been folded.

Phosphorus pills have been made by dissolving the phosphorus in hot cacao butter, and when the fat has solidified, rolling it into pills. They are then dusted with desiccated chocolate and sugar to cover the odor and taste. Wax and cacao butter have also been used in a similar way.

The *British Pharmacopœia* directs a phosphorus mass to be made by triturating 3 grains of phosphorus with 120 grains of tolu balsam under hot water until no particles of phosphorus are visible. Then 57 grains of wax are added and thoroughly incorporated, also under water.

The water must be kept hot enough (60° C. or above) to melt the phosphorus and thoroughly soften the balsam and the wax, and the mass so made is stored under cold water. When dispensed every two grains, representing $\frac{1}{30}$ grain of phosphorus, are incorporated with one grain of powdered curd soap, a little alcohol being used if necessary to obtain a plastic mass, then rolled into pills.

Silver Salts.—These are all reduced by contact with vegetable matter, and form an exception to the general rule that inorganic salts should be mixed with a vegetable powder.

To do so with the salts of silver would result in a complete reduction of the salt. This is also brought about by the ordinary excipients, and these too should be avoided.

Since the salts of silver are heavy bodies and are given only in small doses, some diluent is necessary, and an inert inorganic body should be chosen. Kaolin (china clay), talcum, or Fuller's earth are best for these.

A mixture of silver oxide or nitrate with kaolin or Fuller's earth masses well with water, but the pills are apt to crumble when they become dry. Coating with tolu retards this.

A better mass is obtained with hard petrolatum (or a mixture of petrolatum and paraffin about the consistence of ointment) or resin cerate.

These are organic bodies, but having no solvent action upon the silver salts, the latter are only slightly reduced, particularly by petrolatum. Pills made in this way have shown scarcely any change of the silver salt after keeping several years.

Anhydrous sodium sulphate has also been recommended for such pills. The silver salt is mixed with this and then made into a mass with water which must be rolled quickly, as it soon becomes brittle.

The water enables the sodium salt to crystallize, and it sets into a hard strong mass like plaster-of-Paris, which is readily soluble in water. The only objection to this method is the difficulty of working the mass.

Occasionally silver nitrate or oxide is ordered combined with an organic body in pills, as pills of silver oxide and creosote. If these are mixed directly an explosion (in this case) will occur. The only way to prevent this is to make a small mass of the silver oxide with kaolin and petrolatum, also a mass of creosote with wax, flour, and water, then mix the two masses and roll. Even then a reaction is liable to ensue. Such pills cannot, of course, be coated.

Potassium permanganate reacts with organic matter and is reduced, consquently it should always be massed with clay or talcum and petrolatum and rolled on a glass tile or rubber pill-machine. All that has been said regarding the massing of silver salts applies to this also. The best excipient is kaolin and hard petrolatum.

Other Salts.—Occasionally some of the salts of arsenic, bismuth, calcium, copper, lead, potassium, sodium, zinc, etc., are ordered in pill-form. These offer no difficulties beyond the special ones already mentioned under the general head of inorganic chemicals.

It should be borne in mind that salts of bismuth and copper are reduced by prolonged contact with iron, and these should not be massed in an iron mortar, nor with a steel spatula upon a tile. The soluble salts may be mixed with licorice, althæa, etc., and massed with glucose, and the insoluble salts are massed with extract of licorice or mucilage of tragacanth.

This latter contains some glycerin, but not enough to exercise a very decided solvent action.

Pill Coatings.

Pills are coated to cover the taste, to prevent change by excluding air, and to render them more slowly soluble, or even insoluble in the stomach. In the latter case the pills are intended to pass through the stomach entire and dissolve in the intestines.

The coating of pills is an art which demands considerable practice, and the knack for which is less readily acquired than for most pharmaceutical operations.

The pills must be made firm and the use of hygroscopic excipients should be avoided. The latter are apt to attract moisture from the coating and cause it to crack. When gelatin is used over a glycerin excipient the coating is likely to soften.

On the other hand, the pills should be dry enough, so that moisture will not exude and the coating become softened or dissolved. It is customary for the manufacturers to dry the pills in a warm place for a few hours before coating.

The surface of the pill is thus hardened while the interior still remains soft.

Coated pills are almost always more slowly soluble than uncoated, but the solubility should not be hindered to any great extent.

Dusting powder should be thoroughly removed before coating, particularly when a transparent coating is to be applied.

This is best done before the pills are made, *i.e.*, by making the mass so firm that no conspergent is needed. If necessary to use it, licorice is commonly better than lycopodium, as it colors the pills more evenly.

It may be removed by shaking the pills in a sieve. If the surface of the pills still present a variegated appearance, do not apply the coating at once, but either remove all of the objectionable powder with a brush, or cover it and the pills with a little moist lamp-black (or starch), so that the color will be uniform when coated. If an opaque coating is to be applied, this is not necessary.

Varnishing is the term sometimes applied to coating with resinous or balsamic substances, as tolu, mastic and the like. The ordinary varnish, such as is used for wood-work, is never used, but an ethereal solution of tolu, etc., constitutes the varnishing agent.

These coatings are specially adapted for dispensing exigencies, and are often directed for pills which are liable to change on exposure to air. The Pharmacopœia directs tolu coating to be used on the phosphorus and iodide of iron pills as a protective.

An old tolu, which has lost much of its oil and become brittle, is better for this than a fresh balsam.

The resinous remainder of tolu which has been used in making syrup of tolu by the former (1880) official process, or tolu which has been well washed in hot water, may be used in place of fresh tolu.

The tolu having been dissolved in ether, a few drops are placed in a capsule and the pills rotated in this until uniformly coated and the ether has evaporated.

If a strong solution is employed, as directed by the Pharmacopœia, only a few drops of solution should be used at a time, commonly about half as many drops of solution as there are pills to be coated.

Novices are prone to use a large quantity of the solution, whereby the pills are wetted quicker, but on evaporation of the ether the pills will become sticky and adhere to everything they touch. If this occurs the best treatment, after separation of the pills, is to place the capsule on ice in order to harden the coating. It can be obviated by using only a few drops of the solution at a time, and repeating the operation until a sufficient coating has been obtained, or by using a very dilute ethereal solution. A thick coating must not be expected, only enough being needed to form a thin film of resin around the pill.

A still better way of applying the coating is to spray the solution upon the pills from an atomizer, keeping the pills constantly in motion.

Combinations of tolu with other bodies are used, as tolu and sandarac, tolu and mastic, etc. These make a harder coating than tolu alone, and are also more easily applied.

Three parts of tolu and seven parts of mastic or sandarac dissolved in ether or absolute alcohol make a good solution. Ether volatilizes more quickly than alcohol and is preferable on that account.

When the pills are to be double coated, and sugar or gold leaf is to cover the varnish, special treatment may be required to enable the second coating to adhere to the resinous.

If sugar is to be applied by intervention of mucilage the gum will not adhere to the resin unless the latter be first moistened with a little weak solution of potassa, whereby the resinous coating is partially saponified. When heat is used, this is unnecessary.

Sugar and Pearl Coating.—Sugar coating has been replaced to a large extent by gelatin coating, but it is still applied to a great number of pills. It requires more practice to obtain satisfactory results upon a small scale than other coatings, and the best results can only be obtained by operating upon a quantity of pills and by means of expensive apparatus. Sugar alone is never used for coating, being too translucent, but is mixed with some fine, insoluble, white powder, as starch, arrow-root, talcum, etc.

A good mixture for use at the dispensing counter is milk sugar, 6 parts; starch, 1 part; and powdered acacia, 1 part. To coat pills with this, moisten them first with a little water or syrup, and place in a round box or coating-sphere with some of the coating mixture, using about a teaspoonful of the mixture to each dozen pills. Roll the pills thoroughly in the powder, then transfer them to a clean box or sphere, and polish them by attrition. If the first coating is not heavy enough the process must be repeated.

On the large scale the pills are not moistened, but, having been partially dried, are placed in a pear-shaped vessel made of copper, which is mounted on the end of an oblique shaft, and is surrounded by a steam coil or jacket so that the vessel may be heated.

The necessary quantity of sugar mixture is then added, and the closed vessel is made to revolve. Steam is now turned on, and the vessel is heated just enough to partially melt the sugar and make it sticky.

When the coating has been evenly distributed over the pills the steam is shut off and the revolving continued until the pills are polished and the coating is hard. A smooth, glossy coating of any desired thickness is obtained in this way, which is impossible by hand methods.

It is possible to *make pills* in a similar manner by using medicinal agents in place of the sugar mixture. A minute pill or nucleus is first made in the usual way, say of quinine, then these nuclei are placed in the coating apparatus and coated with quinine until a pill of the desired size is obtained.

Such are called *aggregation pills*.

These may afterward be coated with gelatin or sugar, etc. Such a process is of questionable value when medicinal agents which are injured by heat are so treated, but has the advantage of yielding a pill which is easily disintegrated.

Pearl coating is similar to sugar coating, but contains a large proportion of powdered soapstone or talcum, so that the pills have a pearly appearance.

Sometimes talcum alone is used. The coating is applied in the same manner as sugar coating.

In moistening the pills with mucilage do not apply enough to give them a wet and shiny appearance; only two or three drops of liquid are necessary for each dozen of pills. The easiest way of applying it is by spraying from an atomizer. If the gum is mixed with the coating powder the pills are readily moistened in a sieve by holding them for a moment in the steam arising from boiling water.

Egg albumin and gelatin are also used for moistening previously to rolling in the powder. The former is easily applied and gives good results, being prevented from subsequent change by the preservative powers of the sugar, and also by drying. Gelatin is less easily applied, and offers no advantages. If used, the vessels and the solution must be warm.

These require more time in hardening than when mucilage or albumin are used.

Gold and Silver Coating.—This form of coating is very old, but is not now used as much as formerly except for cachous. Gold and silver leaf are used, the pills being first moistened with a little weak mucilage (care being taken not to use too much), then shaken with the leaf. The shaking must be continued for some time, and a second coating is often necessary to give a bright and smooth appearance, and entirely conceal the color of the pill mass. Aluminum leaf may be used in place of silver leaf for the first coating. Being afterward covered with silver, the pills are just as bright and the cost of materials is less.

This is one of the easiest forms of coating to apply, and is readily employed at the dispensing counter. One leaf of silver or gold is sufficient to coat six to a dozen pills, according to size. If the pills contain any sulphides they must first be coated with tolu or sandarac to prevent the discoloration of the silver after-coating. Gold leaf is much better for these.

GELATIN COATING is the most common form of coating at the present time. It is attractive in appearance, practically tasteless, and is readily dissolved in the stomach. Pills which are to be gelatin-coated should be firm, but not too hard, and should contain no glycerin.

The pills are partially dried before coating, so as to form a crust on the surface of the pills upon which the gelatin sets.

The latter shrinks on cooling and presses upon the contents of the pill, and, unless the mass is firm enough to withstand the pressure, some of the interior of the mass may be forced out through the pin-hole of the coating, as is sometimes seen in commercial pills. Pills are frequently covered by an inert powder before coating, in order to present a brighter and more even appearance. This is particularly true of black pills, which are shaken just before coating in a little moist lamp-black, so that the finished pills are jet black and glossy, though the mass may have been grayish- or brownish-black. In order to judge of the color of a coated pill it is necessary to cut or break it open and observe the interior of the mass.

Pills which are not readily soluble in aqueous solutions, as quinine pills, reduced iron, etc., and which are non-resinous in character, are easily coated with gelatin, and, after a little practice, may be satisfactorily done at the store, but the coating of all kinds of pills calls for much skill and experience. The behavior of the coating varies with pills of different character, and the consistence and temperature of the gelatin solution into which the pills are dipped are matters of importance. In general, a hot and thin solution gives the best coating; but if resinous pills are dipped into such, the resins will be softened by the heat and the pills are likely to spurt. Likewise, with very soluble ingredients, as sodium salicylate, the momentary contact of the pill with the hot liquid is enough to partially liquefy the surface of the pill and the shape is spoiled. Such pills need to be dipped in a solution which is kept as cool as possible.

The scum which rises upon the surface of the gelatin solution must be brushed aside each time, and the pills dipped only into a clear solution, or air bubbles or other irregularities will show themselves upon the surface of the pill.

The solution should always be heated by steam or a water-bath, as it is quite likely to burn if direct heat be applied.

Various formulas for the coating solution are in use, some being secret and carefully guarded by the manufacturers. Professor Patch's formula gives good results. Best French gold-labelled gelatin, 2½ ounces avoirdupois; distilled water, 7 fluid ounces, Digest the gelatin in the water until a clear solution is obtained, then add ½ ounce of sugar, 2 drachms of powdered boric acid, and slowly, 2 fluid ounces of mucilage of acacia, U. S. P.

Strain into suitable containers and allow to solidify. This forms a dense stock-jelly, which needs to be diluted with water when used for coating.

Only the best white gelatin and white gum acacia should be used, particularly for white pills. Even with dark-colored pills a much handsomer coating is secured when clean and white materials are used.

The hot solution should be kept covered while in use to prevent loss of water by evaporation. It should also be stirred each time the pills are dipped to keep it of uniform consistence. Never use a solution into which dark-colored pills have been dipped for coating white pills.

The most common method of coating with gelatin is by impaling the pills upon the points of needles, the latter being set into a suitable frame so that a number of pills may be impaled and dipped at once. Several machines are in the market suitable for use on a small scale, one of the best being Prof. Patch's machine. Full directions for use are given with each machine, so that these are unnecessary here.

In an emergency a few pills may be coated by sticking a dozen or more needles through a specie cork, the pills then being impaled upon the ends of the needles and dipped into the solution.

The cork with its load is now kept in irregular motion to prevent the coating solution from flowing to one side of the pills, until the solution has set, and after being allowed to stand until the coating is hard they may be removed from the needles. Another method, much less satisfactory, is to place a few drops of the solution in a warm capsule, and roll the pills in this in the same manner as coating with tolu. Care must be taken not to use too much of the solution, and not to have the capsule too warm.

The needle method is open to the objections that a minute hole is left in the pill and the coating, through which some of the mass may be forced by the contraction of the coating; a little spur of coating also remains when the needle is removed, caused by the coating which adhered to the surface of the needle above the pill. The spur is removed by attrition or by cutting with small curved scissors.

In order to obviate these objections there are in use machines in which the needles are replaced by minute tubes terminating in a little cup which is not large enough to cover the pill. A series of such tubes are connected through a common bar-tube with an air-pump.

The pills having been placed in suitable sockets are covered with these little cups, the air sucked out of the apparatus and the pills are held upon the cups by air-pressure. The external portion of the pill is then dipped into the solution, and when dry the pills are reversed and the uncoated portion dipped. In this way a smooth coating is obtained in which there are no holes. Such an apparatus is too complicated and expensive for any except the largest manufacturers.

KERATIN COATING.*—Keratin is a product obtained by exhausting horn, bristles, feathers, etc., successively in ether, alcohol and dilute acids.

The exhaustion requires digestion for a long time,—twenty-four hours to eight days.

It is insoluble in water, swells in dilute acetic acid or alkalies, and dissolves in them when warmed; hence it is not soluble in the stomach, but is dissolved in the alkaline secretions of the intestines.

It is used as a coating for pills intended to pass through the stomach unchanged and dissolve in the intestines. Such are (1) medicines which may irritate the mucous membrane of the stomach, such as arsenic, creosote, iron preparations, mercurial preparations, phosphorus and anthelmintics.

(2) Medicines which may hinder digestion by producing insoluble or inactive preparations with the gastric juice, such as tannin, alum, acetate of lead, corrosive sublimate, alkalies, sulphide of calcium, etc.

(3) Medicines which should arrive in the intestines in as concentrated form as possible, such as kousso, male fern preparations, santonin, etc.

When used for coating pills, either ammonia water and dilute alcohol in equal parts, or acetic acid, may be used as a solvent, the liquids being heated to effect solution.

The choice of solvent will depend upon the character of the pills to be coated, avoiding any incompatibilities. Thus the acetic acid solution should be used to coat pills containing metallic salts, acids, creosote, etc., while the alkaline solution is better for pills containing alkalies, sulphides, pancreatin, etc.

The pills should not be made with an aqueous excipient, or they will shrink, and fissures will be formed when coated.

A mixture of one part wax with ten parts cacao butter is recommended by E. Bourquelot for an excipient. It is also necessary to avoid the use of vegetable dusting-powders, and to employ kaolin or charcoal in their place.

The finished pills are dipped in melted cacao butter, rolled in charcoal, then sprinkled with a suitable quantity of the keratin solution and rolled until dry. The sprinkling and drying are repeated several times, until a sufficiently thick coating of keratin is obtained.

The pills should not be stuck upon needles and then dipped into the solution, as in gelatin coating, because the pin-holes are not easily stopped, and offer a chance for disintegration of the pill in the stomach.

* (See Amer. Jour. Pharm., 1889, Page 421.)

Pills coated with keratin should not crack nor liquefy after remaining in water for some time.

Salol is frequently used as a coating for the same purpose as keratin, viz.: to prevent the pills from dissolving in the stomach, but allow them to dissolve in the intestines. It may be used in ethereal solution in the same manner as other varnishes, or the salol may be melted in a small capsule, and the pills rolled in the fluid, taking care not to use too much of the salol at a time. But little heat is required, as salol melts at about 45° C. (112° F.). Any of the ordinary excipients may be used for making the pills, except glycerin. When used as a varnish, it may be combined with an equal weight of shellac, the mixture being dissolved in ether, or 2 gm. of salol and 0.5 gm. of tannin are dissolved in ether (10 Cc.).

Collodion is also used, though rarely, for intestinal pills. The surface of the pills should be dry when this is applied (except when oily excipients are used), else the coating will peel off. It is applied in the same manner as tolu coating.

PILLS.

144.

℞. Asafetida . . . . 20 Gm.
Soap, in fine powder . . . 6 Gm.
Water, a sufficient quantity to make one hundred pills.
M. Sig.—Asafetida pills, U. S. P.

" Beat the solids together with water, so as to form a mass, and divide it into one hundred (100) pills."

Make 20 pills. These are best made in a slightly warm mortar.

145.

℞. Pulveris Opii . . . .
Acidi Tannici . . āā 0.650
Misce et fiant in pilulæ . . . No. x
M. Sig.—Opium and tannic acid pills.

Mass with 5 drops of glycerin, added at one time.

146.

℞. Pilulæ Quininæ Sulphatis . āā . .065
. . . . No. xxx
Sig.—" One grain quinine pills."

Make in two ways.
(*a*) Mass with glucose excipient.
(*b*) Add .325 Gm. of tartaric acid, and mass with syrup.

Roll and cut on the tile and use starch as a dusting powder, for each method. These pills should be white.

147.

℞. Morphinæ Sulphat 0.008
Fiat Pilulæ Tales . . . . . No. xvi
M. Sig.—" Morphine, ⅛ gr."

Triturate with four times its weight of starch and mass with glucose excipient. Use starch as a dusting powder, and roll out and cut on the tile. These pills should be white.

148.

℞. Sodii Salicylatis 3.250
Fiat massa in pilulæ decem dividenda. Sig.—Salicylate pills.

Mass with glucose.

149.

℞. Camphoræ . . . . gr. xxxvi
Saponis Pulv. . . . . . . gr. vi
Olei Ricini . . . . q. s.
M. Ft. pil. No. xij. Sig.—" 3 gr. Camphor pills."

150.

℞. Pulv. Opii 0.325
Camphoræ 0.650
M. Fiat massa et in pilulæ decem dividenda. Sig. Opium and camphor. More dictu.

Add 2 Gm. of powdered soap, and mass with water.

151.

℞. Ferri et Quininæ Citratis . . . ʒ ss
M. Fiat pilulæ No. x. Sig.—Tonic pills. Cap. unam post cibo.

Mix with 5 grains of extract of licorice and mass with glucose.

152.

℞. Pill Potassii Iodidi . . aa . . gr. iv
. . . . No. xij
M. Sig.—Potassium iodide pills.

(*a*) Powder the iodide very finely, mix with a double-weight of starch, and mass with glucose.

(*b*) Dissolve the iodide in the smallest possible amount of warm water (about ʒ ss), add ten grains powdered tragacanth, and sufficient kaolin or talc to make a mass. The pills should be white, in both cases.

153.

℞. Potassii Iodidi 2.00
Olei Theobromatis 2.00
Petrolati . . . . q. s.
M. Ft. pil. No. xx. Sig.—" Iodide pills."

154.

℞. Mercury . . . . 33 Gm.
Glycyrrhiza, in No. 60 powder 5 Gm.
Althæa, in No. 60 powder . 25 Gm.
Glycerin . . . . 3 Gm.
Honey of Rose . . . . . . 34 Gm.
M. Sig.—Blue Pill, U. S. P.

" Triturate the mercury with the honey of rose and glycerin until it is extinguished. Then gradually add the glycyrrhiza and althæa, and continue the trituration until globules of mercury are no longer visible under a lens magnifying at least ten diameters."

Make twenty grams.

155.

℞. Massæ Hydrargyri . . . . . . q. s.
Fiat Pilulæ Viginti, ana 325
Sig.—" Blue Pills."
Nocte una sumenda.

Roll, cut and finish these on the pill machine without using the finisher or fingers to round them.

Do not weigh the mass, but return what is left to the container. Weigh the finished pills.

156.

℞. Aloes . . . . gr. ij
Massæ Hydrarg. . . . . . . gr. j
Resinæ Podophylli . . . . . gr. ¼
M. Ft. pil. tales xij No.
Sig.—Cathartic Pills.

157.

℞. Hydrarg. Chlorid Mitis	1.5	
Cambogia	0.4	
Ext. Jalapæ	0.75	
Ext. Colocynth Comp.	2.0	Mass with syrup.

M. Fiant pilulæ xxv No.

Sig.—"Compound Cathartic Pills, U. S. P."

158.

℞. Phosphori	0.065	
Glycyrrhizæ Pulv.	4.000	
Tragacanthæ Pulv.	0 300	

M. Ft. pil. lx No.

Sig.—"Phosphorous Pills."

To weigh the phosphorus counterpoise a small capsule or watch-glass containing a little water, cut off a piece of phosphorus under water, of the judged size, dry by pressing between filter-paper, drop into the water and weigh.

If too heavy take out, *again counterpoise the water*, and repeat until the desired weight is obtained.

Dry the weighed phosphorus as before and put into a test tube with 6 Cc. of chloroform. When dissolved pour upon the licorice powder in the mortar, stir gently to distribute the liquid through the mixture and favor evaporation.

When the chloroform has mostly evaporated and the powder is still decidedly moist add the tragacanth and ten drops of glycerin. Work together and add enough syrup to make a mass.

Coat the pills as soon as finished with tolu.

159.

℞. Phosphori	0.65
Glycyrrhizæ Pulv.	4.00
Tragacanth Pulv.	0.30
Glycerini	0.63
Syrupi	q. s.
Chloroformi	6.00

M. Fac pilulæ xx No.

Sig.—Phosphorus Pills, U. S. P.

Weigh the phosphorus carefully (see No. 158), dry with filter-paper and dissolve in the chloroform. Pour this solution upon the powdered licorice root, stir to diffuse it thoroughly, and when the chloroform has almost (not entirely) evaporated add the tragacanth and glycerin, and enough syrup to make a mass. Mass quickly.

Coat the pills with tolu.

160.

℞. Sodii Bicarbonatis	1.30
Pulv. Rhei	0.650
Olei Menthæ Viridis	0.325

M. Ft. pil. x No.

Sig.—"Soda-mint Pills."

Mass with glucose excipient, or with glycerin.

161.

℞. Ferri Reducti 130

Fiat pil. no. i.

Mitte l.

Sig.—"Reduced Iron."

Triturate the iron with one-tenth its weight of powdered extract of licorice and mass with glucose excipient.

162.

℞. Aloini	gr. $\frac{1}{5}$
Strychninæ Sul.	gr. $\frac{1}{60}$
Ext. Belladonnæ	gr. $\frac{1}{8}$

M. Ft. pil. tales xxx No.

Mix the strychnine with the aloin, then with 20 grains of powdered licorice root. Soften the ext. belladonna with syrup, incorporate with the mixed powders and mass with syrup.

163.

℞. Strychninæ Sulphat. 0.065
Acidi Arsenosi 0.065
Ferri Sulphat Exsiccati 0.650
M. Ft. massa in pil. x dividenda.
Sig.—Iron, arsenic and strychnine.

Mix well, according to art, and use .5 Gm. powdered extract of licorice and glucose as excipient.

164.

℞. Quininæ Sulphatis . . . . . . ℥ss
Ferri Reducti . . . . ℥i
Acidi Arsenosi . . . . gr ij
Spiritus Glonoini . . . . . . ℥ss
M. Ft. massæ et in pil. xxx No. divide.

Nitroglycerin explodes violently if triturated. Mix well the first three ingredients, add the spirit, and stir quickly and lightly, in order to diffuse it, add the excipient (glucose, mucil. tragac., etc.) and mass before the spirit can evaporate.

165.

℞. Opii Pulv. . . . . gr. vi
Plumbi Acetat. . . . . gr. xij
M. Ft. pil. xij No.
Sig.—Lead and opium.
(State excipient used.)

166.

℞. Plumbi Acetatis . . . . . . gr. xvi
Camphoræ . . . . gr. xij
Opii Pulveris . . . . gr. iij
Bismuthi Subnit. . . . . . . gr. xij
Ext. Gentianæ . . . . q. s.
Misce fiat massa et in pil. duodecim divide.
Sig.—"Thompson's Diarrhœa Pills."

167.

℞. Bismuthi Subnit. . . . . . . gr. ij
Camphoræ . . . . gr. j
Caffeinæ . . . . gr. j
M. Ft. pil. j No.
Mitte tales xij.
Sig.—"Headache pills."

168.

℞. Calcis Sulphuratæ . . . . . gr. j
Sacchari Lactis . . . . . . gr. viij
Misce fiat pilulæ viij No.
Conspergentur cinnamomi.
Sig.—"Calcium Sulphide."

Use mucilage of tragacanth as excipient.

169.

℞. Camphoræ . . . .
Tinct. Valerianæ . . āā . . gr. vi
M. Ft. pil. xij No.
Consperga pulvero aromatica.

170.

℞. Potassii Permanganatis 1.30
Fiat pil no. x.
Sig.—Permanganate Pills.

Powder the permanganate and mix with 1 Gm. of kaolin or of talcum. Mass with petrolatum, to which a little paraffin has been added. (Melt together .2 Gm. paraffin and .6 of petroleum for excipient.)
Use horn spatula and cut on pill-tile, avoid contact with metals.

171.

℞. Potassii Permanganatis . . . .
Ferri Reducti . . . āā . . . ℨi
Quininæ Sulphatis . . . . . . ℨiss
M. Fiat pilulæ xlviii No.

Mix the permanganate with half a drachm each of petroleum and paraffin, previously melted together, add the iron, then the quinine. If too soft stiffen with a little kaolin or talcum. Use horn spatula and cut on pill-tile.

172.

℞. Pilulæ Argenti Nitratis . . . . gr. ss
No. vj.
Sig.—One in the morning, fasting.

Make in the same way as permanganate pills.

173.

℞. Ferrous Sulphate, in clear crystals . . . . 16 Gm.
Potassium Carbonate . . . . 8 Gm.
Sugar . . . . 4 Gm.
Tragacanth, in fine powder . 1 Gm.
Althæa, in No. 60 powder . 1 Gm.
Glycerin . . . .
Water, each a sufficient quantity to make 100 pills . . .
Sig.—Blaud's Pills, U. S. P.

"Rub the carbonate of potassium, in a mortar, with a sufficient quantity (about ten (10) drops each) of glycerin and water, then add the ferrous sulphate and sugar, previously triturated together to a uniform powder, and beat the mass thoroughly, until it assumes a greenish color. When the reaction appears to have terminated, incorporate the tragacanth and althæa, and, if necessary, add a little more water, so as to obtain a mass of a pilular consistence. Divide this into one hundred (100) pills."

"These pills should be freshly prepared, when wanted."

Make 25 pills. Too much excipient is directed. Use two drops each of glycerin and water for 25 pills.

174.

℞. Ferrous Sulphate, in clear crystals . . . . 100 Gm.
Sodium Carbonate . . . . 100 Gm.
Clarified Honey . . . . . 38 Gm.
Sugar, in coarse powder . . 25 Gm.
Syrup . . . .
Distilled Water, each a sufficient quantity to make . 100 Gm.
Mix. Sig.—Vallet's Mass, U. S. P.

"Dissolve the ferrous sulphate and the sodium carbonate, each separately, in two hundred (200) cubic centimeters of boiling distilled water, and, having added twenty (20) cubic centimeters of syrup to the solution of the iron salt, filter both solutions, and allow them to become cold. Introduce the solution of sodium carbonate into a bottle having a capacity of about five hundred (500) cubic centimeters, and gradually add the solution of the iron salt, rotating the flask constantly or frequently, until carbonic acid gas no longer escapes. Add a sufficient quantity of distilled water to fill the bottle; then cork the bottle and set it aside, so that the ferrous carbonate may subside. Pour off the supernatant liquid, and having mixed syrup and distilled water in the proportion of one (1) volume of syrup to nineteen (19) volumes of distilled water, wash the precipitate with the mixture by decantation until the washings no longer have a saline taste Drain the precipitate on a muslin strainer, and express as much of the water as possible. Lastly, mix the precipitate at once with the honey and sugar, and, by means of a water-bath, evaporate the mixture in a tared capsule, with constant stirring, until it is reduced to one hundred (100) grammes."

Make one-tenth the quantity.

175.

℞. Reduced Iron . . . . 4 Gm.
Iodine . . . . 5 Gm.
Glycyrrhiza, in No. 60 powder 4 Gm.
Sugar, in fine powder . . . . 4 Gm.
Extract of Glycyrrhiza, in fine powder . . . . 1 Gm.
Acacia, in fine powder . . . 1 Gm.
Water . . . .
Balsam of Tolu . . . . . .
Ether, each a sufficient quantity to make one hundred pills . . . .
M. Sig.—Blancard's pills, U. S. P.

"To the reduced iron, contained in a small mortar, add six (6) cubic centimeters of water, and then, gradually, the iodine, constantly triturating until the mixture ceases to have a reddish tint. Then add the remaining powders, previously well mixed together, and mix the whole thoroughly. Transfer the mass to a porcelain capsule, and evaporate the excess of moisture, on a water-bath, with constant stirring, until the mass has acquired a pilular consistence. Then divide into one hundred (100) pills." Coat with tolu.

Make 50 pills. Avoid evaporating too much. The mass stiffens considerably on cooling.

176.

℞. Strych. Sulph . . . . . . gr. iss
Aloini . . . . gr. iij
Iodi . . . . gr. v
Ferri Reducti . . . . . . ʒ i
Ext. Quassiæ . . . . . . gr. xlv
M. Fiant pilulæ No. xxx.

Place ten grains of the iron in a mortar moistened with ten minims of a mixture of water and glycerin and add the iodine. Stir until the color of iodine has disappeared (showing complete formation of ferrous iodide), add the remainder of the iron, then the strychnine and aloin and incorporate the extract. Roll into pills.

177.

℞. Iodoformi . . . .
Creosoti . . . .
Benzoini . . . .
Balsami Tolutani . . āā . . . gr. j
M. Ft. pil. tales xij.

178.

℞. Lupulini . . . .
Camphoræ . . . āā . . . . . gr. x
M. Ft. massa in pilulæ decem dividenda.

Powder the camphor by means of a little ether, mix with the lupulin, work thoroughly and roll. The massing is hastened by using a warm mortar. No excipient is needed.

179.

℞. Copaibæ . . . . 94 Gm.
Magnesia . . . . 6 Gm.
Water, a sufficient quantity .
M. s. a. Sig.—Copaiba mass, U. S. P.

"Triturate the magnesia with a little water, in a capsule, until the powder is uniformly dampened throughout. Then gradually incorporate with it the copaiba so that a uniform mixture may result, place the capsule on a water-bath, and heat during half an hour, frequently stirring. Lastly, transfer the mixture to a suitable vessel, and set this aside until the mass has acquired a pilular consistence."

Make one-fifth the quantity.

If this does not form a sufficiently stiff mass, the addition of a little resin of copaiba will usually aid in giving a proper consistency.

180.

℞. Copaibæ 10
M. Ft. pil. No. xxx.

Triturate the copaiba with 3.4 Gm. of powdered acacia, add 5 Cc. of water and emulsify. Add 1 Gm. magnesia and let stand over night, then add powdered borax, incorporate and roll. (The mixture of magnesia and emulsion of copaiba may be kept in stock if desired.)

181.

℞. Creosoti 1.0
Pulv. Glycyrrhizæ Rad. 1.9
Pulv. Glycyrrhizæ Ext. 1.0
Glycerini 0.1
M. Fac pilulæ No. xv. Sig. — "One-grain creosote pills."

182.

℞. Creosoti 1.0
Farinæ Tritici . . . .
Syrupi . . . āā . . . . q. s.
M. Ft. pil. No. xv. Sig.—"One-grain creosote pills."

Make a stiff mass with the creosote and a sufficient quantity of wheat flour, and add a few drops of syrup or honey to impart plasticity.

183.

℞. Creosoti . . . . ♏xij
Pulv. Glycyrrhizæ . . . . gr. xviij
Pulv. Ext. Glycyrrhizæ . . gr. xij
M. Sig.—"One-grain Creosote Pills."

Use glucose or glycerin for excipient.

184.

℞. Creosoti . . . . gr. xxx
Saponis Pulv. . . . . q. s.
Ft. massa in pil. xx divide.
Sig.—"1½ gr. Creosote Pills."

185.

℞. Creosoti . . . . ʒss
Ceræ Flavæ . . . . gr. x
Pulv. Glycyrrhizæ . . . . . . q. s.
M. Ft. pil. xx No.
Sig.—"1½ gr. Creosote Pills."

186.

℞. Creosoti . . . . gr. xxx
Gelatini Comp. . . . . . . gr. xv
Ext. Glycyrrhizæ . . . . . . q. s.
M. Ft. pil. x No.
Sig.—3 gr. Creosote Pills.

Make the gelatin compound by dissolving 11 parts of gelatin and 5 parts of sugar in 24 parts of hot water.

187.

℞. Olei Tiglii . . . . ♏vj
Fiat pil. iv No.
Sig.—Croton Oil Pills.

Add ten grains of flour and two grains of soap, then glucose q. s.

188.

℞. Olei Tiglii . . . . ♏v
Saponis . . . .
Pulv. Acaciæ . . . āā . . . . ℈i
M. Ft. massa in pilulæ viginti numero dividenda.
Sig.—Croton Oil, ¼ gr.

189.

℞. Lupulini . . . . gr. vi
Camphoræ . . . . gr. iss
Terebinth. Venet. . . . . . gr. xij
M. Ft. massa et in pilulæ xii numero divide.

Needs licorice powder or magnesia to make a mass.

190.

℞. Terebinthinæ Venetæ . . . . ℨ is
Extracti Hyoscyami . . . . . ℨ ss
Pulveris Rhei . . . . ℨ ss
Camphoræ . . . . gr. x
M. et in pil. xxvi divide.

191.

℞. Chloralis . . . .
Camphoræ . . . āā . . . . gr. xviij
M. Ft. pil. xij no.

Mix the chloral and camphor thoroughly and mass with 50 grains of flour and 6 drops of syrup (or q. s.). Or, add half a drachm of melted wax, and incorporate enough powdered licorice root to make a mass.

192.

℞. Terebeni . . . .
Picis Liquidæ . . . āā . . . . ℨ ss
Balsami Peruviani . . . . . .
Sodii Benzoatis . . . āā . . . ℨ i
M. Ft. pil xxxv.
Sig. One every 4 hours.

CHAPTER VIII.

LOZENGES, TABLETS, PASTILS, ETC.

Lozenges are small discs of medicated or flavored sugar, intended to be dissolved in the mouth. The word lozenge is used in a broad sense, and refers to the form in which the medicinal matter is stored or administered. It may be applied to troches, tablets, pastilles, etc., all of which are broadly called lozenges, but the other terms are used in a more restricted sense.

Troche (Lat. *Trochiscus, i*) (pronounced trōch or trō′kē), a lozenge composed of medicinal ingredients mixed into a paste with sugar and mucilage and dried. It is intended to be gradually dissolved in the mouth and slowly swallowed, producing a demulcent effect.

Tablet (Lat. *Tabella, æ*).—(1) A disc of pure medicinal matter made into lozenge form by compression, when it is called a *compressed tablet*, or (2) potent medicines mixed with a saccharine or other suitable base and moulded into a small lozenge without having been made into a paste called a *tablet triturate*.

Pastil or **Pastille** (pas-tel′) (Lat. *Pastillus, i.*)—The Latin word *pastillus* is the diminutive for *panis*, a loaf, and thus means properly a little loaf. In pharmacy the word is used somewhat indefinitely, referring mostly to lozenges having gelatin and glycerin, or chocolate for a base.

Chocolate lozenges are called pastils in the German Pharmacopœa, but "tabellæ" in the British.

Fumigating pastils are little cone-shaped compounds of balsams, spices, etc., with charcoal or other combustible substances as a base, designed for burning as a fumigator or disinfectant.

Bacill (Lat. *Bacillula, æ*), a short, rod-like lozenge corresponding to troche, except in shape. It is a more convenient form for the small troches.

Lamel (Lat. *Lamella, æ*).—Minute glycero-gelatine discs medicated for use in the eyes or for hypodermic injections.

Orbicules or **Globules** (Lat. *Rotula, æ*), are hemispherical globules of sugar, medicated by dropping upon their surface a volatile oil, which is absorbed.

THESE classes of preparations, though largely sold in drug stores, are not made to any considerable extent (with the possible exception of the tablets) by pharmacists.

They are, properly, medicated candies, and require special apparatus and skill to obtain tempting products. The numerous candy cough-drops are included here, which might be included in the domain of pharmacy but that they require a skill in the manipulation of melted sugars and special moulds, work-benches, etc., which will confine them to the work of the large confectioners.

Many of the smallest medicated lozenges are coated heavily with sugar, and are thus rendered more candy-like, while the chocolate lozenges and the bacillula suggest other familiar forms of confectionery.

Nearly all the common forms of candy have been utilized for the administration of medicines, but one form, which has appeared in the market in late years, has not yet found such a use, though it is quite suggestive of possibilities, perhaps in the line of cough-drops or similar agents.

These are the brandy or liquor-drops, consisting of a chocolate-coated shell of sugar, containing a thick brandy or rum-syrup. On breaking one of these open, the outside of the shell is seen to be quite smooth, while the inside is very irregular, and has the appearance of rock candy. This suggests their method of manufacture. If brandy (diluted or strong) be heated, and sugar added thereto until no more will dissolve, a hot supersaturated syrup is formed from which crystals of sugar will separate on cooling.

If this hot solution be poured into small metallic moulds, while hot, the solution will cool first upon the sides of the moulds and crystallize there, so that when the moulds have set for several hours a crust of crystallized sugar will have formed on the inner surface of the mould, and will inclose the remaining syrupy liquid which will not crystallize. On removing these from the mould they may be coated with chocolate or other material for which no pressure or continued heat are required.

An application of this principle to a cough-drop, or other medicament, might easily be made, but has not yet appeared to the author's knowledge.

In the following pages only such forms of lozenges are treated as are official in the principal pharmacopœias, and are liable to be prescribed by physicians, or can be profitably made in the pharmaceutical laboratory.

Troches are made of various forms, the more common being round or rectangular. No shape is specified in the Pharmacopœia, and consequently the pharmacist is free to dispense any form which comes within the definition of troches. The manufacturers, by whom most of the troches at the present time are made, use dies of various shapes and sometimes arranged to stamp some name or design upon the face of the troche.

Such dies consist of a metallic cylinder with a cutting edge, into which is sometimes fitted a plunger, bearing upon its face the design in bas-relief or intaglio, which, being forced upon the soft mass, leaves its impression upon the troche. The mass, having been rolled into a flat sheet, either upon a troche board or between adjustable metallic rollers, is then cut by hand with these dies, the latter being either single or in sets.

A troche-mass consists of medicinal matter, mixed with sugar and gum, made into a dough by means of syrup or honey. When no dry gum is used the mass is made with mucilage. It should be made softer than a pill mass, so that it may be moulded and flattened without cracking. Moistening agents should be added very cautiously, since sugar softens by kneading, and a little liquid which appears to be insufficient to produce plasticity, may, upon being well worked in, produce a mass which lacks firmness. When the troche contains acacia, it is usually mixed with the sugar in dry form, but when tragacanth is used the mucilage of tragacanth is preferred as an excipient.

The choice of these two gums depends upon the purpose of the troche as well as upon its ingredients. Acacia makes a more tenacious troche which dissolves more slowly than when tragacanth is used.

It is to be preferred, therefore, for throat lozenges and such as are desired to dissolve slowly. The proportion of gum present controls to a large extent the rate of solubility.

The sugar should be in a very fine powder, or the surface of the troche will not be smooth. That sold under the name of "confectioners' sugar" is best to use. It has been recommended to reserve a portion of the sugar from the mass until the excipient has all been added and kneaded in, then the reserve portion is incorporated; this is to avoid an unduly soft mass, but such proceeding is not necessary if the excipient be added cautiously.

White of egg and syrup of marshmallow are sometimes used as excipients in place of mucilage. These do not make as hard a troche, unless gum is also present, but they are very palatable. For laxative troches prune-paste is an agreeable excipient.

If a troche-board and cutter is at hand, the mass is now weighed, and the weight divided by the number of troches desired. The weight of one troche having thus been ascertained, that amount is weighed out and formed into a troche in the cutter, in order to ascertain its thickness, The sides of the troche-board are now adjusted to correspond to this, and the entire mass rolled into a sheet of corresponding thickness, which is then cut into troches by means of the cutter.

In rolling and cutting the mass a dusting-powder is usually necessary. Powdered sugar of milk is usually best for this, being less hygroscopic than cane sugar, and less quickly absorbed by the mass. Starch is also used. When dark-colored troches are made an aromatic powder, as cinnamon, orris, etc., may be employed in very sparing quantities. These should be avoided, unless the aromatic flavor will harmonize with that of the troche. Less powder will be needed if the mass is rolled and cut upon paraffin paper. Few stores are provided with troche apparatus, because most of these medicaments are now made by the large manufacturers. A fairly good troche can be made, however, without the use of special apparatus, and no pharmacist need turn away a prescription for a troche which he does not keep in stock because of the lack of such conveniences. If a troche-cutter is at hand the mass may be rolled into a sheet upon the pill-machine or tile by means of a round, smooth-sided bottle. Or in the absence of a troche-cutter the mass is first made into boli, in the same manner as making pills. These, after having been well rounded, are pressed into a flat form by means of a broad spatula or a flat board, care being taken to have all of the same size. A good method is to flatten a number together upon the pill-machine, using the raised sides of the machine as a gauge for thickness. Very good-looking troches can be made in this way if the mass is made very soft. With a dry or stiff mass the edge of the troche will crack and be uneven, but with a soft mass a smooth and round edge is obtained. The mass should always be cut as soon as made.

All troches should be partially dried before being delivered. In most cases drying in a warm place—as near a stove or radiator—for about an hour is sufficient; but when the troches contain volatile ingredients, essential oils, etc., heat should be avoided. These should be dried in a desiccator, which may be readily improvised by placing them in a tight pasteboard or wood box, alongside a lump of quicklime. The lime abstracts the water greedily, but does not affect the oils.

Instead of flattening the bolus with a spatula or board, a troche-former may be used. This consists of a smooth metallic tube about three inches in length, the diameter of which is the same as that of the troches desired. Into this is fitted, not too tightly, a rod of wood or metal which is used as a plunger and is longer than the cylinder.

The tube is now placed in an upright position over the bolus, so that the latter rests upon the pill-tile inside the tube. The plunger is then pressed gently upon the bolus and the latter is thereby formed into a troche.

If the bottom of the plunger has cut into or raised upon its surface a suitable design the latter will appear in reverse upon the surface of the troche.

Troches which contain poisonous substances should either be colored or stamped in such a way as to warn against their too free use. Commercial santonine lozenges are usually colored pink for this reason.

Bacills.—Short, rod-like lozenges are the form in which the smallest troches are sometimes preferred. They are also dispensed in the place of round troches when special apparatus for these is wanting.

They may be made by rolling the mass into a pipe, as in making pills, then cutting into short lengths, or a smoother surface may sometimes be obtained by flattening the pipe between the cutters of the pill-machine, so that it is forced into the grooves.

In the German pharmacopœia this form is directed for troches weighing less than ten grains.

Tablets are of two kinds, the compressed and the tablet-triturates. These differ materially in character as well as in their methods of preparation.

Compressed tablets are lozenge form, but have oval instead of flat faces.

They are made from *granulated materials*, and not from fine powders.

When chemical salts are made into tablets, as potassium chlorate, etc., the granulated (fine crystals) powder is used, and no preparation is necessary.

When amorphous powders, or powdered drugs, are to be compressed, they are first made into a granular powder by moistening with syrup, glucose, mucilage, alcohol, or other suitable fluids until it aggregates into fine lumps, and is then dried at a low temperature. This "granulated" powder is then mixed, without trituration, with the other ingredients, yielding a mixture somewhat resembling a sachet powder, which accounts for the mottled appearance of the finished tablets. This necessity for granulation is the greatest obstacle to the manufacture of compressed tablets by the retail pharmacist.

The dry granulated powders are then compressed in a suitable machine, the pressure of which is adjustable, so that tablets can be made of any degree of hardness from the easily friable, intended for making hypodermic solutions, etc., to the slowly-soluble tablets which are sometimes so hard as to require the full strength of the fingers to break them.

These machines are made of various sizes and forms, from the small hand-machines, capable of turning out 30 to 50 tablets per minute, to the power machines, capable of making 200 to 250 per minute.

In selecting a machine, choose one which is simple and strong in construction, easily adjustable, both in weight of tablets and in pressure, and one which can be easily taken apart and cleaned. Machines are furnished with a number of dies, making tablets of various sizes. These measure from 1/8 inch to 3/4 inch in diameter, though tablets larger than 1/2 inch are not frequent.

When very lightly compressed it is sometimes necessary to use a slightly moist powder, but most tablets are compressed dry. The dies are, occasionally, lubricated with talcum or liquid petrolatum to prevent the powders from adhering to them, but most salts and mixtures will compress without the use of these. The talcum may also be mixed with the ingredients before being fed into the machine to prevent sticking.

A matter of importance is the quick disintegration of such tablets as are not intended to be used as a lozenge, when dropped into water. With readily soluble salts, as ammonium chloride, no difficulty is presented, but with slowly soluble, or partially soluble bodies, as quinine sulphate, the admixture of some inert soluble body is almost a necessity. A mixture of tartaric acid and sodium bicarbonate has been employed in very small proportions for this purpose.

Not enough is used to cause an effervescence when the tablet is dropped into water, but just sufficient to force the tablet apart. Sugar, or sugar of milk, starch, or tragacanth, with light compression, are better agents. Slight traces of petrolatum, either liquid or semi-solid, are also useful in preventing the drug from packing together too firmly. So small a quantity suffices that its presence is not noticeable in the water.

Incompatible salts must be granulated separately, and mixed only when dry, then pressed lightly, since a heavy pressure is sufficient to bring about a reaction. Tablets containing vegetable powders are sometimes discolored from the oil forced out by too great pressure.

Tablet triturates are a recent form of medication which has become very popular. They are an American idea, having been introduced by Dr. Robert Fuller, of Philadelphia.

They are very small and comparatively thick lozenges, differing from the troches in being easily broken or crushed, and containing (in most cases) no gum, and from the compressed tablets in being diluted medicinal agents, and being made from very fine powders.

They are specially adapted for the administering of very powerful remedies, or such as are given in small doses, like strychnine, morphine, narcotic extracts, etc. They dissolve quickly in the mouth or when dropped into water. Powdered drugs or bulky medicines are seldom made into triturate tablets.

The principal base for these is sugar of milk, and tablet triturates are thus nothing more than moulded triturations; but sometimes a mixture of sugar of milk and cane-sugar, in the proportion of five parts of the former to one of the latter, or cane-sugar alone is used as a base, this last being preferred for hypodermic tablets.

For salts which are incompatible with these, as silver nitrate or potassium bichromate, kaolin is used as a base.

The medicinal agent is first made into a trituration with one of these bases, by thorough rubbing in a spacious mortar, followed by sifting, then moistened, so that a mass is obtained which will not be the least pasty, but will cohere when pressed together. Water is used in most cases for moistening, even where resinous ingredients are used, for the sugar of milk forms the greater bulk of the tablets, and this makes the best mass with water Where oily ingredients enter, alcohol may be used to moisten, and for chemicals which are insoluble in water, mixtures of alcohol and ether or alcohol and chloroform are sometimes to be preferred. Starch paste is employed in tablets containing a large proportion of extracts. The choice of the base and the moistening agent are important. A smooth and bright tablet can only be secured by the use of a very finely-powdered base, preferably a number 120 powder. Sifting should not be neglected.

When tinctures or fluid extracts are made into tablets no moistening may be necessary.

The best method of procedure is to mix the tincture with a portion of the base, allow it to partially evaporate, then incorporate the remainder of the base, and mould.

Milk sugar is the best for this class, as a rule, but a mixture of this with cane-sugar is preferred in some cases, as making a harder tablet.

Tablet saturates are sometimes substituted for these. Plain sugar of milk tablets are saturated with an alcoholic tincture, either strong or diluted with alcohol or ether, and then dried. These correspond to the homœopathic pellets, made of sugar, which are medicated in the same way.

Tablets for saturation may be kept in stock, and can be medicated at short notice. When the tincture contains too much water for successful results, the fluid extract must be substituted in proportionate amounts and diluted with alcohol or ether.

When solid extracts are made into tablet triturates the proportion should not exceed one-third the entire weight of the tablet, otherwise it is very difficult to obtain a smooth tablet.

Aside from such cases as the above, water is preferred as a moistening agent.

Tablets containing chemical salts, resins, aloes, etc., can be made by use of milk sugar and water.

The moulds in which the tablets are formed are very simple. They consist of a flat plate of hard rubber or metal, of the thickness of the desired tablets (usually $\frac{1}{16}$ to $\frac{1}{8}$ inch), perforated with a number of holes, commonly one hundred.

A corresponding plate has a number of projecting pegs, which fit into these holes and eject the tablets when these are ready.

The mixture having been made, it is transferred to a large glass plate or porcelain pill-tile, and the perforated plate is also placed upon the tile. Then, by means of a broad-ended spatula, preferably of horn, the moist powder is spread over the plate and rubbed into the holes until these are completely filled and the surface of the tablets is smooth. The excess of mass is then brushed off and the plate turned over, when the smoothing process is repeated on the other side. After allowing a moment for drying (even this is unnecessary in some cases) the plate is pressed down upon the ejecting plate, and the tablets, which will now rest upon the ends of the pegs, are set aside in a tray to dry and harden.

In order to obtain a definite number of tablets which will contain a known quantity of medicinal matter, it is necessary to know how much of the diluent must be used. The weight of diluent will vary with different tablets, owing to the difference in bulk of the medicinal agents and the variations in strength of tablets.

A separate trial is therefore necessary for each kind of tablet, and a formula should be made and kept for subsequent use. In order to ascertain the amount of diluent necessary to make any given tablets the following method may be used:

Enough of the active constituents of the tablets to make a given number is weighed out and mixed with a quantity of base which is known to be insufficient.

This is moistened and rubbed into the given number of holes in the plate, which it only partially fills. More of the same base, without the active ingredients, is then moistened and the holes are completely filled, smoothed off on both sides and the tablets ejected. These tablets are now broken into small pieces, or powdered, thoroughly dried and weighed. The total weight of the tablets, minus the weight of the active constituents, gives the weight of diluent necessary for a given number of tablets.

The amount of moistening agent used will affect the amount of base required.

If the mass is made decidedly wet a quantity of sugar will pass into solution, and upon drying the tablets these will be much firmer and heavier than those made with a corresponding mixture, which has been only slightly moistened.

It is possible to vary the weight of tablets by more than 50 per cent. in this way. Thus in constructing a formula for regular use, not only should the amount of base necessary to make a definite number of tablets be recorded, but also the exact character and amount of moistening fluid required.

The metal moulds, made of steel and nickel-plated, are the easier to use, but should not be employed for tablets containing corrosive ingredients or those which are liable to reduction in contact with a moist metallic surface, as calomel, salicylic acid, etc. Only the hard rubber mould should be used for these.

When only one mould or set of moulds (these vary in size) can be had, the hard rubber are to be preferred.

When metal moulds are used, a broad-ended putty-knife is a very convenient tool for filling the holes.

A special tablet-spatula of horn with a very broad and short blade can be obtained for the rubber moulds, and is used by some manufacturers for both moulds, being more springy and less tiresome than the stiffer steel tool.

Many commercial tablets which are labelled "triturate tablets" are in reality made in the compressing machines. The composition of these is essentially the same, and the pressure is the lightest possible to make a tablet. The main reason for making them in this way seems to be that when the power and machinery are at hand it is cheaper to make them in a machine which completes only one tablet at a time, but is automatic, than in a mould which makes 100 tablets at once, but requires an operator.

The larger tablet moulds are sometimes used for making tablets which consist almost entirely of active medicinal matter, this being moistened with mucilage and formed into tablets. These are more properly troches, and the mould answers well in forming them. Only a few kinds of troches can be made in this way.

PASTILS or PASTILLES (pronounced pas′-til or pas-tel′) are soft lozenges, having, usually, gelatin or chocolate for a base. Glycerin is associated with the gelatin to keep the mass soft.

A formula which is popular in England is gelatin one part, glycerin and water each two and one-half parts by weight. The gelatin is softened in the water by aid of heat, and then the glycerin is added and the heat continued until a clear solution results. This sets on cooling to a firm transparent jelly, which dissolves slowly in the mouth.

Medicinal agents are added just before the solution stiffens, and stirred until the mass becomes firm enough to remain homogeneous. When insoluble powders are added they should first be made into a stiff paste with a little glycerin.

The pastils are flavored with fruit-juices and acids, with aromatics, etc.

Rose water, cinnamon-, orange flower-, or bitter almond-water may be substituted for the water used to dissolve the gelatin. Glycyrrhizin in the proportion of 24 grains to 1 ounce of gelatin makes a good flavor for pastils of ammonium chloride.

The pastils may also be colored with carmine if desired.

To form the pastils the melted mass is allowed to congeal upon a flat surface, having raised sides or edges, so that it will form a square or rectangular sheet of the size and thickness desired. When cold this is cut into squares with a sharp knife. Moulds can be obtained of glass or tin which have the bottom marked with lines to indicate the squares of the finished troche, and any measurements are unnecessary. In the absence of these fairly good results may be obtained by allowing the mass to congeal in the bottom of a tin seidlitz-powder box, or in the pasteboard cover of a powder box of suitable size, which has previously been oiled to prevent sticking.

The sheet of gelatin is then taken out and cut into suitable pieces by eye or measurement.

Pastils containing active ingredients of a volatile or changeable character should be freshly prepared, but in many cases these can be kept for a considérable time if coated with gelatin while fresh. Unless otherwise specified, pastils of gelatin should weigh about thirty grains each.

A more slowly soluble mass for throat affections may be obtained by addition of acacia. A good formula is: Gelatin, 1 ounce; glycerin, 2½ ounces; acacia, 2 drachms; aromatic water, 2 ounces.

Chocolate pastils are made by fusion in a similar manner to those of gelatin, or by the cold method in a manner similar to the making of troches and bacills. The commercial sweet chocolate may be used, or a mixture of equal parts of cacao butter and sugar with one-fourth to one-half these quantities of cacao, as best suits the case. The latter is preferable for pastils which contain much insoluble or liquid matter.

The same precautions must be taken in handling of these as in suppositories, which they closely resemble from a manufacturing standpoint. Tragacanth is sometimes recommended to make the mass more adhesive (when some water must be present) and saccharin is also used as a sweetener.

In many cases the sweet chocolate of the market, with addition of a little cacao butter and sugar, suffices for a good mass.

Paraffin may be added if too soft.

LAMELS are minute discs of glycerinated gelatin, containing small doses of active medicinal matter. They are used chiefly in ophthalmic treatment in place of collyria, or for producing dilation or contraction of the pupil, producing anæsthesia, etc. They are made very thin and small, so that they can be inserted underneath the lids.

They may also be used for extemporaneous preparation of hypodermic solutions.

In the British Pharmacopœia three are official, one containing $\frac{1}{5000}$ grain of atropine sulphate, one of $\frac{1}{50}$ grain of cocaine hydrochloride, and one containing $\frac{1}{1000}$ grain of physostigmine in each lamel.

Sugar Globules or Orbicules are small hemispherical globules of sugar made by heating sugar with water until a stiff pasty mass is obtained, then dropping upon a cold polished surface in such a way as to obtain little half-round lozenges of sugar similar to the peppermint drops of the market. These are medicated as desired, with volatile oils, dropped upon the globules. When very small quantities of oils are administered in this way the oil is first diluted with alcohol or ether and the globules saturated with this mixture.

The globules thus correspond to the sugar-pellets of homœopathic pharmacy, except in size and shape, and like them are always obtained from confections ready for medication. They are official in the German Pharmacopœia under the title *Rotulæ Sacchari.*

TROCHES.

193.

℞. Tincture of Ginger . . . . 20 Cc.
Tragacanth, in fine powder. 4 Gm.
Sugar, in fine powder . . . 130 Gm.
Syrup of Ginger, a sufficient quantity to make 100 troches.
M. Sig.—Troches of Ginger, U. S. P.

"Mix the tincture of ginger with the sugar, and, having exposed the mixture to the air until dry, reduce it to a fine powder. To this add the tragacanth, and mix thoroughly. Lastly, with syrup of ginger, form a mass, to be divided into one hundred (100) troches."

Make 20 troches.

194.

℞. Potassium Chlorate, in fine powder . . . . 30 Gm.
Sugar, in fine powder. . . 120 Gm.
Tragacanth, in fine powder. 6 Gm.
Spirit of Lemon . . . . . 1 Cc.
Water, a sufficient quantity.
Make 100 troches.
Sig.—Potassium Chlorate Troches, U. S. P.

"Mix the sugar with the tragacanth and the spirit of lemon by trituration, in a mortar; then transfer the mixture to a sheet of paper, and, by means of a bone spatula, mix with it the potassium chlorate, being careful, by avoiding trituration or pressure, to prevent the mixture from igniting or exploding. Lastly, with water, form a mass, to be divided into one hundred (100) troches."

Make 20 troches.

The powders must be mixed and massed very cautiously, as the dry mixture is explosive by friction or pressure.

195.

℞. Prepared Chalk . . . . . . 25 Gm.
Acacia, in fine powder . . . 7 Gm.
Spirit of Nutmeg . . . . . 3 Cc.
Sugar, in fine powder . . . 40 Gm.
Water, a sufficient quantity.
Make 100 troches.
Sig.—Troches of Chalk, U. S. P.

"Rub the powders with the spirit of nutmeg until they are thoroughly mixed; then, with water, form a mass, to be divided into one hundred (100) troches."

Make 20 troches.

196.

℞. Olei Gaultheriæ. 0.20
Pulveris Sacchari 15.00
Mucilaginis Tragacanthæ . . q. s.
M. Fiat Trochisci Viginti No.
Sig.—Wintergreen Lozenges.

197.

℞. Pulv. Glycyrrhizæ Comp. . . . ℥iv
Pulpæ Pruni . . . . q. s.
M. Ft. Trochisci xxiv No.
Sig.—Compound Licorice Lozenges.

198.

℞. Sodii Boratis 10
Sacchari 90
Tragacanthæ 0.25
Tinct. Benzoini 1.0
Aquæ 6.0
M. Ft. trochisci No. c.

Mix the borax with half of the sugar, and the tragacanth with the remainder of the sugar. Triturate the tragacanth-and-sugar mixture with the water, add the tincture of benzoin, triturate well, then add the borax mixture, incorporate quickly and divide into 100 troches.

(Borax coagulates gum, and a tough, elastic mass which cannot be worked, is formed if the borax is added directly to the tragacanth. The same would apply to acacia.)

199.

℞. Gelatini 5.0
Aquæ 5.0
Glycerini 0.5
Misce et adde.
Creosoti 10.0
M. Ft. emulsionis et in pastilli c. divide.

Make an emulsion of the hot paste and creosote by rapid trituration, continued until the gelatine stiffens, then allow to congeal and divide.

200.

℞. Camphoræ . . . . gr. viij
Menthol . . . . gr. iv
Pastæ Gelatini pro pastillos . q. s.
M. Fac. pastillos No. xij. Sig.—Sedative pastilles.

201.

℞. Iodoformi . . . . gr. xij
Pastæ Gelatini pro pastillos . q. s.
M. Ft. pastillos No. xi. Sig. — Idoform pastilles.

202.

℞. Ext. Kola . . . . 1.
Pulv. Chocolate . . . . 10.
Pulv. Milk Sugar . . . . . . 1.
Syrup . . . . q. s.
M. Ft. pastilli No. x. Sig.—Kola pastilles.

203.

℞. Hydrarg. Chlor. Mitis . . . . 1.
Chocolatæ 20.0
Syrupi . . . . q. s.
M. Ft. pastilli xv No. Sig.—"Calomel pastilles."

Powder the chocolate and mix the calomel thoroughly, mass with the syrup and divide.

204.

℞. Olei Ricini . . . . 10.
Pulv. Theobromat. Sine Oleo 10.
Saccharai . . . . 20.
Tinct. Vanillæ 0.50
M. Ft. pastilli No. x. Sig.—"Castor oil pastilles."

Mix the oil with the cocoa (the powdered cocoa put up for making hot drinks may be used) with the other ingredients, and roll into pastilles.

CHAPTER IX.

POWDERS, SPECIES, CACHETS, CAPSULES, WAFERS.

Species (Lat. *species-um*).—Very coarsely powdered or merely bruised drugs, intended for the domestic preparation of infusions or decoctions. They are also called "*teas*," as "Breast-tea," "Physic-tea," etc.

Powders (Lat. *pulvis-eris*, plural *pulveres-um*).—Applied to drugs and chemicals administered in the dry powdered form. When divided into doses powders are administered as,—

Papers (Lat. *chartulæ-arum*).—Small folded papers each containing a single dose.

Capsules (Lat. *capsulæ-arum*).—Ovoid, or short cylindrical, shells of gelatin, usually in two close-fitting parts, in which powders, pastes, or liquids are enclosed.

Cachets.—Small concavo-convex discs made of flour or starch and gum, the two parts of which, when fitted together and cemented by moistening, form a receptacle for powders. When swallowed, they are softened by dipping into water.

Wafers.—Small sheets resembling powder-papers, composed of flour or starch and gum, in which, after moistening, powders are folded in the same manner as in papers. These are softened before being swallowed by dipping into water.

THE effect of certain medicines upon the system is due to a considerable extent to the form in which they are administered.

If a teaspoonful of dry salt (sodium chloride) be placed upon the tongue and slowly swallowed, it checks hemorrhage of the lungs, but the same amount of salt dissolved in a teacupful of warm water is a prompt emetic.

The alkaline bromides, given in dilute solution, allay excitement, but if swallowed dry they irritate the stomach and anything but a quieting effect is produced.

Bismuth salts owe their efficiency in a measure to mechanical action, and produce better results when administered in powder form or in mixtures than in solutions.

Hence the administration of medicines in powder form is not only a matter of convenience to the patient, or because of insolubility, but oftentimes because of certain peculiar actions upon the system. The bodies which are most frequently prescribed in powders, are those which are insoluble in the ordinary solvents, and are too bulky for administration in pills, or when a greater diffusion is desired than can be obtained in pills or tablets.

Thorough diffusion of some drugs and chemicals seems to modify and increase their action. This is illustrated in the official Dover's powder.

The prolonged trituration which is necessary to reduce the coarsely powdered sugar of milk to a fine powder, comminutes and thoroughly diffuses the ipecac and opium, and the resulting mixture possesses materially different medicinal properties from a corresponding mixture, the ingredients of which are mixed in a crude or "easy" way. Calomel is another of those bodies which act the better the more finely it is powdered, and (within certain limits) the more thoroughly it is diffused.

Such bodies should always be triturated in a mortar.

The dispensing of prescriptions calling for powders, then, demands some knowledge of the therapeutic action of drugs and their physical characteristics, in order to intelligently interpret the physician's desires.

Less observation of incompatibilities is demanded than in most other forms of medication, since chemicals do not readily react in the absence of moisture, and many salts may be administered commingled in powders which could not be combined in liquids or moist solids.

Powders are mixed in three ways: by trituration in a mortar, by stirring with a spatula on paper, and by sifting.

The choice of methods should not be altogether a matter of convenience, but should be governed by the results.

The mortar method is better when pulverization and thorough diffusion is desired, but it gives a more compact powder than sifting. Light powders, snuffs, insufflations, etc., are best mixed by sifting, when the powder is not compacted and diffuses more readily when thrown into water or in the air. Powders containing magnesia are most conveniently mixed on a sheet of smooth paper, or by sifting. If triturated heavily in a mortar it is pressed into a heavier condition, and subsequent sifting does not restore its lightness.

Most *vegetable and non-crystalline bodies* can be mixed in this way, and the resulting powder diffuses through water more readily than when they are triturated.

The sifting should be repeated two or three times, to insure complete admixture, unless combined with stirring on a piece of paper. A cheap and handy little sieve for mixing small quantities of powders can be constructed from a four-ounce chip ointment box and a small bit of cheese- or bolting-cloth. The top-piece of the cover is removed, leaving only the rim. The cloth is now stretched over the top of the open box, and the cover-rim placed in position, so as to hold the cloth in place and leave a part of the rim above. Powders are readily rubbed through the cloth by means of a spatula, and caught inside the box, preferably upon a paper lining, or the bottom of the box may also be removed and the sifted powder caught upon clean paper.

Crystalline salts, even if already powdered, are best mixed by trituration. Wedgwood mortars grow very smooth with use when powders do not mix as readily in them. A suitable degree of roughness should be occasionally imparted by triturating a little coarse emery in this mortar. Pumice stone, sand, etc., may be used in place of emery, but they are not as quickly effective.

When small quantities of powerful remedies are to be mixed with bulky powders, the potent drug is first placed in the mortar with an equal bulk of its diluent and triturated until well mixed, then a double volume more of diluent is added and mixed before a further quantity is added, so continuing till the end.

In this way complete admixture is assured with a minimum of time and labor, and the dispenser can always feel confident of the homogeneity of the powder.

If the entire amount of diluting-powder is added to the potent drug at once, even a long-continued trituration will not bring this same confidence.

When heavy powders are to be mixed with light ones, the mixing is hastened by placing the heavy powder (when first weighed) on top of the lighter; then upon stirring the heavier powder gradually sinks through the lighter and mixes with it in the process. If placed at the bottom of the mortar or sieve, the entire mixing must be done by mechanical force.

Incompatible salts and those containing water should be mixed lightly, as pressure may start a reaction.

Soluble powders may be dispensed in granular condition or powdered. They are easier divided when in powder.

The following suggestions by Mr. Peter Boa,* on the effects of different methods of mixing powders, may be found useful. He says, "Certain powders when mixed together are very difficult to diffuse in water, though it may happen that each one by itself can be mixed with ease. Again, there are compound powders in which one or more of the ingredients might be immiscible separately, yet when in combination they do not present the same difficulty. The most marked examples of these peculiarities occur when insoluble inorganic substances are mixed with vegetable powders. The inorganic substances may be diffusible or non-diffusible, and magnesia and sulphur may be taken as types.

"Sulphur does not diffuse in water by itself, but in combination with vegetable powders it may do so with little difficulty.

"Magnesia diffuses readily, but when compounded with certain vegetable powders it forms a powder which persistently floats upon water. Sulphur has, therefore, to be made miscible; magnesia has to be prevented from becoming immiscible. And it is here that the method of mixing may be brought into play, so as to effect the different results which we have in view."

The magnesia is prevented from becoming immiscible by avoiding trituration, hence we mix magnesia powders on paper or by sifting. Sulphur is made miscible by triturating with vegetable powders in a mortar. In cases where both enter into a compound powder, the sulphur may be triturated with vegetable powders, then this mixture combined with the magnesia by sifting or by means of a spatula.

Sometimes, however, magnesia renders resinous and other bodies

* Phar. Journ. and Trans., 1881, p. 546.

which are immiscible with water, more diffusible by trituration with them, and no hard and fast rule can be laid down.

DISPENSING POWDERS.—Powders are dispensed in bulk, in papers (*chartulæ*), in capsules, in cachets, or in wafers.

Powders which are taken in relatively large doses, as a teaspoonful at a time, are dispensed in bulk. If not easily altered by contact with the air, they are placed in a suitable box, which is labelled; but hygroscopic, or changeable powders, granular effervescing salts, etc., should always be dispensed in wide-mouthed bottles.

Sometimes powders which are administered in comparatively small doses, are ordered undivided, with the insertion of a sample-dose in a separate paper. If a chemical, it should be powdered to destroy its physical identity, and the sample is then carefully weighed, folded in paper in the usual manner, and placed in an envelope, plainly marked. This method of dispensing is practiced only in the interests of economy, and is usually eschewed.

Finely powdered drugs should never be used in preparing species, because they make a muddy and disagreeable infusion. The drug should never be finer than a number twenty powder, and in many cases a bruised drug is preferable even to this. The bruising is readily done in an iron mortar. The mixing need not be thorough unless the package is to be divided for the preparation of successive lots of infusion.

Powders which are to be encased in capsules, wafers, and cachets, are to be first divided in the usual way. The administration of powders in this form is chiefly for the purpose of disguising the taste, but some protection is also afforded against the action of the air.

The action of air and light upon chemical substances calls for special attention in the dispensing of powders, to avoid undesirable changes in their preparation or subsequently. A list of these are given in the following tables, the more important to be memorized being printed in heavy type.

Salts that absorb moisture from damp air and ultimately become liquid, or DELIQUESCENT SALTS.	Salts that lose moisture in warm and dry air and become pulverulent, or EFFLORESCENT SALTS.
Acid, Carbolic.	
" **Chromic.**	
" Citric.	Acid, Citric.
Aluminum Acetate.	
" **Chloride, Bromide and Iodide.**	
Ammonium Nitrate.	Ammonium, Phosphate.
" Valerianate.	" Valerianate.
Antimony Chloride.	Antimony and Potassium Tartrate.
	Barium Acetate.
Calcium Chloride, Bromide and Iodide.	Calcium Acetate.
" Chlorate.	
	Cinchonidine Sulphate.
Cobalt Acetate.	Cobalt Sulphate.
" Chloride.	
" Nitrate.	Codeine.

Salts that absorb moisture from damp air and ultimately become liquid, or

DELIQUESCENT SALTS.

Copper Chloride.
" Nitrate.
Gold Chloride.
Ferrous Chloride, Bromide and Iodide.
Ferric Chloride.
Ferri et Ammonii Citras.
" " " **Tartras.**
" " **Potassii Tartras.**
" " Quininæ Citras.
" " " " **Solubilis.**
" " Strychninæ Citras.
Hyoscyamine Hydrochlorate.
" **Sulphate.**
Lithium Chloride, Bromide and Iodide.
" Citrate.
" Salicylate.
Magnesium Chloride, Bromide and Iodide.
Magnesium, Acetate.
" Chlorate.
" Citrate (Gran. Effervescing).
Manganese Chloride, Bromide and Iodide.
Manganese Nitrate.
Physostigmine (Eserine) Sulphate.
Pilocarpine Hydrochlorate.
Platinum Chloride.
Potassa.
Potassium Acetate.
" **Carbonate.**
" Citrate.
" **Cyanide.**
" **Hypophosphite.**
" Iodide (slightly).
" Nitrite.
" Sulphite.
" Sulphocarbolate.
" Sulphocyanide.
" **Tartrate.**
Soda.
Sodium **Hypophosphite.**
" Iodide.
" Nitrate.
" Nitrite.
" Sulphovinate.
" Valerianate.
Strontium Chloride, Bromide and Iodide.
Zinc Chloride, Bromide and Iodide.
" Chlorate.
" Nitrate.

Salts that lose moisture in warm and dry air, and become pulverulent, or

EFFLORESCENT SALTS.

Copper Acetate.
" Sulphate.
Ferrous Sulphate.
Ferric Alum (Ferri et Ammonii Sulphas).
Lead Acetate.
Magnesium Sulphate.
Manganese Sulphate.
Potassium Ferrocyanide.
Potassii et Sodii Tartras (Rochelle Salt).
Quinine (alkaloid).
" **Bisulphate.**
" Hydrochlorate.
" Hydrobromate.
" **Sulphate.**
Sodium, Acetate.
" Arsenate.
" Borate (in warm and dry air).
" **Carbonate.**
" Hyposulphite (above 33° C.).
" Phosphate.
" Pyrophosphate.
" Santoninate.
" **Sulphate.**
" Sulphite.
" Sulphocarbolate.
Strontium Acetate.
" Nitrate.
Strychnine Sulphate.
Zinc Acetate.
" Sulphate.

Some bodies are *hygroscopic*, *i. e.*, absorb moisture from the damp air, but do not liquefy. Among these are,—

Ammonium Chloride, Bromide and Iodide; the first very slightly so, the last badly.

Amylene Hydrate.

Chloral and Butyl Chloral, Chlorinated Lime (very hygroscopic).

Dried Alum, Dried Sulphate of Iron, Dried Carbonate of Sodium, and other exsiccated salts.

Granular Effervescing Salts.

Citrate of Iron, Phosphate of Iron, and Pyrophospate of Iron (in scale form).

Saccharated Iodide of Iron (very hygroscopic).

Pepsin (very hygroscopic).

Sulphurated Potassa.

Sodium Chloride (slightly), and Bromide.

Sparteine Sulphate.

Other bodies are decomposed, volatilized, or become changed in color and appearance when exposed freely to the action of air and light. Care should be exercised in dispensing such to see that they are in proper condition, and to prevent any subsequent change.

SUBSTANCE.	CHARACTER OF CHANGE	REMARKS.
Acid, Carbolic	Becomes red	No deterioration in value.
Ammonium Benzoate .	Loses NH_3.	Restored by addition of ammonia water.
" Bromide . .	Decomposes	" " " " "
" Carbonate. .	"	Loses both NH_3 and CO_2 and finally becomes bicarbonate.
" Iodide . . .	"	Restored by addition of ammonium sulphide (see U. S. P.), or by washing with ether.
" Valerianate .	"	Restored by addition of ammonia water.
Apomorphine Hydrochlorate	Becomes greenish. . .	By action of light, rapidly.
Aconitine	" yellowish . .	" " "
Aristol	Decomposes	" " "
Arsenic Iodide	Loses iodine	Decomposes very easily.
Bismuth and Ammonium Citrate	Loses NH_3.	Restored by addition of ammonia water.
Calcium Hypophosphite	Oxidizes	By action of air.
Calcium Sulphide . . .	"	" " "
Chinoline	Decomposes	
Chloral	Evaporates.	
Chrysarobin	Darkens	By action of light.
Cinchonidine Salts . .	Become brownish. . .	Very slowly by action of light.
Cinchonine Salts . . .	" " . .	" " " "
Europhen	Decomposes	
Ferrous Carbonate, saccharated	Oxidizes and darkens .	By action of air; best kept in the light.
Ferrous Iodide, saccharated	" " .	" " " " " "
Ferrous Salts in general.	" " .	" " " " " "
Ferric, scale salts . . .	Darken	Become less soluble, by action of light.
Iodoform	Darkens.	Loses iodine and volatilizes.
Lead Acetate.	Loses acetic acid and carbonates	Restored by addition of acetic acid.

SUBSTANCE.	CHARACTER OF CHANGE	REMARKS.
Lime	Absorbs water and carbonates	Must be kept in tight containers.
Lime, chlorinated . . .	Absorbs water and oxidizes	" " " "
Magnesium Sulphite. .	Oxidizes	By action of air.
Mercuric Cyanide . . .	Darkens	By action of light.
" Iodide. . . .	Reduced, darkens . . .	By action of strong light.
Mercurous Iodide . . .	" " . .	Reduced rapidly by light, forming metallic mercury and poisonous red iodide.
Mercuric Oxide, yellow.	" " . .	By action of light.
" " red. .	" " . .	" " " very slowly.
Potassa, sulphurated. .	Oxidizes	By action of air.
Potassium Cyanide . .	Loses CN and carbonates	" " "
" Hypophosphite	Oxidizes	" " " more rapidly if deliquesced.
Pyrogallol	Oxidizes and darkens .	By action of air and light.
Quinine Salts.	Become brownish . . .	" " light very slowly.
Resorcin.	Darkens	" " air and light.
Santonin.	Becomes yellowish . .	" " light.
Silver Salts, all	Reduced and darken. .	Must be well protected from light.
Sodium Santoninate . .	Becomes yellowish . .	By action of light.
" Bicarbonate . .	Loses CO_2—reduced to carbonate.	By warm air.
" Bisulphite . . .	Loses sulphurous acid.	By action of air.
" Sulphite. . . .	Oxidizes to sulphate. .	" " "
Sulphur Iodide	Loses iodine.	" " "
Zinc Acetate	Loses acetic acid . . .	Restored by addition of acetic acid.
" Iodide	Oxidizes and liberates iodine.	By action of air.
" Phosphide	Emits phosphorous vapor	" " "
" Valerianate . . .	Loses valerianic acid .	Restored by addition of valerianic acid.

GRANULAR EFFERVESCING SALTS.—These may be easily and quickly made, to satisfy small special orders, at the prescription counter. The basis of these is a mixture of sodium bicarbonate with citric or tartaric acid and sugar.

When thrown into water the bicarbonate is neutralized, carbonic acid is evolved, causing the effervescence, and a citrate or tartrate of sodium remains in solution, a slight excess of acid being present to give a pleasant acidulous taste.

Citric acid mixtures are easier to granulate than tartaric mixtures, but the latter are less expensive, and are more frequently employed for that reason.

The bicarbonate and acid are used in nearly molecular proportions, *i. e.*, 83.85 parts of sodium bicarbonate to 70 parts of citric acid or 75 parts of tartaric acid. The amount of sugar varies with different mixtures, and may be made to serve as a filling.

All these salts are given in teaspoonful (or multiples of it) doses, and 90 grains (6 Gm.) of finished salt are reckoned as a teaspoonful. Then if 10 grains of a salt are desired at a dose, the mixture which is to be granulated consists of 80 grains of effervescing mixture (with sugar) and 10 grains of medicament.

Since each 90 grains represents one teaspoonful, or ordinary dose, 20 teaspoonfuls would weigh 1800 grains, or a little less than 4 troy-ounces, which is a convenient quantity to operate upon.

In this quantity 600 grains of sodium bicarbonate may be used with 500 grains of citric acid or 540 grains of tartaric acid. To these amounts are added 5 times 20 grains, or 10 times 20 grains or 20 times 20 grains, as the case may be, of the active medicinal ingredient and enough sugar to make the whole weigh 1800 grains.

Thus a granulated effervescing potassium bromide, containing 5 grains to the teaspoonful, would require 600 grains of sodium bicarbonate, 540 grains of tartaric acid, 5×20 grains $= 100$ grains of potassium bromide, and $1800 - (600 \times 540 \times 100) = 560$ grains of sugar.

In a few cases it might be advisable to vary the proportions of soda-acid mixture to sugar, but the above will give quite satisfactory results in a large number of cases. A good idea of the varieties may be obtained from a comparative study of the formulas for effervescing salts in the Pharmacopœia and National Formulary. The official granular effervescing citrate of magnesium is a very troublesome salt to make, and does not yield a clear solution, consequently it is seldom found in the market.

Numbers 235, 236, 237 and 239 in the exercises are types of the commercial substitutes for this salt.

Granulation may be effected in two ways, by means of heat or by moistening.

When sugar and tartaric or citric acids are heated they become soft and sticky, as though moistened. In these mixtures a heat of about 220° F.—a little above that of the water-bath—is required to produce large and even granules. Direct flame should not be used, lest the mixture be burned, and become discolored. A glycerin or paraffin bath will give better results.

The powdered mixture is placed in a tinned-iron or porcelain dish, and heated until it becomes sticky, then it must be kneaded vigorously with a wooden spatula (do not use steel) or a tinned iron spoon until the entire mass is well granulated, when the mixture is removed from the heat and the stirring continued until cool. Mixtures containing bromides are liable to discolor under this treatment.

The wet method is more convenient in most pharmacies, and gives just as good results when carefully performed.

It consists in moistening the mixed powders with a liquid which possesses only a slight solvent power upon it, and when the mass has become sticky drying it quickly by aid of a gentle heat.

Alcohol is most suitable for small quantities of salts.

The mixed powders are placed in a suitable dish, and alcohol gradually stirred in, until the mass coheres into small granular lumps. If large granules are not required no sifting is necessary, but when large granules are to be obtained the mass is made a little more moist, until relatively large lumps are formed, then these are broken up and the granules made even by sifting.

Do not use enough alcohol to make a paste, nor attempt to conform the granules to the size of sieve which is used. The granules are formed entirely by the cohesiveness of the moist mass, under the influence of kneading. In cold and dry weather the granulated salt is readily dried by spreading upon a tray or clean paper, which is then placed upon a register or radiator, or in any current of warm air.

In warm and muggy weather it is difficult to dry these salts thoroughly, and recourse must be had to a drying-oven or closet.

As soon as the salts are dry they may be sifted and the finer portions regranulated or saved for a future lot.

The granulated salt should then be bottled and the bottles tightly stoppered, as the salt soon loses its effervescing qualities on exposure to the air. They keep best when dried at a very low temperature, and if a drying-oven be used the heat should not exceed 100 to 110° F.

Dividing Powders.—Guess-work is never proper in the dividing of powders.

When the powders are comparatively large and accurate dosage is not necessary, the powders may be divided by means of a cup-shaped measure.

These are often used in dividing seidlitz powders, but for such constant use they need to be standardized frequently. The edges of the cup wear away quickly, and the capacity of the cup gradually diminishes.

By far the best way for all kinds of powders is to weigh each separately. This can be done very quickly, as the hand and eye soon become accustomed to the necessary quantity, and after a few powders have been weighed approximately the right amount can be placed upon the balance each time, and the adjustment quickly made. Care must be taken, however, not to give overweight, particularly when a definite quantity of mixture is to be divided into a definite number of powders. It is very easy, for instance, in dividing 24 grains of mixture into 12 powders, to place $2\frac{1}{11}$ grains of powder upon the pan each time, and obtain 11 powders thereby, instead of 12, or by a slight deficiency in each weight to find a part of the mixture remaining after all the powders have been folded.

It is much more difficult to weigh small powders satisfactorily than large ones, and for this reason most pharmacists prefer to divide these upon the pill-tile in a manner similar to the dividing of pills. The powder is placed upon the tile and built up into a rectangular pile, one edge of which is parallel and close to the division-scale of the tile. This is readily done by means of a couple of straight-edged spatulas, care being taken to get the surface of the pile as well as the edges straight and even. The pile is now divided into the desired number of parts by cutting with the spatula, the division-scale serving as a guide.

Occasionally a powder or a mixture is obtained which flows so easily that it cannot be built into a parallelogram, and this must be divided by weight, or by means of a suitable mechanical divider, of which there are several in the market.

Papers.—The folding of powders in papers (*chartulæ*) is an art which is acquired only by practice.

When only two or three powders are dispensed at a time, they may be enclosed in a small envelope, but a number of powders are sent out preferably in a box.

The papers should be selected to fit the powders, and folded to fit the box. Hygroscopic, deliquescent, effervescent, or otherwise changeable substances, should be folded first in white calendered papers, then these are folded inside in paraffined or parchment papers to exclude moisture.

Powders intended for making lotions, or otherwise for external use, should be folded in colored papers as a distinguishing feature.

Wafers are folded by moistening one side of the wafer-paper before placing the powder upon it, then, while moist, folding in the same manner as a powder, but as small as possible. If too wet they do not fold nicely, and if not moistened enough they break, but a very little practice will enable one to get the proper degree of wetness, and they can then be folded as nicely and easily as papers. When dispensed the patient should be given explicit directions for taking them.

They are easily swallowed after soaking for a few seconds in a spoonful of water, and are tasteless. Do not soak long enough to cause them to break in the mouth.

Cachets.—In filling these care should be taken to get the whole of the powder in the center of the cachet. If any is spilled upon the edge the taste may be noticeable when the cachet is swallowed. In cachet-filling machines funnels are included for this purpose, as also some arrangement for moistening the edge of the cachet and pressing the two halves together.

But little moistening is needed, just enough to cause the two parts to adhere. Too much moisture causes the edges to shrivel and the appearance is spoiled.

Like wafers, these are easily swallowed after dipping into water, and full directions for their administration should be given.

Capsules.—When suitable funnels are at hand the filling of these is an easy process, but without suitable apparatus they are somewhat troublesome to fill without getting some of the medicinal matter upon the outside.

Since their chief purpose is to disguise the taste, a small portion upon the outside may effectually defeat this.

The divided powders may be poured into the capsule through a funnel, or directly from the paper, if carefully handled. In many cases a little packing of the powder into the capsule is necessary. This may be done with a small stick of wood or other contrivance.

In some sections the powder is made into a very soft pill-mass, which is rolled and divided in the usual manner, then the little rods of mass are inserted into the capsule with the fingers and the cover put on. This is a very convenient and easy method, but some physicians will not allow of it.

The pharmacist is always safe in dispensing dry powders in the capsules, but the mass-method may, or may not, give satisfaction.

Capsules of gelatin are also used for the administration of oils, oleoresins and liquid bodies. These are in one piece and ovaliform, the opening being at the end. They are made of "soft gelatin," *i. e.*, gelatin containing glycerin, which renders them elastic and more easily swallowed, and also, in the small sizes, of hard gelatin, the latter being about the size of a pill and spherical.

Liquids which dissolve gelatin or which are easily soluble in glycerin are not suitable for the capsules, the former dissolving the capsule and the latter rendering it porous.

Creosote cannot be held in the soft capsules, unless first mixed with an equal or double quantity of a fixed oil, on account of its affinity for glycerin.

The filling is easily accomplished. The protruding neck on the soft capsule is first cut off with a pair of scissors, and the liquid flowed into the capsule from a tap or from a small pipette. The little ends which have been cut off are melted in a small dish by aid of a little heat, and a drop of this liquid is transferred to the opening in the capsule from a glass rod, so as to form a film over the opening which quickly sets, and the capsule is hermetically sealed.

If only a small number are to be filled, as a dozen or less, they may be sealed by holding a hot spatula for a moment upon the opening. The gelatin in contact with the hot metal quickly melts and forms a film underneath.

The capsules should contain a little air when sealed, to preserve the elasticity.

205.

℞. Potassii Chlorat. . . . .
Ammonii Chloridi . . āā . . ʒ ij
Senegæ Contusæ . . . . . . ʒ iv
Glycyrrhizæ Contusæ . . . . ℥ ij
M. Ft. species.
Sig. Make a quart of tea and drink half a wine-glassful every hour.

206

℞. Sennæ . . . . 16.
Sambuci Florum . . . . 10.
Fœniculi . . . . 5.
Anisi . . . . 5.
Potassii Bitartratis . . . . . . 4.
Contusa et misce.
Sig.—Laxative Species, N. F.
(St. Germain Tea.)

207.

℞. Althæa . . . . 8.
Verbasci Foliæ . . . . 2.
Glycyrrhizæ . . . . 3.
Tussillaginis . . . . 4.
Anisi . . . . 2.
Iridis . . . . 1.
Contundantur et miscentur.
Sig.—"Breast Tea, N. F."

208.

℞. Prepared Chalk . . . . . . 30 Gm.
Acacia, in fine powder . . . 20 Gm.
Sugar, in fine powder . . . 50 Gm.
"Mix them intimately."
Sig.—Compound Chalk Powder, U. S. P.
Make one-tenth the quantity.

209.

℞. Ceylon Cinnamon, in No. 60 powder . . . . 35 Gm.
Ginger, in No. 60 powder . . 35 Gm.
Cardamom, deprived of the capsules and crushed . . . 15 Gm.
Nutmeg, in No. 20 powder . 15 Gm.
Sig.—Aromatic Powder, U. S. P.

"Triturate the cardamom and nutmeg with a portion of the ceylon cinnamon, until they are reduced to a fine powder; then add the remainder of the cinnamon and the ginger, and rub them together until they are thoroughly mixed."
Make 10 Grams.

210.

℞. Sulphuris Præcip. 7.5
Guaiaci 5.0
Magnesiæ 10.0
M. Sig.—Teaspoonful twice a day.

Triturate the magnesia and guaiac together, then mix these with the sulphur by trituration.
The mixture should readily diffuse through water.

211.

℞. Naphthalini . . . . 10.
Acid Borici . . . . 10.
Camphoræ 0.40
M. Ft. pulv. subtilis. Sig.—Use as a snuff.

212.

℞. Acidi Salicylici 0.3
Acidi Borici 1.0
Pulveris Talci 8.7
M. Ft. pulv. subtilis. Sig.—"Salicylated talcum powder, N. F."

213.

℞. Zinci Oxidi . . . . ℥iv
Acidi Carbolici . . . . . . gr. viij
Acidi Tannici . . . . . . ℥ss
Amyli . . . . ℥iij
M. Sig.—Dusting powder.

214.

℞. Amyli . . . . 16.
Zinci Oxidi . . . . 8.
Camphoræ 1.0
M. Ft. pulv. subtil. Sig.—"Dusting powder."

215.

℞. Iridis Florent. . . . . 100.
Potassii Bitart. . . . . 300.
Myrrhæ . . . . 100.
Kino . . . . 100.
Olei Caryophyl 5.0
M. Sig.—Toothpowder.

216.

℞. Pulv. Amygdal. Amaræ Sine Cortice et Olei . . . . . . ℥vi
Farinæ Tritici . . . .
Pulv. Iridis . . āā . . . . . ℥iv
Saponis Pulveris . . . . .
Sodii Boratis . . . āā . . . ℥i
Olei Amygdal. Amaræ . . . gtt. x
Olei Bergamottæ . . . . . ʒii
Tinct. Moschi . . . . ʒi
M. Sig.—Almond meal.

217.

℞. Ipecac, in No. 60 powder . . 10 Gm.
Powdered Opium . . . . . 10 Gm.
Sugar of Milk, in No. 30 powder . . . . 80 Gm.
M. Sig.—Dover's powder, U. S. P.

"Rub them together *into a very fine powder.*"
Make one-tenth the quantity.

218.

℞. Pulveris Doveri . . . . ʒi
In pulveres vi. divide et mitte in cachets . . . .
Sig.—10-grain Dover's powder.

219.

℞. Morphine Sulphate . . . . 1 Gm.
Camphor . . . . 19 Gm.
Glycyrrhiza, in No. 60 powder . . . . 20 Gm.
Precipitated Calcium Carbonate . . . . 20 Gm.
Alcohol, a sufficient quantity.
M. Sig.—Tully's Powder, U. S. P.

"Rub the camphor with a little alcohol, and afterwards with the glycyrrhiza and precipitated calcium carbonate, until a uniform powder is produced. Then rub the morphine sulphate with this powder, gradually added, until the whole is thoroughly mixed. Finally pass the powder through a No. 40 sieve, and transfer it to well-stoppered bottles."
Make one-sixth the quantity.

219 a

℞. Pulv. Morphinæ Comp. . . . . ʒi
In pulveres vi divide et mitte in wafers.
Sig.—10 gr. Tully's Powders.

220.

℞. Aquilæ Albæ . . . . gr. iss
Sacchari Lactis . . . . . . ʒi
M. Ft. chartulæ xij No.
Sig.—Calomel Triturates.
(Aquila alba—old name for calomel.)

Triturate *very* thoroughly together.

221.

℞. Sodii Salicylatis 1.30
Sodii Bicarbonatis 2.00
M. In pulveres decem divide.
Sig.—Capiat pulverem unam ex aqua cyathis post cibo.

222.

℞. Calomelanos . . . . gr. x
Magisterii Bismuthi . . . . . gr. xx
Sal æratus . . . . gr. xl
M. Sig.—Ut dictum.

Triturate the calomel thoroughly with the powdered potassium bicarbonate, then add the bismuth subnitrate and mix gently.

223.

℞. Bismuthi Salicylat. . . . . .
Salol . . . . . āā 10.00
M. Ft. chart. xxiv No.

These make a slippery powder, which cannot be divided accurately in the usual manner. Each powder should be weighed.

224.

℞. Pulveris Thebaicæ 0.325
Magisterii Bismuthi 3.250
Misce in chartulas decem dividenda.
Sig.—Opium and Bismuth.

225.

℞. Pepsinæ 2.0
Bismuthi Subnitrat. 5.0
Magnesii Carbonat 3.0
Pulv. Aromatici 1.0
M. et in chart. xij divide.
Sig.—Capiat unam post cibo.

Mix on paper. Do not triturate.

226.

℞. Pulveris Rhei . . . . gr. xxiv
Magnesiæ . . . . gr. xlviij
Olei Anisi . . . . ♏vi
Alcoholis . . . . ♏x
M. Et in chart. vi divide.
Sig.—"Rhubarb and Magnesia."

Mix the powders on paper, or by sifting, and add the oil previously dissolved in the alcohol. Mix this on paper.

227.

℞. Hydrarg. submur. . . . . . gr. ij
Pulv. rad. rhei . . . . gr. v
Elæosacch. menth. pip. . . . ʒ ss
M. Ft. pulv. dent. tal. dos. no. xij. Det. in chart. cerat. Sig.—Hora decubitus sumatur unum.

228.

℞. Tinct. opii 1.0
Plumbi acet. 1.0
Sacchari 2.0
M. Ft. pulv. No. vi. Sig.—P. r. n.

Triturate the tincture with the sugar dry in a warm (not very hot) place, and add the sugar of lead, mixing thoroughly.

229.

℞. Phenacetin . . . . gr. v
Caffeinæ citrat. . . . . gr. s
M. Ft. pulv. et mitte tales vi. No.
Sig.—Sumat nocte.

230.

℞. Potassii chlorat. . . . . ʒ ij
Acidi tannici . . . . ʒ i
Sacchari . . . . ʒ ij
M. Ft. chart. xij No. Sig.—One in a tumblerful of cold water, for a gargle.

Powder the ingredients separately, and mix very lightly on paper.

231.

℞. Ammon. carbonat. . . . . . . ʒ ss
Pulv. Tullii . . . . ʒ i
M. et in pulv. vi No. divid. Sig.—One at night.

Mix quickly and dispense in double papers, the outer papers being waxed.

232.

℞. Ammon. bromidi . . . . . . ʒ ss
Sodii bicarbonat. . . . . . . ʒ ss
M. et in chart. xij divide. Detur in scatula.
Mix lightly and fold in paraffin papers.

If the salts are not perfectly dry, ammonia gas will be liberated.

233.

℞. Quininæ Sulphatis . . . . . gr. ij
Ammonii Carbonatis . . . . gr. iv
Misce et detur tales numero quatuor in chartæ ceratæ.
Sig.—Sumatur una nocte maneque.

234.

℞. Elaterini . . . . gr. ij
Capsici . . . . gr. ij
Ol. Tiglii . . . . ♏vi
M. Et in partes æquales xij divide. Dentur in capsulæ.

Make a soft mass by means of a little powdered soap and water.

235.

℞.	Magnesii Sulphatis Exsic. . .	3.
	Sodii Sulphatis Exsic.	3.
	Potassii Carbonatis	10.5
	Sodii Bicarbonatis	9.5
	Acidi Tartarici	14.0
	Sacchari Pulv.	11.0

M. Ft. pulv. effervesc. Da in ampulla.

(About 18 Gm. of Rochelle salt are formed when this is dissolved.)

236.

℞.	Magnesii Carbonat	1.0
	Sodii Bicarbonat	14.5
	Potassii Bicarbonat	8.0
	Acidi Citrici	9.0
	Acidi Tartarici	12.0
	Sacchari Pulv.	5.5

M. Ft. pulv. effervesc. s. a. Da in ampulla.

When this mixture is dissolved in water 22.5 parts of Rochelle salt are formed by the reaction between the bicarbonate and tartaric acid. Sodium citrate is also formed.

237.

℞.	Magnesii Sulph. Exsic. . . .	
	Sodii Sulphatis . . . āā . .	6.
	Potassii Carbonatis	10.5
	Sodii Bicarbonatis	9.5
	Acidi Tartarici	14.0
	Sacchari Pulv.	7.0

M. Ft. pulv. efferv. s. a.

238.

℞.	Sodii Sulphas Effervescens [Ph. Br.]	
	Sodium Sulphate	100 Gm.
	Sodium Bicarbonate . . .	100 Gm.
	Tartaric Acid	54 Gm.
	Citric Acid	36 Gm.

Dry the sodium sulphate until it has lost 56 per cent. of its weight, powder the product and mix it with the other ingredients.

Granulate in the same manner as magnesii sulphas effervescens.

239.

℞.	Magnesii Sulphas Effervescens [Ph. Br.]	
	Magnesium Sulphate . .	50 Gm.
	Sodium Bicarbonate . . .	36 Gm.
	Tartaric Acid	19 Gm.
	Citric Acid	12.5 Gm.
	Powdered Sugar	10.5 Gm.

Dry the magnesium sulphate at about 544° C. (130° F.) until it has lost 23% of its weight, powder the product and mix it with the sugar, then with the other ingredients. Place the mixture in a suitable dish heated to between 200° and 220° F., and when the particles of powder begin to aggregate, stir assiduously until they assume a granular form; then separate the granules into uniform sizes by sifting and preserve the product in well-stoppered bottles.

CHAPTER X.

SUPPOSITORIES, BOUGIES, PESSARIES.

Suppositories are solid medicated substances, usually of a conical form, designed for introduction into the passages of the body, there to be absorbed.

Bougies.—This term *bougies* (bōō-zhē) is properly employed to designate solid and insoluble or non-absorbable bodies intended to be introduced into passages for the purpose of dilation. These are composed of silver, steel, wax, rubber, gum, etc., and are sometimes smeared with medicinal substances when a medicinal as well as a mechanical action is desired.

The term is often improperly used to designate medicated suppositories of gelatin, wax, cacao butter and wax, etc., for nasal, vaginal, or urethral use.

Pessaries.—In like manner the term *pessarie* properly denotes an instrument introduced into the vagina for the support of the uterus, but is often improperly applied to urethral suppositories.

THIS form of medication may be intended for local diseases or for general absorption. Medicines introduced into the rectum in a proper condition, will produce their characteristic effects upon the system in the same way as when swallowed. Foods are also given in this manner in special cases, as after-surgical operations, or when the stomach is in an irritable or weak condition and is unfitted for the reception of food or medicines. Suppositories are generally employed for local treatment, as in hemorrhoids, or when for any reason, medicines cannot be taken into the stomach. As a rule, medicines act more slowly in this form and slightly larger doses are required than when administered by the mouth.

Strychnine is, however, a notable exception.

ESSENTIALS.—Suppositories should be of firm consistence when cold, should melt at or slightly below the temperature of the body (98° F.), should be non-irritating, and must not become rancid.

The size and shape is governed by the use to which the suppository is to be put. Those designed for the rectum or vagina are usually bullet or cone-shaped, the vaginal suppositories being made about twice as large as the rectal.

Suppositories designed for the urethra or nasal passages are made into slender rolls ¾ inch to 2 inches in length, pointed at one end and weighing from 10 to 15 grains.

Suppositories for the aural cavities are a compromise between the two forms, or are cartridge-shaped and weigh 5 to 10 grains.

Suppositories were first introduced into the U. S. Pharmacopœia in 1870.

The present (1890) Pharmacopœia requires that rectal suppositories shall be cone-shaped and weigh about 1 gramme, urethral suppositories pencil-shaped and weigh about 1 gramme, and vaginal suppositories globular and weigh about 3 grammes.

BASES.—*Cacao Butter** (*Oleum Theobromatis*) is probably the best general base for suppositories, and should be used for prescriptions unless another base is designated.

This is hard and wax-like at ordinary temperatures, but melts at 86° to 91° F., can be readily incorporated with small portions of aqueous substances, or with oils, etc., and does not become rancid.

When mixed with volatile oils, chloral, creosote, etc., the melting-point is lowered to a considerable extent. This may be corrected by adding spermaceti or wax, the former being preferable. If needed, equal parts of spermaceti and cacao butter may be used.

Spermaceti is sometimes added to those which are designed to absorb very slowly, as in hemorrhoids, etc., in order to bring the melting point of the suppository to as near the temperature of the body as possible. A mixture of 5 parts of cacao butter and 1 part of spermaceti melts at 98° F.

Wax or paraffin raises the melting point higher.

Lard should not be used in suppositories, because of its tendency to become rancid.

Lanoline is a useful adjunct to suppositories containing large amounts of extracts or aqueous fluids. This absorbs the liquid better than cacao butter, mixes well with the latter, and affects the fusing point but little. Lanoline is also more readily absorbed.

Hollow suppositories of cacao butter were introduced into pharmacy some years ago.

These come in the various forms and sizes and resemble the ordinary moulded suppository, but consist only of a thick shell of cacao butter, with an opening at the top for the introduction of the medicinal matter. A cap or plug of cacao butter, slightly warmed just before inserting to soften its surface, serves to seal the suppository after the medicaments have been placed inside. These are intended to be used in place of the usual forms, but have not proved acceptable for several reasons. The labor of mixing, dividing, and inserting the medicinal matter, particularly when extracts are used, is often as great as that involved in making a corresponding suppository entire, either by hot or cold process; no medicinal effect can be produced until the suppository has entirely melted, and then the condition of the medicament may not be the best for absorption, and the appearance of the suppository offers no clew to the nature, condition, or strength of its contents.

Soap is sometimes used as a base for suppositories, particularly when a laxative action is desired. Soap cones, made from ordinary castile soap, are used to produce evacuation of the bowels, which it causes by a slight irritant action.

* Cacao butter or cocoa butter (the first term is preferable) is a concrete oil obtained from the seeds of *theobroma cacao*, or chocolate plant.

It is separated from chocolate by heavy pressure between heated plates, and commercially is a by-product of the manufacture of cocoa for drinking or flavoring purposes.

It should not be confounded with cocoanut butter, a semi-solid oil obtained from cocoanuts (*cocos nucifera*), which is not firm enough to use for making suppositories.

The British Pharmacopæia uses a mixture of curd-soap (a soap made with soda and a purified animal fat) and glycerite of starch, stiffened, if necessary, with a little powdered starch, for its carbolic acid suppositories, morphine suppositories with soap, and tannic acid suppositories with soap.

These are made by the cold process, shaping the suppositories by hand.

The glycerin suppositories of the U. S. Pharmacopœia have a similar soap base, but without the starch.

It should be remembered that, in making suppositories with a soap base, soap is incompatible with metallic salts, forming an insoluble metallic soap, and hence is unsuitable for such. Soap also affords a good medium for incorporating aqueous fluids with cacao butter.

Gelatin.—This does not make a good general base, because the proportions of gelatin must be varied with different medicants, owing to the liquefying properties of many bodies upon gelatin.

The following have recently been recommended. Hard glycerin-gelatin: Cover 25 grammes of gelatin with 70 Cc. of water, allow to stand until the gelatin is softened, add 50 grammes of glycerin, and heat on a water-bath until the whole is reduced to 100 grammes.

Soft glycerin-gelatin is made in the same way, using 15 grammes of gelatin, 45 Cc. of water and 50 grammes of glycerin, the whole being reduced to 100 grammes.

The first are used with oils or other liquid medicants, the second with solids.

Glycerin suppositories containing 75 or 80 per cent. of glycerin may be made with gelatin in the same manner as the above.

Gelatin suppositories are useful in cases where fats are objectionable, but are not as agreeable to the patient as suppositories made with cacao butter. The gelatin has a rubber-like feel, and clings to the surfaces unless wet with water immediately before inserting; moreover, it is less quickly absorbed.

They should be kept in a *dry* and *cool* place, since they are hygroscopic, and will melt if moistened.

Tannin and preparations containing it, also metallic salts, are incompatible with gelatin, and should not be incorporated in gelatin suppositories.

Other Bases.—The three bases mentioned—cacao butter, glycerin-gelatin and soap—have been found satisfactory in all cases thus far, and there seems to be no demand for others. Many mixtures of common fats and waxes, or of new bodies, have been proposed at various times, but the advantages offered are in nearly or quite all cases offset by corresponding disadvantages, and they have attracted only a momentary attention. Probably the above three bases will continue to be used almost exclusively for many years to come, and the following which have been proposed are mentioned merely as interesting substitutes.

Equal parts of oleic and stearic acids give a mixture for which the following advantages were claimed by Mr. Martindale: It melts at the temperature of the body, shrinks upon cooling, and the suppositories are thus easily removed from the moulds; the suppositories are very firm, and the proportions may be varied to suit varying conditions of temperature, ingredients, etc. It also is an excellent solvent for alkaloids, and is readily absorbed.

This is probably the best substitute for cacao butter that has yet been proposed.

Cocoanut stearin, stiffened with a small proportion of wax, is stated to make a less expensive base than cacao butter. It has a tendency to become rancid, which is objectionable.

A mixture of anhydrous lanolin and stearin is claimed to make an excellent base, which is permanent and more easily absorbed than cacao butter.

MOULDS are of various kinds, the most common being of brass, nickled iron or white-metal.

Those which separate longitudinally are easier to use, rendering the ejection of the suppository much easier.

Two sizes are needed; one for rectal suppositories and one for vaginal. A pessary or urethral mould is also desirable.

All moulds should be standardized, or the amount of base metal which they will hold ascertained as soon as received.

They are usually designated as 15-grains, 20-grains, 30-, 45-, 60-, 120-grains, etc., but the amounts which they will actually hold will commonly vary a little from these figures. The beauty and value of the suppository demands that the moulds be well filled, and that none of the mass containing a part of the medicinal agents be wasted, hence the capacity of the mould should be accurately known.

It is more convenient to know the volume-capacity of the moulds, since this will be the same for all bases.

This is quickly ascertained by over-filling the moulds with cacao butter, allowing this to solidify, and after removing all excess of butter remelting the suppositories so obtained. The liquid fat is now measured in a graduate or test-tube which is thereafter kept for that use. Rectal moulds commonly hold five or six drachms of melted cacao butter per dozen suppositories, and vaginal moulds two or three times these quantities.

When a new base or a mixture of bases is used, the quantity necessary for filling the moulds is readily obtained by measure.

Metallic moulds should be kept clean and dry. If allowed to become rusty the surface is roughened and the appearance of the suppository is marred, as well as the difficulty in ejecting it from the mould increased.

Extemporaneous moulds may be made by rolling waxed paper or tin-foil upon a wooden form and then sticking into wet sand. Upon withdrawing the form the paper mould is left in the sand ready for use.

Plaster-of-Paris moulds are made by preparing a thick cream of plaster-of-Paris with water, which is then poured into a suitable box or frame, and suppositories of wax inserted until the plaster hardens.

The wax suppositories are then removed, the edges of the mould smoothed, and the mould rendered less absorbent by boiling for a short time in linseed oil.

Suppository machines or compressors are in common use at present. In these the cold mixture of base and medicaments is placed in a strong cylinder or hopper, and forced by pressure, applied by means of a screw, into the moulds. These make smooth, hard suppositories, and are especially useful in making large quantities.

More care is required in mixing the mass than when the mass is melted and poured into chilled moulds.

THE MANUFACTURE OF SUPPOSITORIES is accomplished by three processes, viz., the hot process, the cold process, and by means of a suppository machine or compressor.

In making them by the hot process sufficient cacao butter is first weighed out to just fill the moulds, and about two-thirds of it placed over a water-bath in a capsule or cassarole. While this is heating the medicinal ingredients are weighed out and prepared for incorporating with the remainder of the cacao butter.

Powders or salts should be rubbed to an impalpable powder, taking special care that no grit or small lumps are allowed to remain, then mixed thoroughly with the cacao butter which has been reserved.

Extracts should be first softened and rendered semi-liquid by means of a little water or diluted alcohol, then incorporated with the reserved cacao butter.

In the meantime the cacao butter which was placed in the capsule has melted, and the capsule containing it should be removed from the heat, and its contents allowed to cool to 95° F., or lower, then the medicated butter, now rendered soft by friction, is added to that in the capsule, where a little stirring with a spatula or glass-rod will render the whole liquid and homogeneous.

The fluid is now poured into the chilled moulds and the moulds allowed to remain on the ice until the suppositories have hardened.

The temperature at which the mixture is poured into the moulds is the critical point with most suppositories. If too hot, insoluble salts will settle at the apex of the suppositories before the mass stiffens sufficiently to hold them in suspension. Extracts, particularly extracts of belladonna, stramonium and hyoscyamus, are precipitated in granular condition by the least excess of heat and cannot again be reincorporated, while volatile bodies, alkaloids, etc., may be driven out or decomposed by the heat. The mass shrinks on cooling, and if poured while hot, a depression forms at the top of the suppository, which is unsightly.

Moreover, the suppositories are more easily removed from the moulds and consequently less liable to break if the mass has begun to thicken before being poured.

A little practice will enable one to judge of the proper temperature of the melted butter without the use of a thermometer.

The capsule will not feel warm to the hand, and the butter will show signs of thickening. If the medicinal agents and the cold cacao butter be triturated vigorously just before it is added to the melted butter, it will become softened by the friction and liquefy the more readily.

Should a little additional heat be necessary it must be applied cautiously.

A momentary application to the water-bath, then a brief stirring with a glass rod, and the process repeated if needed, will suffice and will avoid overheating.

It should be remembered that in the melting of any solid body latent heat must be absorbed, and if done rapidly the portion first melted will become heated far beyond its critical point before the last portions of the solid become liquefied, hence the necessity of first melting a portion of the cacao butter and allowing this to cool before adding the medicinal agents.

The Pharmacopœia allows the sprinkling of the moulds with lycopodium.

This is usually not necessary if the moulds be well chilled before pouring in the mass.

Some prefer to use a little fixed oil or vaseline rather than lycopodium, while soap-liniment is a favorite with others.

The latter should never be used for suppositories containing metallic salts, lest a reaction occur between the soap and the salt. An alcoholic solution of castor oil is a good substitute in these cases.

Still another way of preventing sticking is to line the moulds with tin-foil or waxed paper.

The mould of urethral suppositories is often troublesome. If the moulds are well-chilled the mass will often congeal before reaching the bottom of the mould, leaving a portion unfilled.

The better way is to pour the mass into the moulds before chilling, then chill thoroughly and after the mass has congealed, remove from the ice and allow to stand until the mould has acquired the temperature of the room again.

This is necessary because in chilling the metal of the mould contracts more than the cacao butter, and grips the suppository tightly when very cold. Upon allowing the mould to warm in the air the metal expands and allows the suppository to slip out.

Extemporaneous urethral moulds are best formed of the foil or waxed paper.

A glass tube rounded at the end, and not entirely closed, makes an excellent form. The suppositories should be made 2 to 2½ inches long and ⅛ to ¼ inch in diameter. The waxed paper or foil having been wrapped smoothly around the glass tube, the tube is then gently withdrawn, the air-vent in the end allowing of its easy removal, and the shell makes an excellent mould. It will be found difficult to remove the shell from a pencil if substituted for the glass tube, owing to suction of the air.

In the absence of ice the moulds may be chilled by spraying ether upon their surface from an atomizer. The rapid evaporation of the ether quickly chills the metal as effectually as when ice is used. Only a little ether is needed. Carbon bisulphide, benzine, chloroform and other easily volatilized liquids can be used in the same way.

Another method is to cool the mould in a "freezing mixture," obtained by quick solution of a salt in water.

The mould is three-quarters submerged in water in a suitable vessel, then a definite proportion of some quickly-dissolving salt is stirred in, which lowers the temperature of the water as it passes into solution and thus chills the mould. If the suppositories do not harden readily two such treatments may be necessary, one for the preliminary chilling and one after the moulds have been filled. In many cases the salt may be divided, and one portion used for the first chilling, while the other is reserved for use in the second. The solution may afterward be evaporated and the salt recovered for subsequent use.

The following table gives a list of salts most suitable for this purpose, and the proportions by which the lowest temperature is obtained.

	Lowers the temperature.
Ammonium nitrate 1 part, water 1 part	27° C.
Ammonium chloride 1 part, potassium nitrate 1 part, water 1 part	35° C.
Potassium sulphocyanide 5 parts, water 4 parts . . .	33° C.
Glauber's salt 8 parts, hydrochloric acid 5 parts . . .	27° C.
Sodium phosphate 9 parts, diluted nitric acid 4 parts . .	39° C.

The salts should be finely powdered, used in just the above proportions and quickly stirred, in order to obtain the above results. The limit of temperature depends upon the degree started with and the limit of solubility.

The cold process is preferred by many, being more sure of success, and often more quickly finished, even on a large scale. For this method the entire amount of cacao butter should be grated or shaved off, and then mixed with the medicinal ingredients in the same way that a pill-mass is worked.

A little oil of sweet almonds or glycerin is worked in, about a drop to each suppository, to render the mass more cohesive. After working the mass in a mortar until it has become homogeneous and plastic (taking care that no particles of cacao butter show in the mass), it is taken out and worked in the hands or on a pill-tile until formed into a cylinder. It is then cut into the required number of pieces, and each piece formed into a conical (or otherwise) suppository, by means of the fingers and a broad spatula.

Practice is required in this method in order to work rapidly, and make smooth and even suppositories, but the skill is easily acquired and the process gives satisfaction.

If the mass begins to break, its plasticity may be restored by working thoroughly in the hands. On the other hand, if handled too much the mass begins to melt.

In warm weather or in a warm room it may be necessary to cool the hands from time to time by immersing them for a moment in ice water and wiping quickly.

The pill-tile should be kept well dusted with lycopodium or starch while working the mass upon it. Starch is to be preferred in most cases.

When a compressing machine is used, the mass is made in the same manner, then placed in the cylinder and forced into the moulds. Suppositories made in this way look much like those made by the hot process.

The machine and moulds should be thoroughly cleaned after each mass, or succeeding lots may appear streaked.

Coating Suppositories. — Suppositories containing hygroscopic substances, as glycerin or very volatile bodies, are sometimes protected by coating or wrapping them.

Flexible collodion, paraffin, and wax are used as coatings. The suppositories are impaled upon needles and dipped quickly into the collodion or melted wax, then set aside until the coating has hardened.

These are good protective agents, but have been objected to because patients frequently neglect to remove the coating before inserting the suppository, and it does not melt or absorb, as intended. When dispensed with coatings, plain directions for the removal of the films should be affixed to the container and verbal instructions also given to the patient.

Similar protection is afforded by wrapping the suppository in tin-foil or paraffin paper. It is generally preferred, however, to dispense such as need to be protected from the air in tightly-stoppered bottles or in glass tubes containing only one or two suppositories.

Dispensing.—Suppositories should be sent out in tight boxes lined with impervious paper. Special compartment boxes are employed in many cases, so that the suppositories do not come in contact with each other. These are to be preferred; but plain, well-lined boxes may be employed in most cases, the suppositories being wrapped in waxed paper or tin-foil. If the suppositories are soft, a little starch or lycopodium should be sprinkled upon them. In all cases a label upon the box directing its storage in a cool place is almost a necessity.

SUPPOSITORIES.

240

℞. Glycerin . . . . 60 Gm.
Sodium carbonate . . . . . 3 Gm.
Stearic acid . . . . 5 Gm.
M. S. A. Make ten rectal suppositories. Sig.—Glycerin suppositories, U. S. P.

Dissolve the sodium carbonate in the glycerin in a capsule on a water-bath; then add the stearic acid, and heat carefully until this is dissolved and the escape of carbonic acid gas has ceased. Then pour the melted mass into suitable moulds, remove the suppositories when they are cold, and wrap each in tin-foil. These suppositories should be freshly prepared when required.

Make one-third the quantity and pour into vaginal moulds.

241

℞. Acidi stearic 0.250
Sodii carbonat. 0.250
Glycerini 9.500
M. Ft. supposit. No. v. Sig.—Transparent glycerin suppositories, 95 per cent.

242

℞. Suppositoria Glycerini (Ph. Br.)
Gelatin . . . . 2 Gm.
Glycerin . . . . 10 Gm.
Distilled water . . . . . . q. s.
Make six rectal suppositories.

Place the gelatin in a weighed evaporating dish with sufficient water to cover it, allow it to stand a minute or two, then pour off the excess of water; set aside until the gelatin is quite soft, then add the glycerin. Heat on a water bath until the gelatin is dissolved and the mixture has been reduced by evaporation to 13 grammes, and pour into moulds.

243.

℞. Camphoræ 2.00
Olei Theobromat. . . . . . . q. s.
M. Ft. supposit. vi No. pro recto.
Sig.—" Camphor suppositories."

Dissolve the camphor in the melted butter and pour the solution into the moulds.

244.

℞. Iodoformi . . . . gr. vi
Acid Tannici . . . . gr. xij
M. Ft. supposit. pro recto vj No.
Sig.—" Iodoform and Tannin suppositories."
(Caution: Avoid overheating these.)

245.

℞. Mitte Suppositoriæ Iodoformi pro recto āā gr. ij No. vj.
Make by two methods.

246.

℞. Plumbi Acetat. 1.20
Pulv. Opii 0.40
Olei Theobromatis . . . . . . q. s.
M. Ft. supposit. pro recto vi No.
Sig.—"Lead and Opium Suppositories."

247.

℞. Chloralis 2.00
Olei Theobromatis . . . . . . q. s.
M. Ft. suppos. pro recto vi No.
Sig.—"Chloral Suppositories."

For cold process, powder the chloral, incorporate with cacao butter and form into suppositories.

For hot process, melt 2.5 Gm. spermaceti. Mix with 4 Gm. of warm cacao butter, dissolve the chloral in the warm (not hot) mixture, add enough cacao butter to make up to the full volume of the moulds (ʒ iiss), mix well and pour into the chilled moulds.

248.

℞. Extracti Belladonnæ 097
Morphinæ Sulphatis 097
Olei Theobromatis . . . . . . q. s.
M. Fiant suppositoriæ pro recto vi No.
Sig.—Morphine and Belladonnæ.

249.

℞. Extracti Belladonnæ 187
Morphinæ Sulphatis 130
Olei Theobromatis. . . . . . q. s.
ut. fiant suppositoriæ pro vagina sex numero.
Sig.—Morphine and Belladonna.

Make by mould and by hand.

250.

℞. Unguent. Hydrarg. 2.0
Olei Theobromatis . . . . . . q. s.
M. Ft. supposit. vi No.

Mix the ointment thoroughly with the melted butter and pour into well-chilled moulds.

251.

℞. Ext. Carnis . . . . ʒ i.
Pepsini . . . . ʒ ss.
Pancreatini . . . . ʒ ss.
M. Fiat suppos. vj. No. Sig.—Nutrient suppositoıies.

252.

℞. Paraldehyd. . . . . ʒ iij
Ol. Theobromat. . . . . q. s.
M. Fiant suppositoriæ pro recto vi. No.
Sig.—Use when needed.

Add half a drachm of paraffin and q. s. cacao butter. If made by the cold process, melt the paraffin, allow to partially cool, stir in the paraldehyde, allow to solidify, then incorporate with the cacao butter.

253.

℞. Iodoformi 1.000
Olei Eucalypti 0.250
M. Fiant suppositoriæ pro urethra iij. No.

When a prescription calls for a number of suppositories that are liable to give trouble in molding, if the material is not too expensive, it is well to attempt to make more than the number called for in the hope of securing the required number in satisfactory condition at once. In this case attempt double the number, using equal parts of paraffin and cacao butter as a base.

254.

℞. Acidi Tannici 187
Acidi Carbolici 187
Olei Theobromatis . . . . . q. s.
M. Ft. suppositoriæ pro urethra No. iij.

Use cacao butter for hand method, and one-third paraffin for hot process.

255.

℞. Camphoræ . . . . gr. viij
Chloralis . . . . gr. viij
Cetacei . . . . ʒss
Olei Theobromatis . . . . . gr. xv
M. Sig.—Headache discs.

256.

℞. Iodoformi . . . . gr. xx
Bismuthi Subnit. . . . . gr. xx
Ol. Theobromatis . . . . . q. s.
M. Ft. suppos. vj. No. Sig.—Use one 3 times daily as directed.

CHAPTER XI.

OINTMENTS, CERATES, PLASTERS.

Ointment (Lat., *Unguentum-i*).—A fatty preparation of such a consistency as to be easily applied to the skin by inunction, gradually liquefying when in contact with it. (Cent. Dict.)

Cerate (Lat., *Ceratum-i*).—A fatty preparation resembling an ointment, but having a firmer consistency and a higher melting-point. True cerates always contain wax (Cera).

Salve.—An ointment or cerate to be applied to wounds or sores.

Unguent.—A term applied mostly to perfumed salves or ointments used for anointing or for toilet purposes.

Plaster (Lat., *Emplastrum-i*).—A solid compound intended for external application, adhesive at the temperature of the human body, and requiring to be softened by heat before being spread. (Cent. Dict.)

Pomade (Lat., *Pomatum-i*).—A fat saturated with the odorous principles of plants by enfleurage; or a perfumed ointment or cerate used for the scalp and in dressing the hair.

THESE differ chiefly in their consistence and melting-points, the ointments being soft unctuous solids, which should partially melt when applied to the skin, the cerates stiffer, and having a slightly higher melting-point, and the plasters have just enough pliability to adhere to the skin, and offer a slight mechanical support and protection, as well as a medicative action through the absorption of medicinal matters contained therein.

They, with the true liniments, afford a gradation from the fluid oil-bases to the stiff waxy or resinous bases, any desired consistency and melting-point being obtained by mixtures of the oils, soft fats, waxes, and resins. They are all designed to produce an effect through the absorption of medicinal ingredients, in which they differ from the plasmas, which are designed for purely external or surface effects, medicinal matter not being absorbed from them to any extent.

Constitutional effects are often produced by the thorough rubbing-in of liniments or ointments, applied usually to the axillæ or groin, where the medicinal matters are more quickly absorbed.

Mercurials, narcotics, etc., can be made to produce their effects upon the system in this way, just as thoroughly as when taken by the mouth.

OINTMENTS AND CERATES.—The usual bases for these are lard, lard and wax, petrolatum and wool-fat. Oils stiffened with wax or paraffin have been used, but possess no special advantages, and are rarely ordered. Frequently the medicated jellies or glyco-gelatins are termed ointments. These are treated in the chapter on Plasmas.

The three principal bases, lard, or lard and wax, petrolatum and wool-fat, differ widely in character, both medicinally and pharmaceutically.

Each has the property of absorbing or emulsifying small quantities of water, but in different degrees, and they also vary in their absorbability and the promotion of medicinal action.

Lard (Lat., Adeps, Gen. Adipis) is the prepared internal fat of the abdomen of Sus Scrofa, or hog, purified by washing with water, melting and straining. Much of the lard of commerce is not the abdominal fat, but the fat of the entire body of the hog, and differs from the official product in melting-point and odor.

The abdominal lard, which should be used exclusively in pharmacy, is sold under the name of "pure leaf lard." This is sufficiently pure for making ointments, etc., but care should be taken that it does not contain salt or any excess of water.

When exposed to the air, lard soon begins to decompose and become "rancid." This gives it a strong and disagreeable odor, renders it incompatible with some chemicals, and causes an irritation when it is applied to the skin.

The tendency to become rancid is promoted by moisture and heat, so to guard against this the lard, and ointments containing it, should be stored in a dry and cool place. To still further preserve it, the Pharmacopœia directs it to be saturated with benzoin, the volatile and antiseptic principles of which are soluble in the melted fat, and these retard change.

The best lard for pharmaceutical purposes is prepared directly from the leaf or flare.

Mr. A. W. Gerard gives the following directions for preparing a superior article: "Cut and bruise 100 parts of fresh leaf (deprived of its outer membrane) and heat in a deep vessel at 55°C. until the fat has melted and separated from its tissues. Add to the melted fat 6 parts of crushed benzoin, and continue the heat and stirring for twenty minutes. Finally strain and gently press through flannel." If the leaf is bloody or otherwise dirty it should be washed and dried as thoroughly as possible before heating.

By trying out and benzoating the lard in one operation freshness and sweetness is assured, and the ill-effects of a double heating avoided. A finely fragrant base is obtained by the above process, which is devoid of irritating properties and keeps well. Moreover, it demands little if any more labor than the official method of benzoinating a prepared lard.

The official method of benzoinating is to suspend the benzoin, coarsely powdered, and tied in a muslin bag, in the top of the melted fat, and allow the hot fat to act upon it for two hours. It is more satisfactory to first mix the benzoin with an equal bulk of clean sand, thereby preventing its lumping together in the lard.

Several quick methods of benzoinating have been proposed, as the incorporating of a concentrated alcoholic or ethereal tincture, or an oily solution, made by dissolving two ounces of benzoin in four ounces of ether and evaporating the filtered solution in an ounce of castor oil, which may then be incorporated with the lard or with extemporaneous ointments, but none of these are as satisfactory as the official process.

When lard is incorporated with beeswax or resin, these act as preservatives, and benzoinating is unnecessary, hence in three cerates and three ointments the Pharmacopœia directs plain lard to be used; benzoinated lard in all others. One per cent. of resin is stated to be quite effective as a preserving agent. An easy test for rancidity is to make an ointment of potassium iodide without any hyposulphite of soda. If the lard is at all rancid, the ointment will become discolored in a short time.

Lard possesses the property of absorbing or emulsifying quite a proportion of water, 100 parts of lard, when cold, emulsifying 15 parts of water, and 100 parts of benzoinated lard taking up 17 parts of water, no other agent being necessary.

This is a valuable property from a pharmaceutical standpoint, since it permits of the incorporation of soft extracts or aqueous solutions of salts. Lard also yields up for absorption the medicinal agents which have been incorporated with it very readily, and is therefore oftentimes preferred when a prompt and strong action is desired. These two valuable properties suffice to hold it in the first rank among the bases, in spite of its objectionable tendency toward rancidity.

The mixtures of lard and water are subject to the usual incompatibilities of emulsions, and it is rarely possible to incorporate as much of a saturated salt solution as of pure water. The range is wide enough for most purposes, however, and evaporation usually aids in incorporating troublesome fluids.

Petrolatum is the most unchangeable of the bases, being unacted upon by air, moisture or chemicals. When of a good quality, it is inactive in itself, but the commercial grades frequently contain some acid, used in purifying and bleaching, and, owing to this, are irritating.

It may be obtained of almost any consistence and fusing point—from the liquid petrolatum to the hard paraffin wax, melting at 45° to 65° C.

These are all similar in nature and composition, being derived from petroleum or "rock oil." They are useful as solvents, but do not mix well with aqueous fluids.

One hundred parts of petrolatum will absorb about four parts of water.

It does not yield up for absorption medicinal agents very readily, and is hence adapted for ointments which are designed to produce a slow and continuous action.

It is almost the opposite of lard, being permanent under all conditions, taking up but little aqueous or alcoholic fluid, and retarding medicinal action.

The most troublesome feature in the use of petrolatum pharmaceutically is the difficulty of combining aqueous fluids with it. Thus it is unsuited for the preparation of such ointments as potassium iodide, etc. Many plans for overcoming this have been proposed, the best of which is the addition of castor oil. Petrolatum containing 5 per cent. of castor oil will absorb (or emulsify) 2½ times as much water as pure petrolatum, or 100 parts of 95 per cent. petrolatum will take up 10 parts of water.

The rule has been formulated to add to the petrolatum 2 drops of castor oil for each gram of aqueous fluid to be added.

Wool-fat, in different proportions, may also be used.

Wool-fat (adeps lanæ) is the purified fat of the wool of sheep, usually containing about 30 per cent. of water. It is not a pure fat, but a mixture of several fats with cholesterin, the latter being a solid alcohol, chemically considered.

It is known in commerce as lanoline, being obtained mostly from one source.

It is a tough, unctuous solid, not as easily worked as other fats, but capable of dissolving or emulsifying an equal weight or more of water, and it does not easily become rancid. If exposed freely to the action of light, air and moisture, after several months it begins to decompose; but under ordinary conditions it will keep for a long time without a trace of rancidity. It is stated to be aseptic.

It is very quickly and freely absorbed by the skin, being very similar in character and composition to the fatty matter secreted by the sebaceous glands of the human body.

It affords a very useful vehicle for incorporating large proportions of liquids in ointments, suppositories, etc., but is not a good vehicle for the incorporation of insoluble powders or bulky solids.

Its stickiness is also objectionable.

This stickiness is partly overcome by the addition of a small proportion of petrolatum. A mixture which has been proposed as particularly free from stickiness is: anhydrous lanoline, 65 parts; liquid petrolatum, 30 parts; ceresin (vegetable wax), 5 parts; water, 30 parts. The resin is melted and stirred into the liquid petrolatum, then this mixture is added to the anhydrous lanoline, and finally, the water is incorporated.

Commercial lanoline contains about 30 parts of water, which may be removed by evaporation, if desired.

Other ingredients which are commonly associated with the preceding as diluents or stiffening agents are:

Beeswax (Cera), either bleached or unbleached. The latter is a better preservative and is purer. White wax always contains a little foreign fat, and these are frequently rancid and cause the lard in ointments to become rancid also. Beeswax melts at 63° to 66° C.

Suet (Sevum), the abdominal fat of the sheep purified in the same manner as lard. This is much firmer than lard, and does not become rancid as easily. Suet melts at 44° to 50° C.

Spermaceti (Cetaceum) is a crystalline wax-like substance, obtained from the head of the sperm whale. It becomes yellowish and rancid on exposure to air. It melts at or near 50° C.

Resin or Colophony (Resina), also called "rosin," is a sticky solid obtained as a residue from the distillation of oil of turpentine.

Its melting point varies, usually above 100° C.

Paraffin or waxy petrolatum, white, hard, and melting at 45° to 65° C.

Besides these, other fats are sometimes called for in domestic practice which are supposed to possess peculiar virtues. Goose-grease is readily absorbed and popular for inunction.

Mixed with one-sixth its weight of cacao butter it makes a firm base.

Skunk oil, bear's grease, porpoise oil, rabbit fat, rattlesnake oil, and many others of similar character are superstitiously regarded. Probably all of these are grossly adulterated or sophisticated.

Starch is used to stiffen ointments and make them more salve-like without raising the fusing-point. It is employed mostly in ointments having petrolatum for a base and insoluble powders as the active medicament, as zinc oxide. It also promotes a closer adherence of these to the skin.

Superfatted soaps (*i. e.*, soaps containing an excess of oil or fat) have been proposed as bases, the advantages being their freedom from rancidity and from irritating properties, good keeping qualities, ready admixture with medicinal matter, and easy removal from the skin by warm or cold water. The following illustrates them:

Mollin is the name applied to a base prepared by saponifying, without heat, 100 parts of cocoanut oil or of fresh fat with 40 parts of a 15 per cent. solution of caustic potassa, mixing intimately with 30 parts of glycerin and heating carefully. This makes a yellowish, smooth and soft base.

Sapo unguinosus or *Sapo leniens* is prepared by converting 100 parts of pure potassium carbonate into caustic potash, with 60–80 parts of quicklime, the solution being concentrated to sp. gr. 1.180; 400 parts of lard are added, the mixture stirred for half an hour, 40 parts of alcohol added, and the whole digested 12 hours in a covered vessel at 50°–60° C.; then 150 parts of glycerin added.

These bases are suited as vehicles for organic bodies, as balsam of Peru, phenols, sulphur, salicylic acid, etc., but are incompatible with metallic salts and oxides.

A mixture of doegling oil with wax has been proposed. This oil does not easily become rancid, and is readily absorbed by the skin. In order to make such a base miscible with aqueous fluids, soap may also be incorporated.

Under the name of "*myronin*," such a base is prepared by mixing sufficient carnauba wax with doegling oil to give an ointment-like consistence; then incorporating 10 or 20 per cent. of stearine soap (stearate of potassium).

Unguentum Caseini.—Dr. Unna, the originator of this new ointment-base, gives the following directions for its preparation: Take milk from which the cream or fat has been entirely removed, and curdle it by the addition of rennet at a temperature of 30° to 40° C. Assemble the coagulum and wash with running water until the washings no longer show an acid reaction; dry carefully and reduce to powder. Dissolve 34.5 parts of caustic potassa and 8.5 parts of caustic soda in 5,000 parts of water, and dissolve 1,400 parts of casein in this solution. Now add 700 parts of glycerin and 50 parts of carbolic acid, and, when these are dissolved, incorporate 2,100 parts of vaselin and 50 parts of zinc oxide, and finally add enough water to make 10,000 parts. Thus prepared, casein ointment presents a perfectly homogeneous, semi-liquid, durable emulsion, which is, in fact, a sort of thick and artificial milk, the vaseline being in a condition of the minutest subdivision. It forms a soft and pliable film upon the skin, and is free from greasiness. Acids and acid salts are incompatible with it, coagulating the casein and causing separation of the base; but medicaments with only a slightly acid reaction which can be emulsionized, as tar, balsams, etc., can be incorporated to the extent of 20 per cent. Alkalies and alkaline salts, ichthyol, etc., thicken the base and the addition of more water becomes necessary. Metallic mercury can be incorporated to the extent of 33 per cent. Powdered substances may be first rubbed up with a little vaseline and then incorporated with the base.

Oleates and Stearates.—The oleates are often employed in ointments in preference to powdered chemicals, as they are more readily absorbed. Some of these are adapted to extemporaneous preparation, and merit mention here.

The true oleates are salts prepared with oleic acid, but all of the official oleates contain an excess of oleic acid, being prepared by dissolving the alkaloid or metallic oxide in the acid.

This is the method always chosen for making oleates of the alkaloids, and but little time is required. Oleic acid varies much in quality as found in the market, and it is desirable that only the purest should be used in preparing these, to avoid irritating qualities.

A light-colored acid is selected by preference, but purity and freedom from rancidity should be the prime requisites.

The free alkaloids (not the salts) are readily soluble in this. Solution is hastened by heat, but the oleate so made does not keep as well. The usual strength is 2 per cent. of alkaloid, except morphine 5 per cent. and quinine 25 per cent.

None keep well, and should be made fresh.

The metallic oleates may be prepared in the same manner by dissolving the oxide in the acid, making a 10 per cent. or 20 per cent. solution. Heat also favors the solubility, but hastens decomposition.

It is preferable to make these by double decomposition with a specially prepared sodium or potassium oleate. On adding a soluble metallic salt to this, the corresponding oleate is precipitated as a soft unctuous mass, which is then washed and dried. These keep much better than when an excess of acid is present, and may be diluted to any strength desired.

If made with stearic acid instead of oleic, a fine powder is obtained instead of an unctuous mass.

Castile soap is sometimes used in place of sodium oleate, and an oleopalmitate is precipitated instead of a pure oleate.

Such are firmer than the true oleates, and may be stiff and plastic-like, as lead plaster, or pulverulent, as the commercial "oleate of zinc," so-called. Both of these may be made in this way.

The advantage of the oleates is that they are more readily absorbed, and a stronger as well as a quicker action may be secured in some cases.

PREPARATION OF OINTMENTS.—Ointments are prepared by two general methods,—mechanical mixing of the ingredients, or by fusion.

The first method is used when soft fats are mixed with insoluble bodies, the second method when waxes, resins, etc., are to be mixed with soft fats, or when medicinal ingredients are to be incorporated which are soluble in the warm fats.

Mechanical incorporation may be performed by trituration in a mortar, or on a glass slab by means of a broad and stiff spatula. The latter method is generally the better, except when a considerable amount of liquid is incorporated. It has this advantage, that lumpy particles are easier pressed out. Ointments are also more easily and thoroughly transferred from a slab than from a mortar and pestle. A glass slab is to be preferred, because it is non-absorptive and readily cleansed. Two of these are convenient, the under sides being painted respectively black and white, then light-colored ointments are made over the dark back-ground, and dark-colored ointments over the light, the condition of the mixture being in this way easily watched. A steel spatula or putty-knife may be used in most cases when water is not present, since reactions of salts do not occur readily through the medium of fats.

It should not be used with citrine ointment, however, as this contains some nitric acid, nor with other mercury salts, tannin, etc., when water is present.

Mortars are preferred when much liquid is to be incorporated, or sometimes when a very hard ointment or cerate is to be mixed with a soft one. In such cases the hard or stiff ointment should be first triturated with a small quantity (one-half to an equal bulk) of the soft body until thoroughly admixed, then the remainder is added and incorporated. During the first mixing the hard fats will become somewhat softened by the triturations and the mixing is easier. If this is not done, lumps are formed in the mixture which are difficult to eradicate.

The same method should be followed when the mixing is performed on a slab.

Relatively large quantities of liquids are best incorporated by adding them gradually to the fatty base, with constant trituration, as in making emulsions. These should not be triturated very rapidly, however, since the colder and stiffer the base, the better it can hold the fluid. Such ointments are usually white and creamy, and more prone to spoil.

Glycerin and oils mix more readily in a warm mortar.

Extracts should always be softened before adding to fats or oils;

aqueous extracts with water and alcoholic extracts with diluted alcohol. Alcohol is less readily incorporated than water.

Powders which are insoluble in the fats or only slightly soluble in water must be first thoroughly incorporated with about an equal bulk of the base before the remainder is added. If in large proportion this is best accomplished in a warm mortar, even warm enough to melt the fat, and the trituration must be continued until the two are well mixed and no lumpy or gritty particles can be discovered. The remainder of the fat can now be very easily incorporated and a smooth ointment results.

The mortar is easily heated by filling with hot water and allowing to stand a few minutes.

Gritty ointments are an abomination to pharmacy, and are often mischievous when applied to a sensitive and sore surface. A pharmacist should never allow an ointment to leave the dispensing counter until it is perfectly smooth and homogeneous, when it will be soothing instead of irritating. This is not always easily accomplished, or rather quickly accomplished, sometimes requiring patience and plenty of muscle, but it is always worth the while. There are now in the market mixtures of zinc oxide with benne oil, made by grinding the two together in a paint-mill, thereby insuring a perfectly smooth though stiff paste.

These may be used in place of the dry powder, but in making small quantities but little time will be saved by their use and the resulting ointment will be softer.

In some of the mercurial ointments, the salt is first rubbed to a fine powder with a little oil, partly for the above reason, and partly because these are liable to be reduced by friction if an attempt is made to powder them finely while dry.

Crystalline salts must first be rubbed to a very fine powder, or in case they are very soluble, as potassium iodide, etc., dissolved in a little hot water, except in case of eye-salves, when any risk of minute crystals, which are liable to form in the hot solution before it can be thoroughly diffused, must be avoided. Minute and sharp crystals are exceedingly irritating, and special pains should be taken to avoid them.

When water is inadmissible for this or other reasons, a few drops of oil may be employed. Eye-salves containing crystalline alkaloids are particularly troublesome in this regard. Water should not be used for dissolving the crystals. The oleates of the alkaloids are better when permitted by the physician, but care should be taken that these are fresh and free from rancidity. In lieu of these the salts should be triturated thoroughly with a little oil or a portion of the base, until rubbed to an impalpable powder.

In preparing large quantities of ointments containing insoluble powders in large proportion, it is often more expeditious to partially incorporate the powder with the melted base, then rub the hot mixture through coarse cloth, taking care that all the powder goes through with the fat. The strained mass should then be well stirred while cooling.

Preparation by fusion.—When wax, stearin, rosin, or other hard fusible bodies are to be incorporated with soft fats, it is necessary to melt both these and the soft fats to get a smooth, homogeneous mixture. Such mixtures have a melting point intermediate between those of its ingredients, and, if the quantities are equal, usually nearer to the lower point than the higher. The fusing point cannot be calculated, but must always be ascertained by experiment.

In mixing these bodies the invariable rule to be followed is to *melt the body having the highest fusing point first, then add that having the next highest.*

Never place the cold ingredients together in a pan or capsule and try to melt all at once, because when this done it is necessary to heat the entire mass to the fusing point of the highest body before all will be melted, and more time and labor are required to secure a smooth fat from this hot liquid. When wax, spermaceti, and stearin are thus mixed with softer fats, it is necessary to stir the warm fluid while cooling to prevent congealing in a granular condition. Do not attempt to chill rapidly while doing this, or the hard fats and waxes are likely to separate, and require re-melting.

The operation is best performed by melting each body very slowly, then the fluid as first obtained will be near its congealing point and begin to solidify in a short time.

It is not necessary to continue stirring until the mixture is hard, but only until a pasty mass is obtained which is just stiff enough to prevent the separation or settling of the hard fats or insoluble powders. If continued beyond this, air is worked into the ointment, and it is more likely to spoil on keeping.

Resin and cacao butter do not have this tendency to separate, and stirring is therefore unnecessary.

It is possible to make wax-ointments also without stirring, but special care and watching are needed to see that the liquid does not get too hot, and little time or labor is saved. If the conditions are just right granulation will not occur, otherwise it will.

When bodies which are soluble in oils are to be incorporated in ointments and cerates, dissolving them in the melted base is often the best method.

Most of such bodies are volatile or injured by heat, and an excess of heat should always be carefully avoided.

The heat is best applied by means of a water-bath, and the fat should not be melted too quickly.

If the fat is not perfectly clear it should be strained before adding the medicinal agent.

When more of the soluble body is to be incorporated than will dissolve in the base, it is preferable to incorporate the whole mechanically.

Chemical changes occur not very frequently in the making of ointments and cerates.

This is illustrated in only one each of the official cerates and ointments.

In ointment of nitrate of mercury, elaidin is formed by the action of nitric acid upon lard-oil, and mercury nitrate by the union of mercury and nitric acid.

This is not within the bounds of extemporaneous pharmacy and a full discussion is out of place here. The official process will give satisfactory results if carefully followed, provided the nitric acid is of *full strength.*

In Goulard's cerate, a reaction takes place between the subacetate of lead and the fats in the camphor cerate, lead soap or plaster being formed. This will not keep well, and should be made fresh each time.

Storing and dispensing.—Comparatively few of the ointments are permanent preparations. Those made of lard or suet tend to become rancid in a short time, and those made with petrolatum separate easily if stored in a slightly warm place.

Many of them change in color by action of light; citrine, chrysarobin, mercurous iodide, iodoform ointments and many others becoming dark, while iodine ointment first darkens, then becomes lighter. Ointments containing extracts of Peru balsam, tar and others separate on standing even if kept cold. Some metallic salts are reduced and some are oxidized, on standing in contact with fats, particularly if water is present.

Cerates are more permanent as a class, but some of these spoil quickly, notably Goulard's cerate.

All such should be made fresh as called for, or only in such quantities as will be quickly disposed of.

Ointments and cerates should always be stored in the coolest and dryest available place. If kept in a warm place, the softening of the base is likely to cause a partial separation of the ointment; heat and moisture also favor chemical changes. When dispensed the patient also should be directed, either by labelling the box to that effect or verbally, to keep it in a cool place.

The best containers are those of amber or opaque glass, both for storing and dispensing. Earthen-ware containers are usually somewhat porous, and if a rancid ointment be once stored in them, they are not easily purified.

Pots with rounded inside surfaces, no sharp corners, are most convenient for removing the ointment for use, and they are also more easily cleaned.

Never mix a new ointment with the remains of an old lot, particularly when made of a base liable to become rancid. The old ointment should be thoroughly removed from the pot before any of the new is inserted. The cleaning can be easily accomplished by rubbing with pine or other soft-wood sawdust, or with soft paper, then washing with caustic potash or ammonia-soap solution. This method is also useful for cleaning utensils with which ointments have been made.

Rather than take the trouble to clean the container each time an ointment is renewed, some prefer to use the cheaper chip boxes made of successive layers of wood veneer.

These are almost impervious, and are cheap enough, so that a new box may be dispensed each time. The turned-wood boxes are practically worthless, as the fat quickly permeates the wood, and they become very disagreeable to handle.

In labelling the boxes the number of the prescription should be placed both on the top and bottom, so that if one label becomes obliterated or lost, the other will suffice for renewal.

Very soft ointments may be daintily despensed in collapsible tubes, such as are used for glycerin jellies, etc.

Avoid putting a hard or stiff ointment into such.

Cerates are sometimes ordered to be spread like a plaster, particularly cantharides cerate. A little heat, sufficient to soften, but not melt the cerate, is admissible in such cases, but *hot* tools should not be used.

PLASTERS.—The making and spreading of plasters is a much less frequent operation now than it was twenty years ago, before the era of the rubber and porous plasters. Plaster-making was then an important part of pharmacy, requiring a skill to acquire which much practice was necessary. At the present time the art is restricted mostly to the preparation and spreading of blistering plasters, and even these are not very frequent. Plasters are still largely used, but the demand is supplied almost entirely by manufacturers who use a rubber and resin basis.

It is questionable if medicines are absorbed from this base as readily as from fats and resins without the rubber, and a number of plasters are still official. The bases of these are medicinally more active than those of ointments and cerates.

Lead plaster, which is essentially lead soap, is one of the most common.

This has a sedative and mildly astringent action. Mixed with soap its action is still milder.

Resin and pitch have a stimulating action and impart adhesiveness.

Wax is used merely to impart firmness and is not often used.

Gum resins and oleoresins are stimulating and also impart adhesiveness.

The purpose of plasters is twofold; to afford protection and mechanical support, and to produce medicinal effects by slow absorption.

For the first reason plasters are always hard and possess little adhesiveness when cold. For convenience of handling they are made into the form of sticks or rolls, which may be protected from the air by wrapping in oiled or paraffined paper.

In only a very few cases are plasters soft enough to be handled conveniently in mass.

Plasters with fatty or soap bases should never be kept already spread, as they become brittle and discolored.

Preparation of Plasters.—Plasters are always made by fusion or solution.

By fusion the process is very similar to the making of cerates, etc. The body having the highest melting point is fused first, then the others are added in order and lastly the medicinal ingredients.

If straining is necessary it should be done before the medicinal matter is added. When these are soluble in the plaster ingredients the mass is kept fluid, at as low a temperature as possible, until the medicinal matter is all dissolved, and thoroughly mixed with the base. Alcoholic extracts are better adapted for plasters than aqueous, for this reason. If the extracts are injured by heat they should be diffused or incorporated as quickly as possible, but with the least heat.

Volatile bodies, as menthol, camphor, etc., are to be treated in the same way.

Insoluble powders, etc., are stirred into the mass while cooling.

The mass should be rolled into sticks while still warm. This is easily done on a glass or porcelain slab by rolling with the hands, or with a flat stick of wood. If the mass contains much resin or pitch, a little vaseline will prevent its sticking to the hands and utensils. Lead plaster does not need this. This should be kneaded thoroughly before rolling to work out the excess of water. If left in the mass the plaster appears whiter, but it oxidizes quicker and does not make as nice a mass when mixed with other bases.

Resinous plasters may sometimes be whitened by pulling and kneading, air being worked into them in this way.

The sticks can be made of any convenient size, usually of a size to fit the can or bottle in which they are to be stored.

Spreading.—Plasters are spread upon skin, silk, cotton cloth or paper.

The large plasters are best spread upon sheep or chamois skin, but cotton cloth will serve nearly as well if the customer does not care to pay for the skin. Small plasters are spread upon thin cloth or brown paper, sometimes upon flexible adhesive plaster, which is sold for this purpose by plaster manufacturers.

The design is first marked upon a piece of cardboard and then cut out, making a stencil form, which is placed over the skin or cloth and filled in with the plaster. The form should have a wide margin, and by preference should be of the same thickness as the desired plaster. It may be tacked upon the cloth, or, if first dipped into water, it will adhere fairly well in the moist condition and will not interfere with the spreading.

Forms are kept, of tinned iron or sheet zinc, in some cases. These are very useful for ear plasters, but the others are likely to vary in size, as ordered. It will be found easier to cut or trim the cloth upon which the plaster is placed after spreading.

The plaster is melted in a convenient dish, poured upon the cloth while hot, and spread over its surface with a few rapid strokes of a large spatula or plaster-iron, previously heated. Plasters which have been spread slowly usually have a crinkly or striped surface. They are much more apt to be smooth and of an even thickness if spread rapidly.

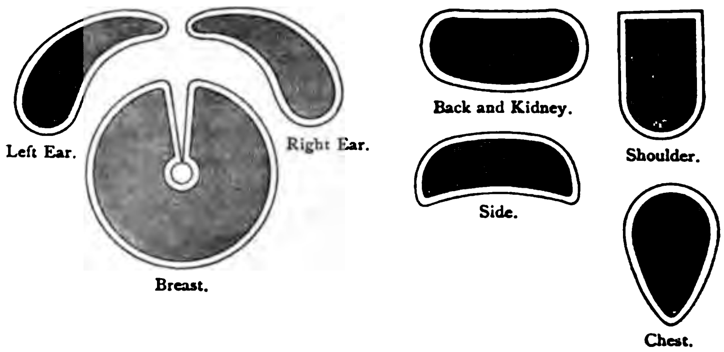
The plaster should not be hot enough to soak through the skin or cloth and stain the under side, and the spreading spatula should be only warm enough to obviate congealing the soft mass. Plaster-irons may be obtained which will retain their heat for a long time or which are self-heating.

Hollow rollers are also used which may be kept filled with hot water, and are useful for giving a smooth finish, but are not good for spreading.

Cantharides cerate should be spread with a warm spatula or iron, but without melting.

The cloth should not be trimmed close to the plaster; a margin of half an inch or so should be left all around.

Ear-plasters may be trimmed close on the inner edge where it



fits against the back of the ear, a margin being left on the remaining sides.

A sheet of tissue or oiled paper should be placed over the surface of the plaster before dispensing; then the plaster may be placed in a box or formed into a roll.

Rubber plasters are essentially an American industry of comparatively recent date. The basis of these is a mixture of best Para rubber with olibanum (true frankincense), pitch, etc., worked together entirely by mechanical means. Attempts were made in the early days of the industry to use solvents for incorporating these and obtaining a homogeneous mixture, but these failed, the rubber never being itself again after solution.

The rubber is first soaked and steamed; then passed through spirally corrugated iron rolls, under a stream of water, until well cleansed.

This forces it out in crinkled sheets, which are hung up to dry and "season." The freshly-exposed surfaces are a very light brownish-yellow at first, but exposure to the air soon turns them dark and even black.

The sheets are then worked on warm, smooth calendar mills to a perfectly homogeneous mass.

The olibanum, or frankincense, to which the fragrant odor of these plasters is mostly due, is stamped and sifted, while the pitch is purified by melting and straining.

The ingredients are then mixed by working on the warm calendar mills, and the medicinal ingredients are incorporated in the same way. The mass is spread, while still warm and plastic, by means of heavy calendars. The cloth, measuring usually 120 yards by 36 inches, is fed through the calendars, and passing under the lower roll, is connected with a large reel behind the machine. The calendars being gauged for the right thickness, are started and the mass fed upon the cloth, between guides.

After standing for a time upon the reels, to cool and harden, the plaster is wound upon wooden drums, cut into strips the width of the finished plaster, and these are afterward cut transversely and perforated. About 100,000 plasters may be spread per day on one machine.

These plasters are very flexible, and adhere well to the skin, the medicinal qualities being readily absorbed. When of the best quality, they retain their flexibility for a long time; but some grades will become brittle and non-adhesive after a time.

These can be temporarily restored by warming and wetting with alcohol.

The rubber being the most expensive ingredient, attempts have been made to find a substitute for it; but the flexible and adhesive qualities cannot be satisfactorily secured without this. Among the materials suggested are chicle, vulcanized oil, varieties of asphaltum, and a base consisting of glue, glycerin, and an alkaline sulphoricinoleate.

OINTMENTS, CERATES AND PLASTERS.

257.

℞ Ammoniated Mercury, in very
fine powder . . . . . . 10 Gm.
Petrolatum . . . . 90 Gm.
M. Sig.—White precipitate ointment.

Rub the ammoniated mercury with the petrolatum gradually added, until they are thoroughly mixed.
Make 20 Gm.

258.

℞. Red Mercuric Oxide, in very
fine powder . . . . . . 10 Gm.
Castor Oil . . . . 5 Gm.
Petrolatum . . . . 85 Gm.
M. Sig.—Red precipitate ointment.

Triturate the red mercuric oxide with the castor oil, until a perfectly smooth mixture results; then gradually incorporate the petrolatum and mix thoroughly.
Make 20 Gm.

259.

℞. Potassium Iodide . . . . 12 Gm.
Sodium Hyposulphite . . . 1 Gm.
Water, hot . . . . 10 Cc
Benzoinated Lard . . . . 77 Gm.
M. Sig.—Potassium iodide ointment, U. S. P.

"Dissolve the potassium iodide and the sodium hyposulphite in the hot water, then mix the solution with the benzoinated lard."
Make 20 Gm.

260.

℞. Iodine . . . . 4 Gm.
Potassium Iodide . . . . 1 Gm.
Water . . . . 2 Cc.
Benzoinated Lard . . . . 93 Gm.
M. Sig.—Iodine ointment, U. S. P.

"Rub the iodine and the iodide of potassium, first with the water, and then with the benzoinated lard, gradually added, until they are thoroughly mixed, avoiding the use of a metallic spatula. This preparation should be freshly made, when required."

Make 20 Gm.

261.

℞. Extract of Stramonium Seed . 10 Gm.
Diluted Alcohol . . . . . 5 Cc.
Benzoinated Lard . . . . . 85 Gm.
M. Sig.—Stramonium ointment, U. S. P.

"Rub the extract with the diluted alcohol until it is uniformly soft; then gradually add the benzoinated lard, and mix thoroughly."

Make 20 Gm.

262.

℞. Lead Plaster . . . . . . 500 Gm.
Olive Oil . . . . 490 Gm.
Oil of Lavender Flowers . 10 Cc.
M. Sig.—Diachylon ointment, U. S. P.

"Melt together the lead plaster and the olive oil, on a water-bath; then having allowed the mixture to become partly cool, add the oil of lavender flowers, and stir constantly, until the ointment is cold."

Make 25 Gm.

263.

℞. Spermaceti . . . . 125 Gm.
White Wax . . . . . . 120 Gm.
Expressed Oil of Almond . 600 Cc.
Stronger Rose Water . . . 190 Cc.
Sodium Borate, in fine powder . . . . 5 Gm.
M. Sig.—Cold cream, U. S. P.

"Reduce the spermaceti and the white wax to fine shavings, and melt them at a moderate heat. Then add the expressed oil of almond, pour the mixture into a warmed, shallow Wedgwood mortar, carefully add, without stirring, the whole of the stronger rose water in which the sodium borate had previously been dissolved, and stir rapidly and continuously, until the mixture becomes uniformly soft and creamy."

Make one-twentieth the above quantities. In larger quantities this is best stirred with a "Dover" egg-beater. Do not stir too long.

264.

℞. Ceræ Albæ . . . . ℥ij
Petrolati Liquidi . . . . . ℥viij
Aquæ Rosæ . . . . ℥iv
Sodii Boratis . . . . . . ʒi
Olei Rosæ . . . . gtt. v
Olei Geranii . . . . gtt. xvi
M. Sig.—"Permanent cold cream."

Melt the wax and mix with the albolene, then add the rose water, in which the borax has been dissolved, and stir until cold. Lastly add the perfumes.

265.

℞. Paraffini . . . . ʒiv
Petrolati Liquidi . . . . . ℥iss
Adipis Lanæ . . . . ℥i
Aquæ Rosæ . . . . ℥i
Sodii Boratis . . . . gr. vii
M. Sig.—"Permanent cold cream."

Melt the paraffin, add the liquid petroleum, then incorporate the other ingredients.

266.

℞. Adipis . . . . ℥ viij
Ceræ Flavæ . . . . ℥ ss
Cetacei . . . . ℥ ss
Sodii Boratis . . . . ʒ iiss
Cucumerum . . . . iij No.
M. Sig.—Cucumber cream.

Melt together the lard, wax and spermaceti and stir while cooling. Peel and slice three (fair-sized) cucumbers, and mix with the ointment, with which half the borax has been incorporated. Allow to stand 10 hours, then melt, strain, chill on ice and separate the watery layer, and incorporate the remainder of the borax.

267.

℞. Resin Cerate . . . . . . 650 Gm.
Oil of Turpentine . . . . 350 Gm.
M. Sig.—Turpentine liniment, U. S. P.

"Melt the resin Cerate in a capsule, on a water-bath, then add the oil of turpentine, and mix them thoroughly."
Make 20 Grams.

268.

℞. Zinci Oxidi 1.0
Camphoræ 0.150
Unguenti 20.0
M. Ft. ungt. Sig.—Eye Salve.

Melt half the ointment and dissolve the camphor in the warm fat, incorporate the zinc oxide, then the remainder of the ointment.

269.

℞. Cocaine Hydrochloratis . . ʒ ss.
Petrolati . . . . ℥ i.
M. Sig.—Apply to the eyes.

270.

℞. Thymol . . . . ʒ i.
Adipis Benz. . . . . ℥ i.
M.—Ft. ungt.

Melt the lard, dissolve the thymol therein, and stir while cooling.

271.

℞. Ung. Hydrargyri . . . . . .
Ung. Aquæ Rosæ . . āā . . 10.0
M.

272.

℞. Ung. Hydrarg. Nit. . . . . .
Ung. Aquæ Rosæ . . āā . . . 10.0
M.

Work cautiously, and avoid the use of metallic implements.

273.

℞. Camphoræ . . . .
Chloralis . . āā 4
Petrolati 15
M. Ft. ung. Sig.—Ad partem dolentum applicetur.

Triturate the chloral and camphor together in a mortar until completely liquefied, and add the petrolatum.

274.

℞. Ext. Eucalypti . . . .
Ext. Hydrastis . . . .
Ext. Irid. versic. . . āā . . . ʒ i.
Petrolati . . . . ℥ i.
M. Ft. ung.

Soften the extracts with glycerin, and mix with the petrolatum. Water or alcohol, if used for softening, does not mix well with the petrolatum.

275.

℞. Naphtoli 2
Petrolati 20
M. Ft. unguent.

Dissolve the naphtol in 3 Cc. of ether and mix with 5 Gm. of petrolatum. Warm on the water-bath until the ether is entirely expelled, stirring the while, then incorporate the remainder of the petrolatum. Aristol ointment may be made in the same way.

276.

℞. Aristol 5.00
Petrolati 45.00
M. Ft. unguent.

Mix on a slab and then warm gently and stir until the aristol dissolves in the warm fat. Or, make in the same manner as No. 275.

277.

℞. Acidi Carbolici 1.0
Unguenti 19.0
M. Ft. ung.

This is best made by dissolving the carbolic acid in the warm ointment and stirring until cold.

278.

℞. Olei Amygdalæ Expres. 4
Cetacei 8
Ceræ Albæ 4
Camphoræ 1
M. Sig.—"Camphor Ice."

Mould in glass tubes.

279.

℞. Adipis Lanæ Hydros. 5.0
Sulphuris Præcip. 5.0
Zinci Oxidi 2.5
Ol. Amygdal. Express 5.0
M. Ft. unguent. M. Sig.—Toilet unguent.

280.

℞. Yellow Mercuric Oxide, thoroughly dried . . . . . 200 Gm.
Oleic Acid . . . . 800 Gm.
M. Sig.—Oleate of mercury, U. S. P.

"Introduce the Oleic Acid into a capacious mortar, and gradually add to it the Yellow Mercuric Oxide by sifting it upon the surface of the Acid, and incorporate it by continuous stirring. Then set the mixture aside in a warm place, at a temperature not exceeding 40° C. (104° F.), and stir frequently, until the Oxide is dissolved."

Make one fiftieth the quantity. If heated too much the oleate becomes discolored and does not keep well.

281.

℞. Camphor Liniment . . . 100 Gm.
White Wax . . . . . . 300 Gm.
Lard . . . . 600 Gm.
M. Sig.—Camphor cerate, U. S. P.

"Melt the white wax and lard with the aid of a gentle heat; then add the camphor liniment, and stir the mixture occasionally, until it has become cold."

Make 20 Gm.

282.

℞. Solution of Lead Subacetate . 200 Gm.
Camphor Cerate . . . . . 800 Gm.
M. Sig.—Goulard's cerate, U. S. P.

"Mix them thoroughly. This cerate should be freshly prepared when wanted."

Make 25 Gm.

283.

℞. Resin . . . . 350 Gm.
Yellow Wax . . . . . . 150 Gm.
Lard . . . . 500 Gm.
M. Sig.—Basilicon ointment, U. S. P.

"Melt them together at a moderate heat, strain the mixture through muslin, and allow to cool without stirring."
Make one ounce.

284.

℞. Resin, in fine powder . . 140 Gm.
Lead Plaster . . . . . . 800 Gm.
Yellow Wax . . . . . . 60 Gm.
M. Sig.—Resin plaster, U. S. P.

"Melt the lead plaster and yellow wax together with a gentle heat; then add the resin, and, when it is melted, mix the mass thoroughly."
Make one ounce.

285.

℞. Soap, dried and in coarse powder . . . . 100 Gm.
Lead Plaster . . . . . . 900 Gm.
Water, a sufficient quantity.
M. Sig.—Soap plaster, U. S. P.

"Rub the soap with enough water to reduce it to a semi-liquid state; then mix it with the lead plaster, previously melted, and evaporate to the proper consistence."
Make one-twentieth the quantity.

286.

℞. Emplastri Plumbi . . . . 2″ x 3″

287.

℞. Emplastri Cantharidis pro auribus . . . . No. ij
Sig.—To go behind the ears.

288.

℞. Camphoræ 2
Ceræ Albæ 1
Adipis 6
M. Ft. ung. Sig.—Camphor ointment, N. F.

Melt the white wax, add the lard, then the camphor, and continue the heat until the camphor is dissolved, then stir until cold.

289.

℞. Bismuthi Subnitratis . . . . . ʒ ij
Oxide . . . . ʒ i
Acidi Salicylici . . . . gr. x
Amyli . . . . ʒ ij
Adipis . . . . ℥ vi
M. Ft. unguent. Sig.—Apply 2 or 3 daily.

This is best made in a warm mortar with melted lard. A very stiff ointment results.

CHAPTER XII.

POULTICES, PLASMAS, PENCILS AND MEDICATED DRESSINGS.

Poultice or Cataplasm (Lat. *Cataplasma-atis*).—A soft, mushy preparation, composed usually of some mealy substance capable of absorbing a large amount of liquid, made into a paste with hot liquids, and spread thickly upon cloths, then applied to the body while hot.

Fomentation (Lat. *Fomentum-i*).—A poultice composed of herbs or other non-absorptive material and hot liquids or lotions, absorbed in woolen cloths and applied hot.

Spongio-piline.—A thick cloth containing small pieces of sponge on one side and rubber or other water-proof material on the other, intended for the absorption and application to the skin of hot liquids.

Plaster Mull.—A thin cloth covered on one side with rubber or gutta-percha, or attached to gutta-percha tissue, upon which a medicinal agent in liquid form is spread or painted. These are used in the same way as plasters, absorption being facilitated by the impervious nature of the cloth.

Plasmas (Lat. *Plasma, atis*).—Non-fatty, unctuous preparations, designed as substitutes for ointments, cerates, etc., in the local application of remedies. They are also called jellies.

Caustics or Escharotics (Lat. *Escharotica, æ*).—Substances used for the destruction of tissues by the caustic action of chemicals or by heat. They are used in the form of

Pastes (Lat. *Pasta, æ*).—Semi-solid masses, composed of starch, flour or other diluent, with the chemical agent and sufficient water, alcohol or glycerin to wet the mixture thoroughly.

Pencils or Crayons (Lat. *Stilus, i*).—Small sticks of pure or diluted chemicals, used in the same manner as crayons.

Moxas.—Small cones of combustible matter, with an oxidizing agent, which glow, but do not inflame when ignited, and give out an intense heat; intended for cauterization by direct heat.

POULTICES are seldom prepared by the apothecary, but he is frequently called upon for directions for preparing and applying them. They owe their virtues in part to the moist heat which they contain, and therefore need to be renewed every few minutes, except in the case of mustard poultice, which acts through the volatile oil formed therein. The other poultices may be used again and again, simply requiring to be re-heated each time before applying. They should be applied as hot as can be borne, and covered with thick cloths while upon the person to prevent loss of heat. A good test of their temperature is their application to the back of the hand, which should be borne easily. The preparation of linseed poultice may be taken as a type of all these.

This is made by quickly stirring about 10 fluid ounces of boiling water into 4 ounces of linseed meal, contained in a warm dish or pan. The mush thus made is then spread thickly upon a piece of cotton or linen cloth, and immediately applied to the skin. If the skin is first greased slightly with a little lard or oil, sticking will be prevented. When the poultice has become only lukewarm, another should be in readiness to take its place, and the treatment continued as long as may be necessary.

Bread-and-milk poultice is prepared by heating together sweet milk and bread deprived of its crust, and incorporating a little lard.

Mustard poultices differ from most of this class in preparation and in action. Pure mustard is used only in exceptional cases, when a prompt and strong action is desired. This is quite likely to blister the skin.

For ordinary cases the mustard is diluted with about an equal weight of flour, corn meal, flaxseed meal or other emollient, or with about half its volume of sodium bicarbonate. In the latter case a vigorous rubefacient action is produced, but the poultice seldom blisters. The mustard should be wet with lukewarm water, never with boiling water, since the action of the mustard is due to a volatile oil generated by the moisture, and this will not be formed if too much heat is applied.

The dry mustard may be mixed with its diluent and moistened, or two mixtures may be made, one with the lukewarm and one with hot water, then these two stirred together.

In applying these, a thin cloth is usually placed between the moist mass and the skin, and staining thereby prevented.

The poultice is allowed to remain upon the skin from ten minutes to an hour or more, according to the demands of the case. The action is usually at its height in fifteen to twenty minutes, but a redness is produced in a shorter time. Upon very tender skins, or in cases of weak system, a short action may be better than a protracted one.

Mustard poultices or plasters are also called *sinapisms*.

PLASMAS. — Non-fatty bases, consisting principally of glycerin and water, thickened into a jelly-like mass with starch, gelatin or other agents, have been recommended as substitutes for the fatty ointment bases.

They are about the consistence of ointments and have the advantage of greater cleanliness, easy removal from the skin and miscibility with aqueous fluids. They are excellent solvents in themselves for many bodies. They do not become rancid, but they mould quickly, and unless some preservative agent is present, putrefaction soon begins. They become hard on exposure to the air, by evaporation.

A large proportion of glycerin prevents such changes; when this is absent some of the common antiseptic agents must be used.

Plasmas or jellies made from starch or gum, do not melt like ointments when applied to the skin, and consequently medicinal matter is not as easily absorbed from them. Their chief use is as toilet preparations, or for superficial skin diseases, in which they serve an excellent purpose as cleansing, softening and cooling agents.

They are usually perfumed, and when not designed for specific diseases are often sold under the name of "glycerin jellies," "emollient creams," etc.

Considered as toilet preparations, there are two classes of these in use; the true plasmas, opaque bodies, of which glycerite of starch and glycerite of tragacanth are types, and the transparent jellies, made from gelatin, agar-agar, etc.

The latter soften with heat or partially melt upon the skin, and are absorbed more readily. They should be made as thin and soft as possible, and dispensed in collapsible tubes.

Glycerin jellies should contain at least one-fourth of their weight of water, since strong glycerin irritates the skin by abstracting water from it.

The gelatinizing agents in common use are:

Starch forms a jelly which is opaque when thick or translucent when thin.

Potato starch is most easily formed into a jelly, and is more translucent than most varieties.

The starch is first triturated with a little cold water to form a uniform mixture, then this is poured into boiling water, and the mixture boiled until the starch granules are fully swollen, usually about five minutes. If the starch be added directly to the boiling water it coheres into lumps which are not easily broken up, even on prolonged boiling.

The official glycerite of starch, which contains ten per cent. of corn starch, is a pretty firm jelly. Particular care is needed in making this lest the mixture become overheated and the glycerin decomposed, thereby rendering it irritating.

Tragacanth and Salep.—These are types of the gum-starches. They do not make transparent jellies, but resemble those made with starch.

Tragacanth makes a jelly in the proportion of five or six parts to one hundred, while only two to three parts of salep to one hundred are required. The process of the official mucilage of tragacanth is the best method of preparing a jelly with this.

Salep is first soaked in cold water, then this mixture is added to boiling water, and the boiling continued for a short time.

The National Dispensatory gives the following method of making salep jelly:

"Rub sixty grains of powdered salep with water in a mortar until it has swollen to four times its original bulk, then add gradually, and with stirring, a pint of boiling water, and boil down to eight ounces."

Chondrus and Cetraria. — These make very thick mucilages which are gelatinous when cold. Ten parts of the former or fifteen of the latter are required to make one hundred parts of stiff jelly. The moss is placed in a double amount of cold water and boiled half an hour, or until reduced to the required bulk. Much care is needed to prevent burning when the magma is thick, the least trace of which will make the jelly dark-colored.

When clear succulent pieces of moss are selected, a grayish-white translucent jelly is obtained. After boiling the mass is strained through cheese-cloth with pressure.

The mass is so thick that filtering is impossible, and a clear jelly cannot be obtained except by filtering a thin solution and then evaporating.

Agar-agar is the most powerful gelatinizing agent.

It is prepared from several species of algæ growing in tropical waters.

The Japanese agar-agar, known also as Japanese isinglass, which is used in operations of the bacteriologist, is one of the best forms. It comes usually in strips about as thick as a straw, and is almost completely soluble in water.

One part of this makes a jelly with two hundred parts of water. It should be boiled about six hours, and filtered while hot. It filters readily when liquefied, but solidifies at 40° C., and in handling large quantities a hot filtration apparatus is needed.

It forms a very clear, firm jelly, and keeps fairly well if ten per cent. of glycerin be added.

Gelatin comes next in power, requiring two to four parts for one hundred parts of jelly.

French "silver" or "gold-label" gelatin is best for pharmaceutical use. It dissolves easily in warm water, and usually gives a clear jelly by straining through cheese-cloth. It can be made to dissolve in glycerin by first softening with water, then heating with glycerin until dissolved and the water has passed off. The jellies are apt to liquefy if stirred very much.

The solution of gelatin should be allowed to stand in a cool place to solidify, and, if not disturbed by stirring, it will keep growing firmer for a number of hours.

Isinglass resembles gelatin very closely; four parts of it make one hundred parts of clear tremulous jelly. It consists chiefly of a very pure gelatin, and is dissolved in the same manner. It is not easy, however, to obtain it of good quality.

By using larger proportions of any of these agents, stiff and rubber-like jellies may be prepared, suitable for making bougies, pencils, etc. Most of the jellies are hygroscopic, and should be preserved and dispensed in tight containers.

If made with agar-agar or gelatin, they should be clear and free from lumps.

They are easily moulded, when desired, and do not stick to the moulds. In all cases they should be allowed to set half an hour or longer in a cool place before dispensing.

In some cases they are used as paints, being melted and applied with a brush while hot. Thus used, they form a film upon the skin, which holds and protracts the medicinal action, operating in the same manner as collodions.

Pastes are but little used for caustic purposes, having become superseded by the surgeon's knife, a desirable substitute in all cases when the patient will admit of it.

The preparation of pastes offers no special difficulties. The active agent is mixed with flour in the proportion desired, and the resulting mixture made into a soft dough or paste by the addition of water.

With very deliquescent substances like chloride of zinc, water must be used sparingly to avoid dissolving all of the salt and developing its causticity too strongly. The action of pastes is intended to be slow and gradual, and the salt should be in a condition of partial solution, except when the strongest action is desired. They are very painful, and are sometimes mixed or moistened with anodynes to mitigate the pain. Alcohol and glycerin are also used as moistening agents for very soluble substances, while starch, calcium phosphate, plaster-of-paris and other inert substances may be used as diluents. These pastes are applied directly to the skin, or to the skin denuded of its cuticle by a blister, or by the application of another caustic.

Caustics which are deliquescent have a tendency to spread, and this action on the surrounding tissues may be prevented by a dressing of simple cerate ointment. This prevents the spreading of the caustic over the surface of the skin by capillary attraction.

Pastes may be used for other purposes than caustics. Toilet preparations are frequently desired in this form.

Crayons or pencils are small pencil-shaped rods, usually measuring two to four inches in length, and one-fourth to three-eighths of an inch in diameter. They are intended for application to very small areas of surface, and are applied, after wetting the point or end, in the same manner as crayons. They need no dressings, and are largely used for the removal of small excrescences, etc.

They may consist entirely of the active agent, or of the same in a diluted form.

They are prepared by fusion, or by combination with a suitable base.

Easily fusible salts, as silver nitrate and zinc chloride, or salts which melt easily in their water of crystallization, as zinc and copper sulphates, alum, etc., are simply melted and poured into suitable moulds. The moulds used for preparing urethral suppositories may be used for this purpose.

The pencils of lunar caustic and diluted nitrate of silver are familiar examples of these. The moulds should be warm to prevent too sudden congealing, and the liquid should be near its congealing point to obtain a smooth surface. The moulds should not be greased, but should be perfectly clean.

Salts that are melted in their water of crystallization must not be heated too long, lest a portion of the water be driven off. It is best to weigh these before melting, and again just before moulding, making up any loss in the second weighing by the addition of boiling water. A porcelain or metallic capsule or crucible is the best form of vessel in which to fuse the salts.

Silver nitrate pencils contain a small proportion (about five per cent.) of chloride of silver (U. S. P.) or of potassium nitrate (Ph. Br.) to toughen them. If made from the pure salt, they are brittle and crystalline.

A slight excess of nitric acid is sometimes also added to the melted salt to prevent discoloration.

If the melted salt is too hot when poured into the moulds, they are likely to be brittle and uneven as well as discolored.

Zinc chloride is seldom made into pencils, owing to its extreme deliquescence.

Copper sulphate may be moulded pure, or mixed with half its weight of powdered alum, and the mixture fused and moulded. Pencils of pure copper sulphate may also be formed out of selected crystals of the salt by turning in a lathe, or by filing.

For non-fusible bodies, when the active agent is desired only in a diluted condition, and when other medicaments than caustics are desired in the pencil form, a base or form must be used.

Gelatin makes a flexible pencil which is not easily broken, and which preserves the active agent in good condition. The jelly used for making these should be pretty stiff, containing ten to fifteen per cent. of gelatin with some glycerin. The medicinal matter may be incorporated with the fluid before moulding, when the pencil will contain a definite proportion of it, or a pencil form may be made of jelly, which is coated with the active agent by rolling therein. In the latter case the pencil is moistened on the surface before rolling, unless the mass contains a considerable proportion of glycerin.

Gums, with starch or flour, make a stiff and hard pencil. They are moistened with a mixture of glycerin and water, the glycerin being necessary to prevent them from becoming so hard as to scratch the skin, and also to preserve them in a condition to yield up their medicinal mattter readily. The gums employed are usually tragacanth and dextrin, the tragacanth furnishing a good body, and the dextrin supplying the additional adhesive qualities needed.

A good general mixture is tragacanth, 5 parts; dextrin, 30 parts; powdered sugar, 20 parts, and starch, 10 to 35 parts. The starch is used as a filler, and varied in quantity according to the proportion of active agent desired. Thus, for a pencil to contain ten per cent. of medicinal agent, 10 parts are added to the above quantities, while for forty per cent. of medicinal agent only 5 parts of starch, or, better, 10 parts of starch and 15 parts of sugar can be used. The powdered ingredients are mixed intimately, and made into a stiff mass by the addition of a sufficent quantity of glycerin-water. The mass is then rolled into the desired form and dried. Unless otherwise specified the pencil may be made two and one-half inches in length and one-quarter inch in diameter. They should taper to a point at one end. As with the gelatin pencils, the points or the surface to which they are applied, must be wetted before being applied.

Wax and hard fats make a plaster-like pencil. They are made in the same manner as suppositories, by either hot or cold process, and should contain only sweet and nonirritating fats. The same rules as those given for suppositories apply to these, except as regards melting points, which may or may not be a consideration in pencils. Pencils used for toilet and theatrical purposes are generally desired of high fusing points.

Medicated Gauzes and Cottons are usually prepared by plaster manufacturers or special dealers, though their preparation is quite within the range of retail pharmacists.

They are generally understood to contain a certain percentage or quantity of medicinal agent in the finished gauze or cotton.

Besides this they also contain in most cases a small quantity of glycerin, or of oil and resin, to preserve a degree of softness and promote the activity of the medicinal agent.

To prepare them the compounds are dissolved in ether, alcohol or other volatile solvent; the glycerin, or rosin and a fixed oil, is added to this, then the mixture is thoroughly diffused through the gauze or cotton, then wrung out and dried. They must be dried quickly, but without heat. If allowed to remain in folds, or if not dried promptly, they are apt to become streaked. This can be prevented by wringing well, or by spreading out thinly, in a horizontal position, in a current of dry air.

If volatile ingredients are present, the gauze should be collected and preserved in tight containers as soon as the ether or alcohol has evaporated, or even before the last traces have disappeared. Since medicinal matter diffused in this manner is in a condition to change readily by action of air and light, or to evaporate if volatile, these preparations must be preserved in tight receptacles.

Furthermore, for their use in surgical dressings pains should be taken to secure absolute cleanliness and to exclude disease or harmful germs.

In calculating the quantities of solution and of gauze required to obtain a gauze of definite percentage strength, allowance must be made for the additional weight of glycerin or of rosin and oil in the solution, which is retained in the finished gauze. Thus the weight of the finished gauze will be the weight of the original gauze plus the total weight of the solids or non-volatile matter in the solution absorbed, and the weight of the medicinal agent must be in proportion to the total or final weight of the gauze, not simply to the gauze taken. (See note under iodoform gauze, No. 329.)

CATAPLASMS, PLASMAS, PASTES, PENCILS, MEDICATED DRESSINGS.

290.

Cataplasma Carbonis (Ph. Br.). Charcoal Poultice.

℞. Powdered Wood Charcoal 1 ounce
Crumb of Bread . . 2 fluid ounces
Linseed Meal . . . 1½ fluid ounces
Boiling Water . . . 10 fluid ounces

"Macerate the bread in the water for ten minutes near the fire, then mix; add the linseed meal gradually, stirring the ingredients that a soft poultice may be formed. Mix with this half the charcoal, and sprinkle the remainder upon the surface of the poultice."

291.

Cataplasma Fermenti (Ph. Br.). Yeast Poultice.

℞. Beer Yeast . . . . . 6 fluid ounces
Wheaten Flour . . . 14 fluid ounces
Water heated to 100° F. 6 fluid ounces

"Mix the yeast with the water, stir in the flour, and place near the fire till it rises."

292.

Cataplasma Sinapis (Ph. Br.). Mustard Poultice.

℞. Powdered Mustard . 2½ fluid ounces
Lukewarm Water 2 to 3 fluid ounces
Mix.
Linseed Meal . . 2½ fluid ounces
Boiling Water . 6 to 8 fluid ounces
Mix.

Stir the two poultices together.

293.

Cataplasma Sodæ Chlorinatæ (Br.). Chlorine Poultice.

℞. Solution Chlorinated Soda . . . . 2 fluid ounces
Linseed Meal . . . 4 fluid ounces
Boiling Water . . . 8 fluid ounces

Mix the linseed meal and boiling water, and add the soda solution.

294.

Onion Poultice.

℞. Onions, chopped fine . . . 6 to 10
Rye Meal . . . . An equal quantity
Vinegar . . Enough to make a paste

Mix the three and heat in a suitable pan, allowing the mixture to simmer about ten minutes, stirring frequently; apply hot, and renew frequently.

(This is highly recommended as an application to the chest in pneumonia and other lung troubles.)

295.

℞. Tragacanth . . . . . . 6 Gm.
Glycerin . . . . 18 Gm.
Water, a sufficient quantity to make . . . . 100 Gm.
Sig.—Mucilage of Tragacanth, U. S. P.

"Mix the glycerin with seventy-five (75) cubic centimeters of water in a tared vessel, heat the mixture to boiling, add the tragacanth, and let it macerate during twenty-four hours, stirring occasionally. Then add enough water to make the mixture weigh one hundred (100) grammes, beat it so as to make it of uniform consistence, and strain it forcibly through muslin."
Make 20 Gm.

296.

℞. Pulv. Tragacanthæ 1
Sodii Boratis 1
Glycerini 36
Aquæ Rosæ 5
M. S. A. Sig.—Glycerin Ointment.

Mix the gum thoroughly together with the glycerin, heat and add the borax dissolved in the rose water.

297.

℞. Starch . . . . 10 Gm.
Water . . . . 10 Cc.
Glycerin . . . . 80 Gm.
M. Sig.—Glycerite of Starch, U. S. P.

"To the starch, contained in a porcelain capsule, add the water and glycerin, and stir until a homogeneous mixture is produced. Then apply a heat gradually raised to 140° C. (284° F.), and not exceeding 144° C. (291° F.), stirring constantly, until a translucent jelly is formed. Transfer the product to suitable vessels, provided with well-fitting covers."

Make one-fifth the quantity.

298.

℞. Amyli . . . . ʒ ij
Aquæ . . . . ℥ x
M. Sig.—Mucilage of Starch, B. P.

Triturate the starch with the water, gradually added, then boil for a few minutes, constantly stirring.

299.

℞. Calomelanos 1.0
Acidi Tannici 1.0
Glyceriti Amyli 30.0
M. Sig.—Calomel and tannin plasma.

300.

℞. Zinci Oxidi 10
Acidi Salicylici 0.2
Glyceriti Amyli 10
M. Sig.—Apply as needed.

301.

℞. Sulphuris 10.0
Tinct. Benzoini 10.0
Mucilaginis Amyli 80.0
M. Sig.—For external use.

302.

℞. Gelatini 2.0
Glycerini 50.0
Aquæ 35.0
M.

Add the gelatin to the water and heat on a water-bath until completely liquefied, then add the glycerin, mix well and pour into bottles to cool and solidify.

303.

℞. Gelatini 10
Albuminis Ovi 20
Acidi Salicylici 1
Aquæ Rosæ 225
Glycerini 250
M. Sig.—"Glycerin Jelly."

Dissolve the gelatin in the rose-water by aid of a very gentle heat. Let cool and before it jellifies stir in the albumen. Dissolve the salicylic acid in the glycerin, and after again warming the gelatin solution add it to the latter, stirring constantly. When well mixed strain into gallipots or wide-mouthed bottles and allow it to gelatinize.

(Used for chapped lips and hands, blisters, etc.)

304.

℞. Gelatini 4
Zinci Oxidi 3
Glycerini 5
Aquæ 9

M. S. A. Sig.—" Unna's Glycerin Jelly."

Melt the gelatin in the water by aid of heat, add the glycerin and *sift* in the zinc oxide; strain through cheese-cloth and stir until it begins to thicken.

(When required for use a portion is melted and applied with a brush.)

305.

℞. Glycerini 24
Amyli 3
Tinct. Arnicæ 4
Aquæ 6

M. Ft. Sig.—Arnica jelly.

Heat the starch, glycerin and water until a transparent jelly is obtained, and when cold incorporate the arnica.

306.

℞. Adipis Lanæ Hydros. 10
Tinct. Quillajæ 5
Glycerin 20
Gelatini 4
Aquæ Fervent . . . . q. s.

M. Ft. gelatinum. Sig. — " Lanolin paste."

Dissolve the gelatin in 75 parts of hot water and strain.

Emulsify the lanolin with the tincture of quillaja in a warm mortar, add the glycerin, then the warm gelatin solution and stir until the mixture thickens.

Set aside to cool.

307.

℞. Gelatin Chondri . . . .
Glycerin . . . āā 25

M.

Prepare the chondrus jelly by boiling 5 Gm. of the moss with 200 Cc. of water down to 25 Cc.; when strained, add the glycerin while warm, and place in wide-mouthed bottles, or jars, to stiffen.

308.

℞. Cydonii Contusi 4.0
Aquæ Bullientis 400.0
Sodii Boratis 4.0
Glycerini 60.0
Spiritus Camphoræ . . . . 30.
Ol. Amygdalæ Amaræ . . 0.60

M. Sig.—" Camphor cream."

Macerate the quince seed in the water for 12 hours, strain and add the glycerin and borax. Gradually add the spirit, in which the oil has been dissolved, and mix thoroughly.

309.

℞. Saponis . . . . 12 G.
Benzini . . . . 38 Cc.
Aquæ Ammon. Fort. . . . 38 Cc.
Aquæ . . . . q. s.

M. Sig.—" Benzine jelly."

Shave the soap very fine, place in 6-inch capsule, cover with 45 Cc. water, and heat on a water-bath until the soap is soft and jelly-like. Add water to make 45 Gm. of mixture, mix well and squeeze through cheese-cloth into 4 ounce, wide-mouthed bottle. Add the benzine, shake together, then gradually add the stronger water of ammonia, constantly shaking.

310.

℞. Benzini . . . . ℥i
Tinct. Quillajæ . . . . ℥ss

M. Sig.—" Benzine jelly."

311.

℞. Benzini . . . . ℥i
Tinct. Quillajæ . . . . ʒii
Aquæ Ammoniæ Fortioris . . . ʒii

M. Sig.—Benzine jelly.

312.

℞. Balsami Peruviani . . . . . .
Iodoformi . . . . . āā . . . ʒ ii
Glycerini . . . . ℥ xiv
M. Ft. unguent

A solid ointment results on mixing. A peculiar mixture.

313.

℞. Zinci Chloridi 20
Amyli 20
Zinci Oxidi 5
M. Ft. escharotica. Sig.—Chloride of zinc paste.

Mass with water, and roll rapidly into cones, which are then rolled in talc.

314.

℞. Zinci Oxidi 20.0
Cretæ Præparatæ 10.0
Liq. Plumbi Subacet. 10.0
Olei Lini 10.0
M. Sig.—Zinc-lead paste.

Shake together the lead water and oil, and stir into this mixture the powders, taking care to thoroughly mix.

315

℞. Acidi Sulphurici . . . . . .
Carbonis Ligni . . āā . . . . q. s.
M. Ft. pasta. Sig.—Acid cautery paste.

316.

℞. Acidi Arsenosi . . . . gr. ij.
Morphinæ Sulphatis . . . . gr. j.
Creosoti . . . . q. s.
M. Ft. pasta.

317.

℞. Acidi Arsenosi . . . . . .
Cocainæ Hydrochlor. . āā . ʒ ss.
Mentholi . . . . gr. viij.
Glycerini . . . . q. s.
M. Fiat pasta.

318.

℞. Barii Sulphidi . . . . gr. x.
Zinci Oxidi . . . .
Amyli . . āā . . . . gr. v.
Aquæ . . . . q. s.
M. Ft. pasta. Sig.—Depilatory paste.

319.

℞. Farinæ Tritici 30
Phosphori 2.5
Aquæ 15
Syr. Fusci 30
Barii Carbonat. 15
Adipis 15
M. S. A. Sig.—*Rat Paste.*

Make a dough with the flour and water, and incorporate the lard.

Place the molasses in a wide-mouth bottle, add the phosphorus and heat upon a water-bath until the latter is melted, stir well to suspend the phosphorus, and then add the dough and incorporate quickly. Finally stir in the barium carbonate and bottle.

(CAUTION.—The mass is liable to take fire while incorporating the phosphorus, which should be done in an open space, the hands being protected by wrapping in wet cloths.)

320.

℞.	Kaolin	8
	Glycerini	6
	Acid Acetici	4

M. Sig.—"Comedone paste."

321.

℞.	Acidi Salicylici	4.0
	Ceræ Albæ	5.0
	Adipis Lanæ Hydros.	11.0

M. Ft. Stilus. Sig.—Salicylic Acid pencils.

322.

℞.	Iodoformi	2
	Tinc. Oxidi	1
	Olei Theobromatis	6
	Ceræ Flavæ	5
	Tragacanthæ	4

M. Ft. bouginariæ, vi. No. Sig.—Iodoform Crayons.

323.

℞.	Iodoformi	ʒi.
	Amyli	ʒiii.
	Tragacanthæ	ʒi.
	Dextrini	ʒi.
	Sacchari	℥ss.
	Glycerini	
	Aquæ . . āā	q. s.

M. Fac. stilos. xiij. No. Sig.—Iodoform Pencils.

324.

℞.	Ichthyoli	4
	Tragacanth Pulv.	1
	Amyli	6
	Dextrini	7
	Sacchari Pulv.	2

M. Ft. stili. Sig.—"Ichthyol Pencils."

325.

℞.	Acidi Carbolici	2
	Resinæ	4
	Ceræ Flavæ	8
	Olei Olivæ	6

M. Ft. stili. Sig.—"Carbolic Acid Pencils."

326.

℞.	Iodoformi	8
	Resinæ	1
	Ceræ Flavæ	6
	Olei Olivæ	5

M. Ft. stili. Sig.—Forty per cent. Iodoform Pencils.

327.

℞.	Carbonis Ligni	30.0
	Potassii Nitratis	4.0
	Ferri Alcoholisati	5.0
	Benzoini	1.0
	Mucilag. Acaciæ	q. s.

M. Ft. styli. Sig.—Moxas, or cauterizing pencils. To be ignited and applied.

(Ferrum alcoholisatum—"alcoholized," —*i. e.*, powdered iron.)

328.

Carbasus Carbolata, N. F. (Carbolized Gauze.)

℞.	Resin, in coarse powder	40 parts
	Castor Oil	5 parts
	Carbolic Acid	10 parts
	Alcohol	225 parts
	Gauze muslin, a sufficient quantity.	

Dissolve the resin, castor oil and carbolic acid in the alcohol. Then immerse in the mixture loosely folded pieces of gauze-muslin, allow them to become thoroughly saturated, then take them out and press out the excess of liquid until the weight of the impregnated gauze amounts to 170 parts for each 100 parts of original fabric. Spread out the pieces horizontally, and as soon as the alcohol has nearly all evaporated, fold and wrap the pieces in paraffin paper and preserve them in air-tight receptacles. The impregnated gauze, when dry, contains about 2.5 % of carbolic acid.

329.

Carbasus Iodoformata, N. F. (Iodoform Gauze.)

℞.	Iodoform	10 parts
	Ether	40 parts
	Alcohol	40 parts
	Tincture of Benzoin	5 parts
	Glycerin	5 parts
	Gauze muslin, a sufficient quantity.	

Dissolve the iodoform in the ether and add the alcohol, tincture of benzoin and glycerin. Immerse in a weighed quantity of this solution, contained in a suitable vessel, the exact amount of gauze required to absorb the whole of it, to produce a product of a prescribed percentage of iodoform, work it about with a pestle so as to impregnate it uniformly; then take it out, hang it up in a horizontal position to dry, and in a dark place. Lastly wrap it in paraffin paper and preserve it in air-tight receptacles.

NOTE.—To calculate the amount of muslin and of iodoform solution required to obtain a product approximately of any required percentage of iodoform, let x denote this required percentage. Then take of the above iodoform solution ten times this quantity (or $10\,x$). Also multiply the required percentage (x) by three, divide the neutral product by two and subtract the quotient from 100. $\left(100. - \frac{3x}{2}\right)$ The remainder represents the number of parts by weight of gauze-muslin to be used.

330.

Gossypium Stypticum, N. F., Styptic Cotton.

℞.	Purified Cotton
	Solution of Chloride of Iron
	Glycerin
	Water . each sufficient quantity

Mix the liquids in the proportion of 5 parts of the iron solution, 1 part of glycerin and 4 parts of water, in such quantities that the cotton shall be completely immersed in the liquid when gently pressed. Allow the cotton to remain in the liquid one hour, then remove it, press it until it has been brought to *twice* its original weight, spread it out in thin layers, in a warm place, protected from dust and light, and when it is sufficiently dry transfer it to well-closed receptacles.

CHAPTER XIII.

HOMEOPATHIC PHARMACY.

THE word homeopathy comes from the Greek words ὤμος, like or similar, and πάθος, treatment, and refers to the fundamental doctrine of this form of practice, that " like cures like." It was founded by Samuel Hahnemann, a German physician, born at Meissen, near Dresden, in Saxony, who was led by the marked effect of a large dose of cinchona to adopt the principle that a remedy given to a healthy subject should produce the symptoms of the disease it would cure. He tried many remedies, and embodied his researches in two extensive volumes. Most of the principles of homeopathic pharmacy and practice were set forth by him in the latter part of the eighteenth century, and but few changes have been made since that time.

The principal motto of the system, "*similia similibus curantur*" —like cures like—while first applied to modern pharmacy by Dr. Hahnemann, is yet very old, for Antiphanes says, 404 B. C.:

> " Take the hair, it is well written,
> Of the dog by which you're bitten ;
> Work off one wine by his brother
> And one labor with another;
> Cook with cook, and strife with strife,
> Business with business, and wife with wife."

Homeopathic pharmacy was first practiced in Leipsic, in 1775, and is thus comparatively new. The main principles at present advocated are : 1st. All medicines must be proved by administration to subjects in health. 2d. Remedies should be given alone, not in combination. 3d. Insoluble substances become very active medicinal agents after being reduced to an impalpable powder and thoroughly diffused through some inert substance. 4th. All medicines should be given in doses too small to produce their physiological effects.

We find no mixtures in homeopathic pharmacy. Two remedies are sometimes given alternately, but never or very seldom mixed. Remedies are also given in very small doses, since they are supposed to act upon a principle directly opposite to that adopted in allopathic practice.

The number of remedies used was originally about two hundred, but now reaches nearly a thousand. Among these are vegetable drugs, chemicals, and a large number of animal drugs, insects, etc., including musk, cantharides, burnt sponge, honey bees, cuttle-fish ink, crab, certain species of spider, several reptile poisons, star-fish, bed-bugs, cockroaches, etc.

With a few exceptions, as nux vomica, rhubarb and cinchona, the drugs are used and preparations made from them while fresh and undried, and animals and insects are captured and preserved alive until the moment of use. The nomenclature differs from that of our Pharmacopœia, being adapted largely from the German. Thus, cinchona is called "china;" quinine, "chininum;" worm seed, "cina;" calomel, "mercurius dulcis," and mercury, "mercurius vivus," etc.

Great stress is laid upon the purity and strength of all drugs and preparations.

Thus, only distilled water is used, and that required to be obtained from tin-lined stills and condensers which are used for no other liquids. Alcohol is required to be re-distilled and kept in glass containers.

Sugar of milk is directed to be purified by recrystallizing or by precipitating with alcohol.

Homeopathic pharmacopœias have been published in England and Germany, and a National American Homeopathic Pharmacopœia is now in preparation, which will be authorized and published by a committee appointed for that purpose, and will correspond to the United States Pharmacopœia.

The English Pharmacopœia, and an American Pharmacopœia, published independently by Boerick & Tafel, have been mostly employed by American practitioners.

Homeopathic preparations are of three classes, (1) the tinctures, commonly called "mother tinctures," which are solutions of the soluble principles of drugs in alcohol, mixtures of alcohol and water, or, rarely, in ether, glycerin and syrup; (2) liquid attenuations made from these; and (3) powders, usually in the form of triturations.

Infusions and decoctions are used but rarely, and are made in the usual way.

Cold infusions are made by percolation, and hot infusions by maceration. All are filtered after being strained, and are made of a uniform strength—ten per cent.

The mother tinctures are also made of a uniform strength—ten per cent.—based on the *dry* drug, and great pains are taken to have the alcoholic strength the same in all cases, for the same drug. Since these are made from fresh drugs, the amount of moisture must be estimated in each lot, and allowance made for it. Thus, if tincture of aconite is to be made, using fifty per cent. of alcohol as a menstruum, the amount of moisture is first estimated, and enough strong alcohol added to make fifty per cent. alcohol with the natural juice of the root. Supposing that it contains seventy per cent. of moisture; there is first poured upon 4 troy ounces of the drug, packed in the percolator, 4.36

fluid ounces (imperial measure) of ninety per cent. alcohol, the amount necessary for the conversion of the water in the drug into fifty per cent alcohol. This is followed with menstruum of the required strength.

Most tinctures are made by percolation in glass apparatus, and those which are affected by light are stored in yellow (or amber) glass bottles. The drugs are never milled, but are prepared for percolation by bruising to a pulp in a Wedgwood mortar. Fibrous drugs are first cut in a tinned-iron mincing machine.

They are never allowed to come in contact with metals other than polished or tinned iron.

Chemical bodies which are soluble, are sometimes used in solution, alcohol, glycerin, ether, or syrup being used as a solvent. They are required to be clear and bright in all cases, and in case of changes of character on keeping, are to be rejected.

These ten per cent. tinctures or solutions are seldom administered as made, but in nearly all cases are diluted.

The *dilutions* are all made in decimal proportion, and are termed *dilutions*, *attenuations*, or (rarely) *potencies*.

The tinctures or chemicals are designated by the sign θ or Φ, the word tincture or solution not being employed in prescriptions. Thus "aconitum Φ" means "mother tincture of aconite;" "acid nitricum Φ" means strong solution of nitric acid.

The dilutions are of two grades, the *decimal* and the *centesimal*. The former are denoted by numbers followed by X, and usually only the odd numbers are employed, since the even numbers will correspond to the centesimal dilutions, as 1^X, 3^X, 5^X, 7^X, etc. (2^X would correspond to the first centesimal dilution, 4^X to the second, etc.).

The centesimal dilutions are designated by simple numbers, as 1, 2, 3, 4, 5, etc.

The decimal dilutions are made by placing 10 minims of the mother tincture in a bottle and adding to it 90 minims of spirit of the same strength as the menstruum in the tincture. This is shaken with several jerks of the arm, and constitutes the first dilution, 1^X. The second dilution is made in the same way, using 1^X in place of Φ, and the mixture then constitutes the second dilution. For the third dilution, and all thereafter, strong alcohol is used. The second dilution is usually made with an alcohol intermediate in strength between that of the menstruum and strong alcohol.

The centesimal dilutions are made by shaking 1 minim of mother tincture with 99 minims of menstruum, this making the first centesimal dilution, or 1.

The second is made in like manner, using 1 minim of the first and 99 minims of the spirit.

Like the decimal dilutions, all the centesimal dilutions after the second are made with strong alcohol.

Both the decimal and centesimal dilutions can be carried up to the thousanths, and the thirty-thousandth dilution has been called for, but usually the third decimal or the sixth or thirtieth centesimal dilution is called for.

The bottles in which these or the mother tinctures, solutions, etc , are kept should be cleansed, then rinsed with distilled water, and never used for any other variety. The diluting should be done in diffused light, not in direct sunlight.

Triturations are mixtures of medicinal substances with sugar of milk. The medicinal substance is in most cases a chemical or insoluble body, but occasionally triturations are made by absorbing tinctures or dilutions in sugar of milk. The object of triturations is not only to diffuse and dilute the medicinal substance, but also, by long trituration, to subdivide it into the finest possible powder. Consequently a simple mixing, as by means of a sieve, will not suffice, but the two must be triturated together.

Sugar of milk is selected as a base because (1) it is devoid of medicinal action, and (2) because its crystals are very hard and of use in grinding the substance.

Wedgwood or porcelain mortars, and spatulas of bone, horn or glass, are directed to be used in making triturations.

The triturations correspond in strength to the dilutions, being of decimal or centesimal strength. The medicinal substance and the sugar of milk should both be in fine powder before mixing. If sifting is necessary, a sieve made of hair cloth is directed.

To make the first decimal trituration, the substance is placed in a clean wedgwood mortar, and an equal weight of sugar of milk is added. These are first mixed by stirring with a glass spatula for a few moments, then they are triturated with force for six minutes, after which four minutes are occupied with scraping the powder from the sides of the mortar and pestle and mixing with the spatula, and then the trituration and scraping are repeated.

Then three parts (or three times the original weight) more of sugar of milk are added and triturated in the same way for twenty minutes, and finally five parts more of sugar of milk are poured in and triturated twenty minutes. An hour is thus occupied in making the first decimal trituration, but since most of the grinding action will necessarily be brought to bear upon the drug in making this, only half an hour is required in making each succeeding trituration. The sugar of milk is added in three portions as at first, each portion being triturated ten minutes.

The centesimal triturations are made preferably from the decimal, or at least from the first decimal trituration.

In making triturations it is recommended that a separate or special mortar be used for each kind, since the power is extended from the remedy to the mortar. Where this cannot be done, it is required that the mortar be first cleansed thoroughly, then purified by burning alcohol in it.

If triturations are made in the drug stores, a wedgwood mortar and pestle should be set aside for this work alone, so that those which are used for general work will not be used also for this.

Homeopathic remedies are dispensed in powders, attenuations and globules.

Rarely the tinctures are dispensed and directed to be added to a definite amount of water, of which a teaspoonful or a certain number of drops are to be taken.

The powders consist of sugar of milk, to which a given quantity of a trituration or of a dilution or tincture is added.

If the latter is used, it must be remembered that a weak alcohol will soften and partially dissolve the sugar of milk. Tincture triturations are sometimes made of which one grain corresponds to one minim of tincture.

The powders may be divided and dispensed in papers in the usual way.

The globules or pellets are little pilules of cane sugar, which are used as vehicles for the dilutions, in this providing for the administration of fractions of a drop.

They come of various sizes, designated by numbers, the latter corresponding to the number of millimeters which ten pellets measure when placed in a row.

They are medicated by filling a vial loosely with the pellets, then pouring over them the required attenuation.

The 3x or higher dilution is commonly used. After standing a few minutes to allow of absorption, the liquid is drained off and the pellets allowed to dry.

In some sections it is customary to dispense them with a portion of the liquid in the bottle, the pellets, of course, being undried. It is stated that a 75 per cent. alcohol absorbs better than 90 per cent., and in some cases the globules are directed to be moistened with water before adding the alcoholic solution, to facilitate absorption.

It is largely for the purpose of medicating globules, however, that dilutions are made with alcohol instead of water.

Homeopathic prescriptions are usually abbreviated to an extreme, the nomenclature allowing of this without ambiguity. The strength of preparation usually follows the name, and after this the quantity.

The strength and quantity may also be written in fraction form, the numerator then corresponding to the quantity, and the denominator to the strength, as

℞ Ferri mur. . . . . 3x gtt. vi.
  Aquæ destill. . . . . . . ʒii. M. Or

℞ Tinct. Ferri mur. . . . . . $\frac{6}{3}$x
  Aquæ Destill. . . . . . ʒii. M.

Six drops of the third decimal dilution of tincture of muriate of iron are to be diluted with two fluid ounces of distilled water.

℞ Aconiti . . . . gtt. $\frac{3}{3}$.
  Aquæ Dest. . . . . ℥vi. M. Or

℞ Tinct. Aconiti . . . . 3 gtt. iii.
  Aquæ Destillat. . . . . . ℥vi. M.

Three drops of the third centesimal dilution of tincture of aconite are to be added to six fluid ounces of distilled water.

℞ Trit. Natr. mur. . . . . . 30 gr. xij.
Sacchar. Lactis . . . . . q. s.
M. ft. pulv. . . . . xij no. Or
℞ Natr. mur. . . . . gr. $\frac{12}{30}$.
Sacchar. Lactis . . . . . q. s.
M. ft. pulv. . . . . xij. no.

Twelve grains of the thirtieth centesimal dilution of sodium chloride are to be mixed with sufficient sugar of milk and divided into twelve powders.

℞ Pil. Nux V. . . . . $\frac{50}{12}$. Or
℞ Nux V. . . . . 12, pil. *L.*

Fifty pills (or globules) of the twelfth centesimal dilution are desired.

℞ Tinct. Bellad. . . . . θ gtt. ij.
Aquæ Destill. . . . . ℥iv. M.

Two drops of mother-tincture of belladonna are to be added to four fluid ounces of distilled water.

Whatever may be thought of homeopathic remedies and methods, the pharmacist who accepts prescriptions from homeopathic physicians owes it as much to them as to any to prepare such, as far as possible, in accordance with the ideas and wishes of the prescribers.

CHAPTER XIV.

INCOMPATIBILITY.

THE subject of incompatibility is an exceedingly broad and deep one. It means an intimate knowledge of chemical physics and chemical reactions, and since these are constantly being increased, the question of incompatibilities can be said to have no end. As long as pharmacy exists there will be something to learn in this line, and no man can be said to know it all. There is, however, a great difference between *possible* and *probable* incompatibilities, and the study of the latter is not a formidable one, " if there exists primarily a clear knowledge of the chemical and pharmaceutical properties of the substances used." The best and easiest method of acquainting one's self with the general subject of chemical incompatibility is by a study of qualitative analysis, and it is chiefly for this reason that this subject is now taught in colleges of pharmacy. After a course in qualitative analysis and a systematic study of the official preparations and processes, the student possesses a foundation upon which quite a clear understanding of the usual incompatibilities may be based.

Success at the prescription counter rests very largely upon a correct application of the principles included in these. In no way can the pharmacist be as helpful to the physician as in the correction of incompatibilities, and it were well if every retail pharmacist could have an understanding with the physicians in his vicinity that prescriptions which can be improved without (*positively*) any alteration in medicinal properties, should be so treated by the pharmacist, and full notes of such changes sent immediately to the physician, either by mail or with the medicine to the house of the patient. It should be noted, however, that any study of this sort means not only a study of incompatibilities, but also of the *means of overcoming them.* The physician, like other people, does not like to be told what he *cannot or must not* do ; he wishes to know what he *can* do, and if improvements are to be made, he is usually ready to listen.

This phase of the situation is too often neglected by retail pharmacists, to the advantage and profit of the manufacturer, who makes it his chief aim to produce elegant and presentable combinations, which the physicians desire.

Therefore, ***study first to know the incompatibilities, and second,*** (*more assiduously*) ***to know how they may be overcome.*** The following notes are arranged with this object in view.

Incompatibilities are of three kinds: therapeutical, pharmaceutical and chemical.

Therapeutical Incompatibilities.

Therapeutical incompatibilities are those in which drugs are combined, which act contrary to each other upon the system. This is purely a question of the medicinal action of drugs, and is beyond the ken of pharmacists. Unless it is obvious that the physician has written absent-mindedly, and ordered combinations which can scarcely be desirable under any circumstances, or has prescribed dangerous doses, the question of action should never be raised by the pharmacist in order to correct.

It is well also to remember that antagonistic remedies may be purposely prescribed together, one acting perhaps as a corrective of the other. This is a condition which is found oftentimes in nature, as in rhubarb, which contains both a cathartic and an astringent principle; in digitalis, which contains certain principles which powerfully contract the arteries, and another which dilates them; and in jaborandi, opium and many other drugs, which contain antagonistic principles, but in such proportions that one does not neutralize another, but only modifies or corrects its action.

The pharmacist should never attempt to judge the physician in these matters, but *should ever be on the alert for unusual and dangerous doses or combinations.* It is for the physician to excel in the details of therapeutics, and for the pharmacist to excel in the details of chemistry and physics.

Pharmaceutical Incompatibilities.

Pharmaceutical, or physical incompatibilities are chiefly cases of insolubility, as when a body which should be administered in solution is insoluble in the combined ingredients of the mixture, or when a body already dissolved is thrown out of solution by admixture with other bodies. Bodies which are insoluble in the ordinary solvents are not considered incompatible in this sense, unless the nature of the mixture is such that an even diffusion of the insoluble substance cannot be readily obtained.

The larger proportion of pharmaceutical incompatibilities can be remedied by changes in the solvent or by some protective or suspending agent. A clear solution cannot always be obtained, but this may not be necessary when a homogeneous mixture which can be depended upon to yield an even dose each time of all ingredients is secured. The treatment of these calls for an intimate knowledge of all the common remedies in the ordinary solvents, which can only be learned gradually. It affords an interesting and profitable field for study which is never-ending, yet not discouraging, and is, moreover, a direct means of success to a pharmacist, in many cases.

Among the most common illustrations of physical incompatibilities are:

(*a*) Mixtures of alcoholic tinctures, fluid extracts, etc., with aqueous fluids, the dissolved drug-principles being thrown out of solution.

(*b*) Solutions of metallic salts in aromatic salts, the aromatic oil being thrown out of solution; or solutions of salts in hydro-alcoholic liquids, the alcohol being separated.

(*c*) Supersaturated solutions which should not be filtered.

(*d*) Mucilaginous and albuminous bodies with strong alcoholic liquids.

There are four general methods of remedying or preventing physical incompatibilities:

1. By the order of mixing.
2. By changes in the bulk of the mixture, whereby the alcoholic or solution strength is kept within certain limits.
3. By alterations in the solvents used.
4. By emulsifying or suspending the troublesome body with gums or syrups.

1. The order of mixing has much to do with the final appearance of the mixture. When a prescription is received, the first thought of the dispenser should be, "In what order should these be mixed?" Oftentimes two ingredients, which alone are incompatible, can be made presentable by first mixing one or both with other ingredients of the mixture. It is always easier to *prevent* precipitation or ill appearance than to remedy it, and the order of mixing oftentimes avails in this way. When a mixture calls for a strong alcoholic liquid to be mixed with weaker alcoholic fluids and water, the strongly alcoholic liquid should be gradually diluted with the weaker, and the water added last. By this procedure a less voluminous precipitation occurs.

If a resinous tincture is to be mixed with water, no protective agent being allowable, *the water should be cold and the tincture added to it* in a fine stream, not vice versa. The resinous matters are thus precipitated in a fine condition, and easily diffuse upon shaking. Compound tincture of benzoin, and tincture of myrrh are frequently prescribed in this way. Camphoraceous solutions should also be added to the water, unless other bodies are present which will prevent their separation, when the solution is protected by this before being mixed with water.

2. *Changes in the total bulk of the mixture.*—The alcoholic strength of a mixture frequently determines whether a salt shall remain in solution or not, and contrariwise the presence of a salt in large proportion, which is soluble in water but insoluble in alcohol, may prevent the mixing of alcoholic fluids.

The alkaloids in certain combinations are the most frequent cases of the first kind. Strychnine in combination with bromides, iodides, and other metallic salts, requires the presence of at least 12 per cent. of alcohol to hold it in solution. In the elixir of iron, quinine, and strychnine phosphates of the National Formulary, the alkaloid phosphates are held in solution by the alcohol, and if the elixir is diluted with water, these are precipitated. In such cases it is not the *amount* of alcohol present which holds the salt in solution, but the *proportion or percentage* strength of the mixture; hence the problem is simply to keep the alcoholic strength of the mixture, up to that necessary for complete solution. When alcoholic liquids are combined with water, this is best accomplished, not by adding alcohol, but by reducing the quantity of water so that the finished solution measures just half of that originally intended, the dose being changed accordingly.

In the opposite class, when a concentrated solution of a salt throws out of solution a salt which is commonly soluble in water, the simplest remedy is to double the measure of the mixture by addition of water, the dose also being doubled. No. 339 illustrates this. *But such changes in the volumes and doses of prescriptions should never be made without the knowledge and consent of the physician.*

Suggestions for diluting might also be made to the patient whenever it is judged that such will be received intelligently, and without criticism upon the prescriber.

In cases of supersaturated solutions, the insoluble body should be powdered finely, so that agitation will diffuse it evenly throughout the liquid. Never use heat to dissolve the excess of salt, and do not filter.

3. *By alterations in the solvents or by protective agents.*—This requires a pretty thorough knowledge of the comparative value of the different solvents upon the different principles, salts, etc., when in combination. This means something more than the question whether the body is soluble in so many parts of such and such a solvent; it means also the question whether certain *solutions* can be combined without precipitating one of the dissolved bodies.

Water is the great solvent, but aqueous solutions of some salts may not be miscible with alcohol without separation either of the salt or of the alcohol. Much also depends upon the *strength* as well as the *nature* of the solutions, weak solutions often being miscible when strong ones are not.

The chief solvents to be considered in this connection are water, alcohol and glycerin.

Water dissolves gums, albuminous bodies, mucilages, and starch, but these solutions are not miscible with alcohol unless diluted. It dissolves many salts, some of which are precipitated on addition of alcohol, and some are not. Solutions of sugar and other neutral principles in water, are not affected by alcohol, unless in extreme proportions.

Alcohol ranks next to water as a solvent. It dissolves most organic bodies except the carbohydrates (sugars, gums, and starches), such as alkaloids, glucosides, organic acids, neutral principles, volatile oils (only one fixed oil, viz.: castor oil), resins, balsams, camphors; and most of these are thrown out of solution by diluting with water. Many metallic salts are also soluble in alcohol. Mr. Frank X. Moerk has given the following statements regardirlg these:

"Metallic salts, soluble in alcohol and water, as a rule, become more soluble as the alcohol is more dilute,—an exception is mercuric chloride.

"Metallic salts soluble in water are not necessarily soluble in alcohol. The converse, however, appears to be true with one important exception, namely: mercuric iodide, which, while soluble in alcohol, is not appreciably soluble in water.

"Metallic salts which *effloresce* are *not soluble* in alcohol. (Exceptions: lead acetate and sodium hydrate.)

"Metallic salts which *deliquesce are soluble* in alcohol. (Exceptions: potassium carbonate and phosphate.)"

"The *metallic salts which are soluble in alcohol* are acetates (excepting mercurous, and silver), benzoates (generally), bromides, chlorates (excepting potassium chlorate), chlorides (excepting those of sodium, potassium, ammonium, silver, lead, and mercurous), iodides (excepting lead, silver, and mercurous), nitrates (excepting potassium, lead, and bismuth subnitrate), salicylates (excepting mercury and bismuth), and valerianates."

"*Metallic salts insoluble in alcohol are* arsenates, arsenites, borates, bromates, carbonates, chromates, citrates, cyanides (excepting mercuric cyanide), ferri-cyanides, ferro-cyanides, fluorides, gallates, hydrates (excepting potassium, sodium and ammonium), hypochlorites, hypophosphites (excepting potassium, sodium and ammonium), hyposulphites (thiosulphates), nitrates, oxalates, oxides, permanganates, phosphates, pyrophosphates, silicates, succinates (excepting those of iron and the alkaline metals), sulphates (excepting ferric and platinic), sulphides (excepting potassium, sodium and ammonium), tannates and tartrates."

It will be noticed from the above list that *most of the acetates, benzoates, nitrates, salicylates, valerianates, and halogen salts* (*i. e.*, chlorides, bromides and iodides, which are mostly deliquescent) *are soluble in alchohol, while nearly all others are insoluble, except those which are also deliquescent.*

Glycerin lies between alcohol and water in solvent properties, dissolving many bodies which are soluble in both. It is an excellent solvent for tannic acid, borax (which it decomposes, developing an acid reaction), carbolic, gallic, and boric acids, creosote, iodine, starch, and many of the metallic salts. It also dissolves normal bismuth nitrate and other similar salts, which are decomposed by water. Glycerin is unobjectionable therapeutically, and is therefore preferred to alcohol in many cases. It is frequently added to prescriptions in the place of a portion of the water, to hold bodies in solution.

Besides these solvents, the use of other salts to dissolve insoluble salts, as given in the table of compound solvents in the chapter on mixtures, is sometimes allowable. This should be practiced very cautiously, as in some cases the medicinal action is altered thereby.

4. *Emulsifying, or suspending the troublesome body with gums or syrup.*—In cases where solution cannot be maintained or secured, it is often advisable to insure an even diffusion of the insoluble body by emulsifying it or incorporating it with a viscid liquid, so that it cannot settle quickly.

When acacia is used, it should be remembered that strong alcoholic liquids cannot be added directly, but a dilute mucilage must be made, to which the alcoholic fluid is gradually added.

Many resinous tinctures, fluid extracts, etc., are suspended in this way.

When tragacanth is used the best results are secured by adding the tincture or fluid extract directly to the powdered drug, and after shaking these together, water is added in the proportion of one of gum to twenty of water, and the mixture should be shaken vigorously until the gum is swollen. Insoluble salts are sometimes suspended by means of tragacanth. Syrup as a suspending agent is used mostly for bodies of light density.

Chemical Incompatibilities.

Chemical incompatibility may be known in three ways: By precipitation, or the formation of insoluble compounds; by effervescence, or the evolution of gases; and by changes in color.

Chemical incompatibilities are the most difficult of all to overcome, and in fact cannot be overcome except in very weak cases.

Glycerin and syrup will often retard changes, and in a very few cases prevent it entirely. These are frequently used in cases where changes occur slowly, if at all.

When one of these is present it should be added to one of the suspected ingredients before adding the other. In the absence of these a good rule to follow is to *dilute the reacting ingredients to their full extent before mixing* (*i. e.*, keep them as far apart as possible), *and to mix them cold.*

Precipitation, or the formation of insoluble compounds, forms the largest class of incompatibilities. These take place according to the general rule that *when two salts can by interchange of radicals form an insoluble salt in the liquid present, such insoluble salt will be formed and precipitated.* By the term salt is here meant all combinations of basic (positive) and acid (negative) radicals, acids being considered salts of hydrogen in this sense.

The salts which react may be both soluble, or one or both insoluble, since reactions can take place between dry and insoluble salts.

Insoluble salts are never inert, but they act more slowly upon the system than soluble salts. Thus we know that the antidote for poisoning by corrosive sublimate is white of an egg, an insoluble albuminate of mercury being formed, but if this insoluble albuminate is allowed to remain in the stomach the poisonous action will continue, though more slowly.

Consequently in cases of poisoning by metallic salts an antidote is first given, which, by reaction, will form an insoluble salt, then this is removed from the stomach by an emetic, the emetic being nearly as important as the antidote.

Thus, because of the varying action of medicines in their different forms, incompatible mixtures may be purposely ordered. Whether this is the case in any particular mixture must be decided largely by the dispenser, since upon a proper interpretation of the physician's intentions depends the correct compounding of prescriptions. No positive rule can be laid down for determining this, except that a change in a mixture which results in compounds having a totally different therapeutic action from that of the original ingredients, cannot be considered as designed.

Furthermore, incompatibilities cannot always be foretold, and it may not be until after the prescription has been compounded that they are detected.

Each new prescription thus becomes "a law unto itself," and expertness in compounding is only acquired by combined study and experience.

In the following notes on solubility, etc., reference is made to *pure salts*, but it must be remembered that incompatibility is often due to impurities in the salts used.

Acetates are all soluble except quinine acetate. Silver and mercurous are sparingly soluble. Ferric and aluminum acetates become basic and insoluble easily, and many others lose acetic acid on exposure to the air, becoming carbonated.

Arsenites are insoluble except those of the alkali metals. All are soluble in hydrochloric acid, and some in ammonium chloride or nitrate. The soluble arsenites act slowly as reducing agents.

Benzoates are mostly soluble. They are easily decomposed by mineral acids, the benzoic acid being thrown out of solution.

Borates are insoluble except those of the alkali metals, but the metallic borates are soluble in an excess of boric or tartaric acids, or in borax and tartrates.

Borax is decomposed by glycerin, and also by glucose, which liberate free boric acid, thus making it incompatible with carbonates, and compatible with alkaloids and many metallic salts, in the presence of these bodies.

$$(1)\ 2C_3H_5(OH)_3+Na_2B_4O_7=2C_3H_5BO_3+2NaBO_2+3H_2O.$$
$$(2)\ C_3H_5BO_3+3H_2O=C_3H_5(OH)_3+H_3BO_3.$$

Borax also causes mucilage to become gelatinous. This is overcome by sugar.

Bromides are soluble, except the mercurous, lead, silver, bismuth, and antimony bromides, the latter two being decomposed by water. Non-metallic bromides are also decomposed by water. Mercurous bromide decomposes into mercuric bromide and metallic mercury, making mercurous salts dangerously incompatible with bromides.

The alkaline bromides frequently contain traces of bromate (which liberates free bromine in contact with acids) and carbonate (which precipitates metallic salts as carbonates) as impurities.

Carbonates are insoluble, except those of the alkali metals. Most of the metallic carbonates are basic salts, and some of these are soluble in an excess of carbonic acid, bicarbonates being formed which are (many of them) soluble. Thus with very cold solutions bicarbonates can sometimes be mixed with certain metallic salts without precipitation, but in most cases an insoluble basic carbonate results, and an effervescence is caused by the escape of carbon dioxide. The carbonates are decomposed by all acids except hydrocyanic.

Chlorides are soluble, except those of lead, mercurous and silver. Hydrochloric acid decomposes nitric acid and nitrates, liberating free chlorine.

Chlorates and *Hypochlorites* are all soluble. They are decomposed by strong acids (the former being fairly permanent if the acid is very weak), liberating free chlorine. They also act as oxidizing agents. Their explosive properties are treated under "explosive mixtures." Sodium chlorate is much more soluble than potassium chlorate.

Chromates are mostly insoluble in water, but soluble in nitric acid. They are powerful oxidizing agents, and the alkaline chromates decompose many metallic salts, particularly in acid solutions.

Citrates, except the alkaline citrates, are mostly insoluble or sparingly soluble in water. Citrate of magnesium crystallizes in three different forms, containing 3, 5, and 7 molecules, respectively, of water of crystallization. The first two are quite soluble in water, but the last is only sparingly so, and it is this salt which deposits in solution of magnesium citrate bottles. The alkaline citrates (in neutral or alkaline solutions, but not in those which contain an excess of mineral acids) have the power of dissolving a large number of the insoluble metallic salts, notably those of iron, bismuth and lead. The scaled salts of phosphate and pyrophosphates of iron, and the elixir of phosphate of iron, etc., are instances of such.

Cyanides are insoluble, except those of the alkali metals, alkaline earths and mercuric. All are soluble, however, in an excess of potassium cyanide, or in hydrocyanic and other acids.

The alkaline cyanides usually have an alkaline reaction, and precipitate the alkaloids from their salt solutions.

Ferricyanides and *Ferrocyanides* are mostly insoluble, except those of the alkali metals and the alkaline earths. Most of them are soluble either in acids or caustic alkalies.

Ferricyanide of potassium acts as an oxidizing agent in alkaline solutions.

Ferrocyanides are easily decomposed by acids, liberating the poisonous hydrocyanic acid. (The ferri- and ferrocyanides are not, in themselves, poisonous.) With weak acids the decomposition may be very slow. (Moerk.)

Gallates are insoluble in water, with the exception of the alkali gallates. Many of the metallic gallates are soluble in alcohol and in acetic acid and in excess of gallic acid. Alkaloids are *not* precipitated by gallic acid, unless tannic acid is also present.

Hydrates are insoluble, except those of the alkalies and alkaline earths, and of lead. They neutralize acids, forming the corresponding salts. The hydrates of aluminum, zinc, lead, tin, gold and platinum are soluble in excess of sodium or potassium hydrate.

Alkaloids are precipitated by the fixed alkalies (hydrates of sodium and potassium), and by ammonium hydrate, some of them being also soluble in excess.

Hypochlorites are all soluble, but are very unstable, decomposing even in the cold. They are more permanent in alkaline solutions. Decomposition is hastened by sunlight and by heat. They are powerful oxidizing agents.

Hypophosphites are mostly soluble in water, and are decomposed by most acids. They are strong reducing agents, changing under certain conditions to phosphates, which are mostly insoluble.

Hyposulphites true are seldom found. Sodium hyposulphite, so-called, is really sodium thiosulphate. This precipitates sulphur when in contact with acids.

It is also a strong reducing agent, and decolorizes solutions of iodine, forming sodium iodide and sodium tetrathionate. It also dissolves many of the insoluble salts of silver and mercury.

Iodides are all soluble except those of lead, mercury, silver and cuprous.

The alkaline iodides frequently contain *iodate*, which liberates free iodine in contact with mineral acids. The soluble iodides are also decomposed by nitric and nitrous acids, and by ferric and cupric salts, liberating free iodine.

The alkali iodides are excellent solvents for iodine.

Iodine in alkaline alcoholic liquids forms iodoform, hence tincture of iodine is incompatible with the weakest alkalies. An excess of alkali forms the colorless iodide. It also forms colorless compounds with volatile oils, tannin, hyposulphites, sulphites, and alkaline carbonates.

Nitrates are all soluble. Bismuth nitrate is soluble in glycerin, but is decomposed by water, forming the basic "subnitrate." Nitric acid is a powerful oxidizing agent, and is reduced sometimes with explosive violence by organic matter. It also decomposes chlorides and iodides.

Nitrites are soluble, except silver and lead nitrites. As a rule they are less soluble than the nitrates. Neutral nitrites are generally compatible, but in acid mixtures nitrous acid is liberated, which acts sometimes as an oxidizing and sometimes as a reducing agent. Spirit of nitrous ether is troublesome for this reason, decomposing easily and liberating free nitrous acid, which then reacts with liquids containing tannin (liberating nitrous fumes), with iodides (liberating iodine), and with solution of ammonium acetate (liberating carbon-monoxide and other gases). These reactions may be prevented, or at least hindered, by first neutralizing the spirit of nitrous ether with potassium bicarbonate.

Oxalates are mostly insoluble. Tetroxalate of potassium dissolves several of the insoluble salts of iron, tannate, etc.

Oxides are insoluble, except those of the alkaline earths. The only oxides from which trouble is to be anticipated in prescriptions are chromic and silver oxides and hydrogen peroxide. All these are oxidizing agents, and should be prescribed alone.

Permanganates are all soluble.

Phosphates are nearly all insoluble, but are soluble in excess of phosphoric, nitric or hydrochloric acid. Some are also soluble in solutions of organic acids, under favorable circumstances. The insoluble phosphates are also soluble in alkaline citrates, except magnesium phosphate, and these are miscible with metaphosphoric acid.

Salicylates.—Salicylic acid and quinine salicylates are the most important of the *in*soluble salicylates met with in pharmacy.

Sodium salicylate is slightly acid in reaction, since if alkaline it is discolored.

Succinates are mostly soluble. The insoluble succinates are dissolved by potassium acetate or citrate solutions.

Sulphates are soluble in water, except those of barium, strontium, calcium, lead, antimony, mercurous and silver. Several of them are soluble in glycerin, but nearly all are insoluble, or but slightly soluble in alcohol.

Sulphides are insoluble, except those of the alkali metals and alkaline earths. All are decomposed easily by acids.

Sulphites are mostly insoluble, except those of the alkali metals, but soluble in acetic and mineral acids.

Tannates are very unstable, and the basic salts of the heavier metals are insoluble, hence the metallic salts in general yield precipitates when in contact with preparations containing tannin. Gelatin, starch and albumin are also precipitated by tannin.

Tartrates.—The normal tartrates are mostly insoluble, but the acid tartrates are mostly soluble, potassium and ammonium bitartrates being notable exceptions.

Valerianates are mostly soluble, but are decomposed by many acids, liberating insoluble valerianic acid.

Acids are incompatible with alkalies and alkaloids, and cause effervescence with carbonates.

The mineral acids displace the weaker organic acids from their salts, and these may be thrown out of solution. They also dissolve oxides.

It should be borne in mind that acids are contained in the official vinegars (aceta), in extract of colchicum, fluid extracts of conium, ergot, nux vomica and sanguinaria, tincture of sanguinaria, solution of ammonium acetate, syrups of citric acid, hydriodic acid, garlic, calcium lactophosphate, hypophosphites, ipecac, lemon, and squill, in citrate of iron and quinine, solution of acetate of iron, of arsenous acid, of ferric chloride, of ferric nitrate, and infusions of cinchona and rose, paregoric and Basham's mixture.

Alkalies are incompatible with acids, with metallic salts, alkaloid salts, chloral, and organic matter in general.

The following preparations contain alkalies: Glycerin suppositories, Fowler's solution, fluid extracts of licorice and senega, syrups of rhubarb and senega, compound iron mixture and pill, seidlitz powders, rhubarb and soda mixture, ammonia liniment, lime liniment.

In the following consideration of the bases the *pure* salts are referred to, but it should be borne in mind that trouble may be caused by impurities in the salts used. In a few cases attention is called to these.

Aluminum.—The borate, hydrate, oxalate and phosphate are insoluble. Alum and aluminum sulphate precipitate organic and coloring matters from impure water, and are sometimes used for this purpose when a clear and colorless water is desired in large quantities for washing white precipitates, etc.

Dried alum is very slowly soluble, and may be partially insoluble if overheated in drying.

Ammonium.—The bitartrate is only slowly soluble. All the ammonium salts are decomposed by potassium and sodium hydrates and carbonates, liberating gaseous ammonia.

Ammonium acetate and valerianate are very unstable, losing both ammonia and acid. For this reason the former is known to pharmacists only in solution. Ammonium carbonate loses both carbonic acid gas and ammonia, and becomes bicarbonate.

Ammonium hydrate is official in four forms, as water of ammonia, stronger water of ammonia, spirit of ammonia and aromatic spirit of ammonia. The spirit of ammonia is intended for use in mixtures in which water would cause precipitation, the alcoholic solution being clearly miscible with collodion, tinctures, etc. Care should be used in mixing ammonia water and spirits with preparations containing free iodine, lest the highly explosive compound NHI_2 be formed.

Ammonium chloride tablets containing potassium chlorate have also been known to explode.

Ammonium salts, particularly the acetate, citrate and chloride, have the property of dissolving many of the insoluble salts of the heavy metals.

Antimony.—Only the acetate and tartrate are soluble, but many of the other salts are soluble in strongly acid solutions. Solutions of the tartrate are liable to decompose slowly unless free acid is present.

Antimony salts precipitate tannin, mucilage and albumin.

The sulphides and oxide are used only in powders, and the former should be mixed cautiously with oxidizing agents.

Tartar emetic (antimony and potassium tartrate) is found in wine of antimony and in compound syrup of squill.

Arsenic.—Arsenic and its compounds act as acids in most cases. The sulphide is insoluble in acid, but soluble in alkaline solutions. It is not easily compatible with other bodies in fluid form, and is used largely in pills, where, owing to its very slow and slight solubility, reactions do not occur easily. There are four solutions official, all of about the same strength and dose, and intended chiefly to be chosen in regard to compatibility. One is an acid solution, one an alkaline, and two are neutral.

Solution of arsenous acid, "Valangin's Solution," is acid with hydrochloric acid, and is intended for admixture with tincture of chloride of iron and similar preparations. Solution of potassium arsenite, "Fowler's Solution," is alkaline with potassium carbonate, and is intended for use in neutral or alkaline mixtures in the absence of metallic salts. Solution of sodium arsenate is neutral, and also contains the arsenic in an *ic* condition, so that it is better compatible with oxidizing agents. This solution is sometimes improperly called "Pearson's Solution." Solution of arsenic and mercury iodides, "Donovan's Solution," is also neutral. It is precipitated by alkalies, and is itself a precipitant of alkaloids and silver salts, hence it is incompatible with solutions containing alkaloids, unless sufficient alcohol be present to hold these in solution.

Solution of arsenate and bromide of potassium, N. F., "Clemens' Solution," is also almost neutral, and corresponds in strength and compatibility to the official solution of arsenate of sodium.

Barium.—The carbonate, chromate, cyanide, oxalate, peroxide, phosphate, sulphate, and sulphite, are insoluble. Barium salts are very poisonous and are never used internally.

Bismuth.—Only the acetate is soluble. The other salts are insoluble or only soluble in highly acidulated water. Bismuth nitrate is slowly soluble in glycerin, but should not be triturated therewith, lest it be decomposed and an explosion follow.

The subnitrate and subcarbonate react somewhat readily with other bodies in fluid mixtures; bismuth subnitrate reacts with soluble iodides, forming the red oxyiodide, which reduces in acid solutions to black iodide; with soluble salicylates the red nitrosalicylate of bismuth may be formed; wfth sodium bicarbonate an interchange of radicals takes place slowly, a very basic bismuth subcarbonate being formed, with sodium nitrate and an evolution of carbonic acid gas, which may burst the bottle. The subcarbonate of bismuth should be used in the last case in place of the subnitrate.

The only solution of bismuth in use is that of the ammonio-citrate, in which bismuth citrate is dissolved in a solution of ammonium citrate. Strong acids decompose the latter salt, and precipitate the bismuth as a normal citrate.

Calcium.—The arsenite, borate, carbonate, citrate, oxalate, phosphate, sulphate, and tartrate, are insoluble. Calcium hydrate and citrate are more soluble in cold than in warm water, and the hydrate is much more soluble in syrup than in water. On the other hand, calcium hypophosphite is thrown out of solution by an excess of sugar. The carbonate is soluble in water charged with carbonic acid gas, becoming bicarbonate.

Copper.—Only the acetate, chlorate, chloride, nitrate, permanganate and sulphate are soluble, the other salts insoluble. Ammonia water dissolves the hydroxide, and this solution dissolves filter paper, cotton, etc. (Much depends upon the condition of the ammonio-copper solution as a solvent for cellulose; it oftentimes fails to act well for this purpose.)

Gold.—Only the bromide and chloride are soluble. Gold salts are reduced with extreme ease by all reducing agents, including ferrous salts, etc., the gold being deposited as a brick-red powder. Alkaloidal salts form insoluble double salts.

Iron.—Reduced iron usually contains some sulphide which may be troublesome if used for manufacturing small quantities of a salt by dissolving the iron in an acid. Sulphuretted hydrogen is thus formed, a part of which will remain in the liquid.

Ferrous borate, carbonate, cyanide, ferricyanide, hydrate, oxalate, phosphate, sulphide, tannate, and tartrate are insoluble. The pure ferrous salts are all bright green, but they oxidize readily and darken in color, becoming bluish or reddish-brown. They should be preserved in the light and in well-stoppered bottles. Sunlight will sometimes restore a solution which has partially oxidized. Sugar and glycerin hinder the oxidation. They are all incompatible with oxidizing agents.

The alkaline citrates dissolve the insoluble ferrous salts and also modify their astringent taste.

Ferric arsenite, borate, chromate, carbonate, ferrocyanide, hydrate, oxalate, phosphate, sulphite and tannate are insoluble. Ferric salts are reddish-brown in color (except the true phosphate), and should be preserved from the light, which reduces them.

Those containing a volatile acid radical, as the acetate, chloride, nitrate, etc., easily lose a portion of the acid and become basic and insoluble. These may be restored by the cautious addition of a little acid, with the aid of a gentle heat, except the acetate, nitrate, and subsulphate, the last of which should be rejected or turned into tersulphate when it refuses to dissolve by aid of heat.

Alkaline citrates and sugar dissolve many of the insoluble salts of iron. This is the case with most of the scale salts, which are combinations of a salt of iron with an alkaline citrate or tartrate.

The iron is not precipitated from these by addition of an alkali, except on heating, but small amounts of mineral acids will sometimes decompose them by destroying the alkaline citrate or tartrate. An excess of the same mineral acid will usually re-dissolve the iron salt.

Iron hydrate and oxide is dissolved by sugar, under proper conditions (*i. e.*, when the hydrate or oxide is free from excess of alkali), and this solution does not show the common reactions of iron unless acidulated. Dialyzed iron acts in the same way as the hydrate, and may be used as a (poor) substitute for the latter in arsenical poisoning.

The inorganic ferric salts liberate iodine from potassium iodide. Ferric acetate does not do this, but will decompose syrup of hydriodic acid, liberating free iodine. This is one reason for the use of syrup and pills of ferrous iodide, the former of which is compatible with the soluble iodides.

Ferric chloride is incompatible with silver and mercurous salts, with alkalies, arsenites and arsenates, borax, albumen, caseine, vegetable extracts and infusions; it gelatinizes mucilage of acacia, and gives colored compounds with many organic bodies, particularly those containing tannin. (See page 242.)

Lead.—The acetate, subacetate, chlorate, nitrate and nitrite are soluble; all other salts insoluble. Solution of subacetate of lead carbonates on exposure to air, or on diluting with water which has stood contact with air and dissolved carbonic acid gas. The subacetate precipitates most vegetable coloring matters, most organic acids, and acacia. In a few cases, glucosides, and alkaloids are precipitated also.

Lead sulphate is sometimes desired as an astringent in lotions, and is formed by reaction between a soluble lead salt and a soluble sulphate, in preference to using the dry and less diffusible salt.

Lithium.—Most of the lithium salts are soluble, the carbonate and phosphate being least so. The carbonate is quite soluble in water containing carbonic acid gas.

Magnesium.—The borate, carbonate, hydrate, oxalate and phosphate are insoluble.

The carbonate is quite soluble in carbonic acid water, and soluble magnesium salts may be mixed, under favorable conditions, with solutions of alkaline bicarbonates (not carbonates) without precipitation.

Magnesium carbonate always contains some hydrate, which is slightly soluble, and gives an alkaline liquid. For this reason it has been discarded as a distributing agent for the preparation of the aromatic waters, since it renders these incompatible with alkaloidal and metallic salts.

Manganese.—The borate, carbonate, hydrate, oxalate, oxide, phosphide, sulphite and sulphide are insoluble in water.

Manganese salts resemble iron salts in general properties. Except the hypophosphite and (less frequently) the sulphate, they are rarely used.

Mercury.—All the *mercurous* salts are insoluble in water, except the nitrate, and this is decomposed on diluting largely, a basic salt being formed.

The mercurous salts are easily reduced by heavy trituration, contact with metals or reducing agents, and by mixing with certain salts. In all these cases metallic mercury and a mercuric salt are formed.

Hence, mercury salts in general, and mercurous salts in particular, should not be triturated heavily when dry. If necessary to pulverize them (except mercuric chloride) they should be moistened with a little alcohol, water or oil, before rubbing in a mortar.

Contact with certain salts, as bromides, iodides and cyanides reduce them quickly, a more poisonous mercuric salt being formed.

Calomel with chlorides is oxidized slowly to corrosive sublimate, unless the solution is weak All these changes occur more quickly in liquids than in the dry condition, Triturations of calomel with bicarbonate of sodium very slowly form corrosive sublimate, but the change does not occur within four to six weeks ordinarily. Thorough diffusion of calomel through a diluent improves the action of calomel, but the powders so made should not be used when old.

Contact with liquid alkalies changes calomel to the black mercurous oxide.

Most of the mercurous salts are liable to contain traces of the corresponding mercuric salts as impurities.

Mercuric albuminate, arsenate, arsenite, carbonate, ferrocyanide, iodide, iodate, oxalate, oxide, phosphate, sulphide and tartrate, are insoluble.

Except the chloride, all the soluble salts require the presence of free acid for complete solution, being decomposed by water.

The mercuric chloride is more soluble in solution of ammonium chloride; mercuric iodide is readily soluble in solution of potassium or sodium iodide.

The double salt formed by mixing solutions of mercuric chloride and potassium iodide, which is known as Mayer's solution, precipitates all alkaloids from acidulated aqueous solutions, except caffeine and theobromine, but these precipitates are soluble in alcohol.

In a few cases, concentrated solutions of mercuric chloride precipitate alkaloids, and, rarely, some other proximate principles.

Mercuric salts also precipitate albumen, gelatin and tannin, the first (albumen) being given as an antidote to corrosive sublimate poisoning. It is well to know, however, that mercuric albuminate is soluble in excess of albumen and in ammonium chloride solution, and the white of one egg is therefore better as an antidote than the whites of half a dozen. A prompt emetic is necessary in all cases.

Potassium and Sodium.—Only potassium bitartrate is insoluble of the common salts.

Trouble with these is more likely to be found in the impurities than in the salts themselves. Thus the iodides frequently contain small quantities of iodate, which is decomposed by acids, liberating free iodine. The iodate is also poisonous.

When iodides are mixed with spirit of nitrous ether, the latter should be neutralized before mixing, since the presence of mere traces of nitrous acid will liberate the iodine. Such mixtures cannot be kept long without change, unless the nitrous ether is entirely decomposed.

The hypophosphites frequently contain excess of sulphates, which are troublesome when mixed with calcium hypophosphite.

The bicarbonates are readily reduced to carbonates by heat or by hot water.

Silver.—Only the acetate, chlorate, hypophosphite, lactate, nitrate, nitrite and sulphate, are soluble.

All the silver salts are reduced by light, by organic matter, and by reducing agents. They should not be allowed to come in contact with metals (steel spatulas) or with vegetable matter. The oxide is quite unstable, and is liable to explode if triturated with organic matter, or with ammonium salts.

Strontium salts are almost identical with the calcium salts in their chemical properties.

Tin salts are little used except as reagents.

Zinc.—The arsenate, borate, carbonate, cyanide, hydrate, oxalate, oxide, phosphate, sulphide and tartrate are insoluble. Zinc salts are used externally as mild astringents, but are seldom used internally. The oxide is liable to be gritty, preventing the formation of a smooth ointment. Only the fine, pharmaceutical grade should be used.

ORGANIC BODIES.—*Alkaloids* are vegetable alkalies and usually are the active constituents of the plants from which they are derived. They are mostly powerful medicinal agents, many of them being potent poisons. They combine with acids to form salts, in which form they are mostly used. No other plant-principles do this, and consequently alkaloids may be known by their existence in commerce as sulphate, hydrochlorate, hydrobromate, acetate, etc. In the plants they are combined with organic acids peculiar to the plants, as igasuric acid in nux vomica, meconic acid in opium, kinic acid in cinchona, etc. It is important to remember this, since these organic acids oftentimes form insoluble salts with metallic bases, and salts of the heavier metals are therefore incompatible with many preparations of alkaloidal drugs (tinctures, fluid extracts, etc.). In some cases the alkaloid is carried down with the metallic precipitate, though rarely.

The incompatibilities of alkaloids are numerous, and, perhaps, the most important of any class of bodies because of their potency and the liability of an over-dose being taken at the last when the bottle is not shaken each time.

Fortunately, nearly all *the incompatibilities of alkaloids can be overcome by alcohol*, a strength of 15 to 40 per cent. of alcohol sufficing in many cases. Thus, the incompatibilities of alkaloidal tinctures, fluid extracts, etc., may, for the most part, be disregarded, unless an excess of water be also present in the mixture.

Sometimes the alkaloidal salts are thrown out of solution as such by other salts. Thus strychnine salts are mostly insoluble in solutions of inorganic salts, but the addition of alcohol to the extent of 12 per cent. of the mixture, holds them in solution.

The principal precipitants of alkaloids are:

Alkalies and Borax.—These decompose the salts of the alkaloids, liberating the latter as free bodies, which are insoluble in water (except caffeine and theobromine, true salts of which are not used in pharmacy). Borax does not precipitate alkaloids in presence of glycerin. The free alkaloids are all, however, soluble in alcohol. Some alkaloids, notably morphine, are soluble in an excess of caustic alkali, but not in the carbonates.

Iodine and Iodides.—The official compound solution of iodine, known as "Lugol's Solution," is a delicate reagent for most alkaloids, precipitating them even in very dilute solutions. The iodides of potassium, sodium, or ammonium, alone, are not as delicate, but precipitate from stronger solutions, the precipitates being very bulky in some cases.

Solution of mercuric chloride in excess of potassium iodide, known as solution of iodohydrargyrate of potassium, or "Mayer's Solution," is a very delicate and universal precipitant, precipitating all alkaloids from very dilute solutions, except caffeine and theobromine. It acts best upon acid solutions, and has been used for quantitative estimation of alkaloids.

It is found in mixtures when mercuric chloride and potassium iodide are combined in them. Mixtures of this sort with alkaloids or alkaloidal tinctures are not infrequent, but the precipitates with this reagent are all soluble in alcohol, hence none is formed in the presence of a sufficient proportion of spirit.

Double iodide of bismuth and cadmium also forms a delicate, though rare precipitant for alkaloids, and the official solution of mercury and arsenic iodides, known as "Donovan's Solution," also acts in the same manner, less delicately.

Bromine and Bromides act in a manner similar to iodine and iodides, but are much less sensitive, as a rule. Strychnine salts are thrown out of solution by potassium bromide, but the presence of 12 per cent. of alcohol re-dissolves them, as already stated.

Tannic acid, and astringent drugs containing it, also precipitates most alkaloids (in the absence of alcohol), and has been largely used as a reagent for this purpose. In a few cases forms of tannic acid are found in alkaloidal drugs, as cincho-tannic acid in cinchona, in which cases alcohol is required to thoroughly extract the drug, unless a mineral acid be present to replace the tannic acid, as in infusion of cinchona. Combinations of alkaloids with astringents are not unusual.

Other Acids.—Many of the organic acids, as tartaric, gallic, oxalic, etc., and also the inorganic phosphoric acid, form very slightly soluble salts with some alkaloids, and these are liable to precipitation.

Alkaloidal salts vary in this respect as do metallic salts, but not as much is known about them. Nearly all the hydrochlorates of the alkaloids are soluble in water, but berberine hydrochlorate is quite insoluble, hence, preparations of hydrastis, columbo, and other drugs containing berberine, are liable to form precipitates with this acid. The very slight solubility of quinine acetate and salicylate should be remembered.

Acacia is precipitated hopelessly by solution of subacetate of lead, but not by acetate of lead. It forms a gelatinous mass with ferric salts and with borax; the former is liquefied by free acids, and the latter by sugar. Alcohol in excess precipitates it in a tough, stringy mass, which is not diffusible. Mucilage of acacia becomes sour and acid on standing, unless prevented by the use of chloroform, betanaphthol, or other preservative agent.

Acetanilid is quite stable. It forms a pasty mass when combined with antipyrin, and slowly develops a yellow or red-colored solution when dissolved in spirit of nitrous ether.

Acids, Organic.—All the organic acids are displaced from their salts by mineral acids, particularly those which are only slightly soluble in water, as benzoic and salicylic acids, which are easily thrown out of combination and solution by hydrochloric, nitric or sulphuric acids. Excepting acetic acid the metallic salts of organic acids are mostly insoluble, and hence salts of the heavy minerals are generally incompatible with solutions containing organic acids and salts. Many of the organic acids coagulate albumen, a notable exception being gallic acid, which for this reason is more assimilable than tannic acid, and valuable for hemorrhage of the lungs, etc.

Carbolic acid also coagulates collodion, and gives a violet color with iron salts, as does also salicylic acid. Salicylate of sodium forms a pasty mass when triturated with some of the newer synthetic remedies as acetanilid, exalgin, etc.

Tannic acid, and astringent drugs containing it, precipitates alkaloids, a few glucosides, gelatin, albumen, starch and tartar emetic, and gives an intense black color with iron salts. It also forms precipitates with diluted sulphuric, hydrochloric and arsenous acids, and prevents the blue color of iodine and starch.

Alumnol is precipitated by the caustic alkalies, the precipitate being soluble in excess, except when produced by ammonium hydrate. It is also precipitated by albumen and gelatin, the precipitate being soluble in excess.

Amyl nitrite resembles spirit of nitrous ether (which see) in its properties. It is decomposed by exposure to light and air, becoming acid.

Antipyrin is an artificial alkaloid, and is precipitated under the same conditions and by the same reagents as the alkaloids. It has, in addition, a large number of incompatibilities, which make it immiscible with carbolic acid, syrup of iodide of iron, alum, mercuric chloride, tartar emetic, beta-naphtol, etc.

Aristol is decomposed by light and heat, liberating free iodine.

Butyl-chloral is decomposed by alkalies, being converted into allylene dichloride and a formate and chloride of the alkali. It liquefies with camphor, phenol, menthol and thymol.

Camphor liquefies when triturated or warmed with chloral, butyl chloral, menthol, thymol, resorcin, beta-naphtol and carbolic acid. The liquid thus formed is soluble in alcohol and oils, but is thrown out of its alcoholic solution by the addition of water. The presence of camphor in Tully's powder should be remembered in this connection.

Mixtures containing camphor with chloral, phenol, etc., may at first be clear ; but if much water is also present the liquefied chloral-camphor, camphor-phenol, etc., is liable to separate in oily drops, which require vigorous shaking to diffuse. Any two of these bodies form a liquid of this character when mixed.

Chloral liquefies, as already remarked, when triturated with camphor, phenol, thymol or menthol. Aqueous solutions of chloral decompose in a short time, becoming acid in reaction. Chloral is decomposed by alkalies, forming chloroform and formate of the alkali. Bottles containing such a combination, which have been stored in a warm place, have exploded from the pressure of chloroform vapor. The incompatibility of chloral with soda or potassa, or their carbonates, with aromatic spirit of ammonia, lime-water, magnesia, etc., are important to remember. In the presence of alcohol and certain very soluble salts, as potassium and sodium bromides, sodium chloride and magnesium sulphate, the chloral may unite with the alcohol to form *chloral alcoholate*, a liquid which exercises a very harsh and irritating action upon the system. This may float upon the surface, or may sink to the bottom according to the density of the aqueous solution. This formation does not occur in the presence of ammonium or calcium bromides, ammonium chloride or potassium nitrate.

Chloralamide is also decomposed by alkalies, and by hot water.

Creosote is readily oxidized by nitric acid and other oxidizing agents. It is liable to inflame if mixed suddenly with these. Its aqueous solution reduces many salts.

Dermatol is decomposed by strong or hot mineral acids.

Diuretin is decomposed by acids and by alkalies.

Europhen is decomposed by hot liquids and by light. It is incompatible with metallic oxides, and mercury salts, and with starch in the presence of fats,—as in ointments.

Exalgine yields a pasty mass when triturated with salicylic acid, but remains dry with sodium salicylate.

Formalin (formic aldehyde) is incompatible with ammonia and bisulphites. It is a powerful reducing agent, acting energetically upon the salts of silver, gold, etc., and deodorizing sulphides, etc.

Ichthiol is incompatible with acids, strong alcohol and (ammonium ichthiolate) fixed alkalies.

Infusions and Decoctions are immiscible with alcoholic tinctures and preparations containing resinous or oily matter. They are decolorized by solution of subacetate of lead and sometimes by acetate of lead. Precipitates, due to astringent principles, organic acids, etc., are likely to form when corrosive sublimate, tartar emetic, silver salts, iron salts, etc., are added to infusions or decoctions. Those containing alkaloids form insoluble alkaloidal tannates when mixed with astringent preparations, as tinctures of kino and catechu.

Iodoform is decomposed by light and heat and by alkalies. This and many kindred bodies,—*diiodoform*, *aristol*, *iodine trichloride*, *iodophenacetine*, *sozoiodol*, etc., owe their antiseptic properties to the looseness with which they hold iodine, and are more or less easily decomposed by organic matter and salts; hence they should not be mixed with bodies having a strong affinity for iodine, as alkalies, volatile oils, silver salts, etc.

Oils.—Fixed oils are saponified by alkalies and sometimes by strong acids. With strong nitric acid some of them form a yellow solid body, called *elaidin*. Iodine combines with them in the cold and sulphur when hot. Contact with aqueous fluids causes them to become rancid more rapidly.

With the exception of castor oil (and croton oil, slightly soluble), they are insoluble in alcohol.

Volatile oils are incompatible with nitric acid and strong oxidizing agents. Bromine and iodine react violently with many of them, and form compounds with all. Very soluble salts throw out the volatile oils from their aqueous solutions, as in the aromatic waters. Water and saline solutions also separate them from alcoholic solutions.

Osmic acid is a powerful oxidizing agent, changing alcohol into aldehyde and acetic acid, liberating iodine from iodides, etc. It blackens in contact with organic matter. The vapor of osmic acid acts violently upon the eyes.

Pancreatin has its action impaired by acids, while *Pepsin* acts well only in acid solutions. Both are precipitated in flocculent condition by alcohol. Pepsin is also precipitated by many salts, *e. g.*, sodium chloride and sulphate, magnesium sulphate, etc. This fact is utilized in the manufacture of pepsin.

Papoid acts in both acid and alkaline media.

Phenacetin is decomposed by strong acids and alkalies. It forms a paste when triturated with salicylic acid. It is liable to contain a poisonous impurity,—paraphenetidin.

Phenocoll salts are decomposed and the base precipitated by alkalies and carbonates of the alkaline earths.

Pyrogallol is a powerful reducing agent, acting upon solution of mercury and silver salts in the cold.

Salol is decomposed by strong alkalies and precipitated by bromine water.

Soaps are decomposed by acids, alkaline earths and mineral salts. They are insoluble in hard waters until after the mineral matters in water have been precipitated.

Sulphonal is a very stable body, unaltered by most reagents.

Terebene resinifies and becomes acid on exposure to light. It is readily oxidized by exposure to the air and by oxidizing agents. It combines actively with chlorine, bromine and iodine, forming addition compounds.

Thymol liquefies when mixed with chloral, menthol or phenol. It combines with alkalies, and coagulates albumen. It is stated to be three times more soluble in water containing ten per cent. of glycerin than in pure water.

Spirit of Nitrous Ether decomposes quickly in the light, liberating free nitrous acid and becoming reduced in strength. It is frequently found less than half the official strength for this reason. The free acid also makes it troublesome in mixtures. It effervesces with carbonates and acts as an oxidizing or reducing agent with other bodies.

Tannic acid acts energetically with it, liberating gaseous compounds of nitrogen. This is an important incompatibility of the spirit, causing it to effervesce slowly when mixed with preparations of buchu, uva ursi, and all astringent drugs. This cannot be prevented. When free acid is present it causes iodine to be liberated from iodides, and decomposes solution of ammonium acetate. These reactions can be prevented for a time by neutralizing the nitrous ether with sodium or potassium bicarbonate. Caustic potassa or soda is not as good, because an excess of alkali immediately decomposes the ether. Acids also hasten its decomposition, and the nitrous oxides and acetic acid so formed may be troublesome in many ways.

Spirit of Ether Compound.—True Hoffmann's anodyne contains a little free sulphurous acid, which neutralizes alkalies and liberates iodine from iodides.

THE FORMATION OF A GAS.—This may be known in one of three ways—by an effervescence, by an explosion, or by a combustion. The first two differ only in degree, an effervescence being the bubbling of a gas through a liquid, occurring when free escape of the gas is allowed, and an explosion being the sudden and forcible escape of gas, either from a gradually accumulated pressure within a confined space which at last became powerful enough to burst its container, or from a sudden reaction between two concentrated chemicals whereby a large volume of gas is formed instantaneously.*

Combustion occurs when a gas rich in oxygen is liberated in the presence of an easily combustible body, the latter catching fire.

Effervescent incompatibilities are troublesome only when the effervescence is slow. When it is prompt the general directions given on pages 56 and 57 should be followed, as the incompatibility is intentional in most of such cases.

A very slow effervescence may be due to two causes—(1) the slow escape of a gas from a very viscid liquid, or (2) the slow motion between chemicals having weak affinities. Instances of the first are found in reactions occurring in the presence of syrups or of glycerin.

Thus syrup of squill is sometimes combined with a carbonate, and the weak acetic acid in the syrup causes the evolution of carbon dioxide from the latter, but owing to the weakness and viscosity of

* Explosions may also occur from *physical* causes, as the partial vaporization by heat of very volatile bodies, such as stronger water of ammonia, ether, benzine, etc., confined in tightly-stoppered bottles, or other closed containers. Explosions due to chemical causes only are considered in this chapter.

the acid solution the reaction is very slow and persistent. It may be hastened by heating gently, or by making the syrup extemporaneously, *i. e.*, taking an equivalent of vinegar of squill to which the carbonate is first added, and when the reaction (which will be prompt) has ceased, adding the proper amount of sugar and water.

Dobell's solution is sometimes ordered without any water, only glycerin, borax, bicarbonates of sodium and carbolic acid being used, and a strong solution thus made, which is afterward diluted. If these be mixed cold, the reaction does not start promptly, and may continue for several hours. It should be hastened by using a part of the glycerin at first, which is heated with the borax and bicarbonate, and when the reaction has ceased the carbolic acid and the rest of the glycerin are added.

But reactions may be slow owing to purely weak affinities, and in these cases but little can be done. Such are mixtures of bismuth subnitrate and sodium bicarbonate with liquids, the bismuth being gradually reduced and liberating nitric acid, which then reacts with the bicarbonate; also mixtures containing spirit of nitrous ether and tannin, or other bodies which gradually decompose the nitrous ether, liberating oxide of nitrogen. To hasten the reaction in such cases is simply to hasten the decomposition of a desired body, and it therefore should be hindered as much as possible, rather than hastened. To guard against an explosion the stopper should not be pressed tightly into the neck of the bottle, and the customer should be warned of a probable change in the mixture. Such mixtures are usually prescribed in small quantities, that they may be frequently renewed if desired.

Explosions and combustions are caused for the most part by violent chemical action, and are more liable to occur during the compounding than afterward.

They are due to a reaction between an oxidizing and a reducing agent.

Oxidizing agents are chemical bodies, rich in oxygen, which under favorable circumstances part with some or all of their oxygen, the latter immediately combining with another (reducing) body.

Reducing agents are those which are capable of combining readily with oxygen, and are therefore bodies which burn easily; or they may be bodies which are raised from a lower to a higher valency by the action of an oxidizing agent. In all reactions occurring between oxidizing and reducing agents, there is a parting with oxygen on the one hand—the oxidizing agent being thereby "reduced"—and a combining with the same oxygen on the other hand—the reducing agent being thereby oxidized. When these reactions occur between dry bodies they are usually accompanied by heat and flame and a detonation; when they occur in liquids, heat, and sometimes flame, accompanies them, but usually no detonation.

These reactions occur in liquids spontaneously, but in solids they take place only when heated. It is well known that solids burn only when they are h- - certain temperature called the "critical point," and so oxidizing and reducing agents may be mixed without any reaction occurring, provided the temperature is kept below the "critical point," and this is true, in a measure, of liquids as well as solids.

Heat is produced by friction, hence if an oxidizing and a reducing agent be *rubbed* together, as in a mortar during the process of mixing, a reaction is liable to ensue, and this reaction may be so violent as to result in an explosion with serious injury to the operator.

Mixtures of this character are, however, frequently called for in pharmacy, and can be dispensed without danger if properly handled. The invariable rule to be followed in the case of solids is to *powder each ingredient separately, then transfer to a sheet of clean paper and mix with a spatula, avoiding pressure.*

The powders may be mixed by sifting if desired, several siftings being necessary, and friction avoided.

Since the explosion is caused, not by the decomposition of a single body, but by a reaction between two bodies, the powdering of each alone may be accomplished safely; but if the same mortar be used for both substances, all traces of the first must be removed before the second is placed in it.

In the case of liquids which are liable to inflame, this may be prevented by *keeping them cold and mixing slowly.*

A partial oxidation is inevitable in these cases, but a rapid combustion may be prevented.

If the reaction becomes too violent, it may be checked by cooling with ice water or other suitable means.

Serious injury and even death have resulted to pharmacists in many cases from carelessness in mixing such.

In the following table all the oxidizing agents are incompatible with the reducing agents, the more important and powerful being in heavy type. These should be memorized, and if combined in any mixture, should be mixed with due regard to the precautions already mentioned.

Hydrogen peroxide is peculiar in that it acts both as an oxidizing and as a reducing agent. It reduces oxidizing agents and is itself reduced at the same time, hence is incompatible with all the bodies mentioned in the table. Nitrites may act in the same way, under favorable circumstances.

Oxidizing Agents.	Reducing Agents.
Chlorates.	Arsenous acid.
Hypochlorites.	Cyanides.
Chlorine and **Oxides of Chlorine**, including Nitrohydrochloric acid.	**Phosphorus** and **Hypophosphites.**
Bromine and Iodine.	**Sulphur.**
Bromates and **Iodates.**	**Sulphides.**
Chromates, including chromic acid and bichromates.	Sulphites.
Nitrates (nitric acid).	Hyposulphites.
Nitrites (sometimes).	Nitrites (sometimes).
Permanganates.	Oxalates.
	Pyrogallol.
	Ferrous, mercurous and stannous salts.

OXIDIZING AGENTS.	REDUCING AGENTS.
Peroxides, including hydrogen, sodium and barium peroxides, and lead and manganese dioxides.	Powdered **iron and zinc.**
Silver Oxide.	**Organic bodies**, including **alcohol, glycerin, ethers, tannins, sugars, vegetable drugs, charcoal**, cork, syrups, extracts, volatile and fixed oils, pyroxylin, creosote, etc.
Sulphuric acid (with organic matter).	Hydrochinone.
Persulphates.	Hydroxylamine Hydrochlorate.
Ferric, mercuric and cupric salts.	Formic aldehyde.
Gold and platinum hydrates.	

Among the most common combinations of these are:

Chlorates of potassium or sodium with tannins and sugar for throat troubles, or with sulphur and sulphides. These are particularly liable to explode with friction, since chlorates part with their oxygen very easily, yielding it up on the application of heat alone.

Chlorates are sometimes prescribed with tincture of chloride of iron and glycerin, for throat troubles. In this case the free hydrochloric acid in the tincture acts upon the chlorate, liberating a highly explosive gas, euchlorine, and unless a considerable water is also present an explosion results should the temperature rise as high as 70° F., a common temperature in summer or in heated rooms.

This gas is also formed with other mineral acids.

$$2KClO_3+4HCl=2KCl+Cl_2O_4+Cl_2+2H_2O.$$

The other oxides of chlorine, as nitrosyl chloride, NOCl, which is found in nitro-hydrochloric acid, are also powerful oxidizing agents, and in many cases free chlorine itself. Explosions with these are best prevented by the presence of a considerable proportion of water.

Chlorates are also incompatible with iodides, as potassium iodide, syrup of iodide of iron, etc., the poisonous iodate being formed. With the iron iodide, oxidation to the ferric condition may also occur and free iodine be liberated. Such combinations are inadmissible.

Iodates and bromates act in a manner corresponding to the chlorates, but their use is very rare.

Nitrates, particularly nitric acid, are frequently used as oxidizing agents in the preparation of salts and compounds. Potassium nitrate is one of the principal ingredients of gunpowder, and nitroglycerin is a familiar explosive obtained by the action of nitric acid upon glycerin.

The most common explosive combinations of nitric acid are with oil of turpentine or other volatile oil, creosote, etc. These mixtures should be made in capacious open vessels, the nitric acid being added slowly and the liquids kept cool. Such mixtures, manipulated in this way, are liable to burst into flame, but do not detonate.

In playing the part of an oxidizing agent the nitric acid is split up into water, nitric oxide and oxygen, the latter two bodies acting directly as oxidizers.

$$(2HNO_3=H_2O+2NO+3O.)$$

The nitric oxide becomes further oxidized to nitrogen tetroxide, NO_2 (or N_2O_4), on exposure to the air, a dense brown and irritating fume arising which is obnoxious in the store or laboratory, hence all mixtures in which nitric acid is reduced should be made in the open air or under a hood.

Nitric acid dropped upon the skin forms the yellow xanthoproteic acid, and a similar yellow is produced upon corks or vegetable matter.

Sawdust has been set on fire by spilling strong nitric acid upon it. *Ous* salts are oxidized into *ic* salts by the acid.

Silver nitrate is reduced in solution in aromatic waters (rose water, etc.), by the volatile oil present. Special care must be exercised in making pills of silver nitrate or oxide to avoid reduction by organic matter. Solutions of silver salts should always be dispensed in bottles protected from the action of light.

Nitrites sometimes act as oxidizing agents, sometimes as reducing agents. In themselves they are prone to change to nitrates and are unstable.

Spirit of nitrous ether is perhaps the most troublesome, this being decomposed by light with liberation of nitrous acid, which changes finally to nitric acid.

Nitrous ether is particularly easily decomposed by tannin, acids and alkalies, liberating gases which may burst the container, if tightly closed. The free acids in the spirit cause effervescence with carbonates, and the liberation of free iodine from iodides. These reactions may be hindered by neutralizing the acid before mixing with a little potassium bicarbonate or tartrate, when no reaction occurs until the ether has become again decomposed by light or other means.

An excess of alkali should never be used, because this immediately decomposes nitrous (and all compound) ethers, forming alcohol and a nitrite of the alkali base.

Chromic acid is a powerful oxidizing agent, causing alcohol, glycerin, and many similar bodies to burst into flame or explode by mere contact. It also acts as a caustic upon the skin, causing painful sores. Bichromates, in the presence of mineral acids, act in the same way as chromic acid. They are used, without the mineral acid, much more frequently than chromic acid.

Permanganates rarely cause explosions. Potassium permanganate acts somewhat slowly but strongly upon such bodies as glycerin, oils, alcohol, and organic matter in general, and is largely used as a deodorizer and purifier. Its disinfectant action is accomplished only when its solution is in contact with the body to be deodorized, the decaying matter being oxidized or burned up by it. Solutions of permanganates should be protected from the light.

Silver oxide is often prescribed in pill form, and explosions have occurred from triturating it with organic matter. Occasionally, pills containing it have exploded several hours after being made. It also forms a very explosive compound with ammonia water and ammonium salts.

Peroxides rarely cause explosions, but like permanganates act slowly and strongly. Peroxide of hydrogen is in itself unstable, and so acts more energetically.

It is seldom used in combination with other bodies.

Iodine sometimes causes explosion when added to volatile oils. It combines with these, and less energetically with fixed oils, forming addition compounds.

It is used in analytical chemistry for determining the purity of oils, each oil combining with a different and known proportion of iodine.

It also forms an extremely powerful and unstable explosive with ammonia water, NHI_2, particularly when iodine is in slight excess. This is not explosive when wet, but explodes violently upon a touch as light as that of a feather when thoroughly dried. It is liable to be formed in the " decolorizing " of tincture of iodine with ammonia water.

Among the reducing agents, the most powerful and common are:

Phosphorus and the Hypophosphites.—The first ignites spontaneously in the air, and with greater promptness in contact with oxidizing agents. Precautions to be observed in weighing and handling it have already been alluded to. The hypophosphites are unstable bodies, becoming oxidized to phosphites or phosphates.

They have been known to explode from trituration. A very low heat decomposes them, liberating the spontaneously combustible phosphoreted hydrogen. They should never be triturated with chlorates or other oxidizing agents.

Sulphur and sulphides combine very readily with oxygen and require special care in mixing and keeping.

Explosions have followed their admixture with chlorates, nitrates and chlorinated lime.

Glycerin is particularly liable to be prescribed with oxidizing agents, and is oxidized by nearly all of them.

COLOR CHANGES.—Changes in the color of galenical preparations are very familiar to the pharmacist. Many tinctures and fluid extracts darken upon standing, particularly when fresh, and a similar change in mixtures is not infrequent. These changes in color are not easy to explain, being, as a rule, imperfectly understood.

From a therapeutic point of view they are commonly unimportant, since no decided change in medicinal properties is observed, but chemically they are interesting, and in a few cases the changes are so marked that the pharmacist should be familiar with them to correctly interpret the appearance of a mixture. Changes in color usually indicate chemical changes in the mixture or liquid, and these may be important, or may not. Thus the iron mixture No. 13, when fresh, is a handsome ruby color, but it gradually darkens to a very deep brown, and then slowly loses its color, becoming at last nearly white. Its taste also changes, being at first sharply astringent, and at last scarcely at all so, showing the reduction of the ferric chloride to the ferrous condition.

In mixtures the changes are most frequently due to the influence of one body upon another, or to a chemical reaction. In only a few instances are these changes considered objectionable, except that the mixtures are rendered less inviting. Preparations containing tannins are a frequent source of trouble from this cause, and cinchona preparations are frequently deprived of their tannin in order to render them miscible with iron salts without forming an ink.

Color reactions are very frequent in chemical analysis, due to the production of a colored salt which may be soluble or insoluble. A complete list of such reactions or of color changes would be impossible in a work of this nature, and in the list below only those which are frequent or important are referred to. A list of liquids which change markedly is also included.

Acetanilid slowly develops a yellow or red color with spirit of nitrous ether. This reaction is considered unobjectionable, unless the mixture is allowed to stand too long (two weeks or more), when decomposition products result.

Acid, Benzoic, produces a flesh color with ferric salts.

Acid, Carbolic, turns red on exposure to light and air, a coloration which in no way detracts from its value.

Acid, Gallic, darkens in contact with alkalies, becoming green to brown with the hydrates or carbonates, and blue with lime water. It gives a bluish-black color with ferric chloride.

Acid, Hydrocyanic, decomposes in the light and air, becoming brown and finally black. This is best prevented by a little hydrochloric acid.

Acid, Nitric, reduces in the light and becomes yellow or brown, due to presence of lower oxides of nitrogen (hyponitric acid, etc.).

Acid, Oleic, and preparations containing it in a free condition, darken and become rancid.

Acid, Salicylic, produces a violet color with ferric chloride. Salts of salicylic acid darken in the presence of the slightest trace of alkali, and are usually slightly acid to avoid this.

Acid, Tannic, in aqueous solution, darkens and the process is hastened by alkalies.

Alcohol usually contains traces of aldehyde or other impurities which cause it to darken in the presence of alkalies. This is one of the causes of change in spirit and aromatic spirit of ammonia.

Aloin.—Some varieties give a greenish-black color with ferric chloride.

Antipyrin quickly produces a green color with spirit of nitrous ether. This was formerly thought to be a poisonous product, but is now considered safe if the mixture is all used up within two weeks. Long standing results in the formation of other and more objectionable bodies.

Bismuth subnitrate forms a red iodo- compound with iodine, and a red nitroso-salicylate with salicylic acid.

Bromoform turns yellow in the light, showing a decomposition which unfits it for use.

Copper salts give a very deep-blue color with excess of alkalies.

Creosote produces a violet color with ferric chloride, which quickly fades to brown.

Iron salts are productive of a variety of colors. Ferrous salts are green, but turn red or brown on oxidation. Ferric salts are brown or red, but lose their color on reduction. The ferric salts, particularly ferric chloride, produce a violet color with carbolic acid, salicylic acid and salicylates, creosote, salol, oil of cloves, oil of pimenta, oil of bay, and many bodies containing phenol radicals, as aniline, salol, resorcin, guaiacol, cresols, etc.

A red color results with acetates, sulphocyanides, antipyrin and mucilage of acacia.

A flesh-color with benzoic acid and benzoates.

A green with thallin, guaiacol, aloin and preparations of guaiac.

A blue-black with gallic acid, and

A black with tannic acid and preparations containing it, and with gentian.

Tincture of iron chloride forms with phosphoric acid the colorless ferric phosphate, soluble in acids.

Oils of clove, bay and pimenta contain phenol-like principles, which give a violet color with ferric chloride.

Phenacetine, unless perfectly pure, gives pink to red colors with oxidizing agents, such as chlorine water, solution of chlorinated soda, etc. The color is due to the presence of paraphenetidine or its formation in the liquid.

Pyrogallol in solution darkens rapidly.

Quinine sulphate exhibits a blue fluorescence when dissolved in a very dilute sulphuric acid. This is characteristic of quinine (and quinidine), and is generally expected in quinine solutions. The fluorescence is destroyed by phenacetine and by hydrochloric acid.

Resorcin turns pink, yellow or deep brown on exposure to light and moisture, more readily in presence of traces of alkaline substances, as ammonia (in the air), alkalies (in glass), etc. With oxidizing agents a series of colorations are produced: thus, ammoniacal silver solution, black; chlorinated soda, violet, finally brown; nitrous acid and spirit of nitrous ether, brown.

Silver salts darken rapidly on exposure to the light. Solutions of silver nitrate, etc., should always be dispensed in amber bottles, or in bottles covered with dark paper, to exclude the light. Blue glass does not prevent this change.

Spirit of Nitrous Ether darkens with tannic acid, and produces a yellow or red color with acetanilid and a bright green with antipyrin, as already mentioned.

Syrup of Garlic turns dark in the light, becoming at last almost black.

Syrup of Hydriodic Acid is reduced by light, liberating free iodine, as shown by the production of a yellow or brown color. It is then unfit for use. A pale straw-color is sometimes observed in the fresh syrup when there is no free iodine present. The cause of this is not well understood, and is probably due to a conversion of traces of the sugar under the combined influences of the acid and heat.

If no free iodine can be detected by the starch test (production of a blue color), the syrup may be used.

INCOMPATIBILITIES.

A.—Therapeutical.

331.

℞. Hydrarg. Chloride Corros. . gr. xij.
Sacchari . . . . ʒ ss.
M. Ft. chart. No. vi. Sig.—One at night.

An over-dose of corrosive sublimate. Calomel was wanted instead.

332.

℞. Acidi Arsenosi . . . . ʒ ij.
Quininæ Sulph. . . . . . . ʒ ss.
Syr. Sarsap. Comp. . . . . . ℥ iv.
M. Sig. — Teaspoonful three times daily.

An over-dose of arsenous acid. Solution of arsenous was wanted instead of the pure acid.

333.

℞. Tincture of Nux Vomica . . . Oi.
Sig.—Teaspoonful four times daily.

The quantity ordered as well as the dose awaken a suspicion of its use,—for a horse, in which case it is safe.

334.

℞. Liq. Plumbi Acet. . . . . . ℥ iv.
Sig.—Tablespoonful, as directed.

Solution of Ammonium Acetate (Spirit of Mindererus) was intended.

335.

℞. Morphinæ Sulphat. . . . . . ʒ i.
Quininæ Sulphat. . . . . . gr. j.
M. Ft. pil. xii.

The quantities should be transposed or an over-dose of morphine will be given.

336.

℞. Liq. Potassii Cit. . . . . . . ℥ iv.
Spt. Ætheris Nitros . . . . . ℥ i.
Syrupi . . . . ℥ i.
Tinct. Aconiti . . . . ℥ i.
M. Sig.—℥ ss. t. i. d.

Contains an over-dose of Tincture of Aconite.

337.

℞. Aconitinæ 03
Sacchari 4.0
M. Ft. pulv. vj. Sig.—One every hour.

An over-dose of aconitine. Probably .003 Gm. was intended instead of .03 Gm.

B.—Pharmaceutical.

338.

℞. Potassii Citratis . . . . . . ℥ i.
Spt. Ætheris Nitrosi . . . . ʒ iv.
Syr. Tolutani . . . .
Aquæ . . āā . . . . ℥ i.
M.

The dense solution of potassium citrate formed in this mixture is immiscible with alcoholic liquids, and the spirit of nitrous ether separates and floats upon the dense fluid.

339.

℞. Tinc. Cardamomi . . . . . ℥i.
Spiritus Chloroformi . . . . ℥i.
Codeini . . . . gr iv.
Pepsini . . . . ʒss.
M. Sig.—Shake. ʒi. quat. in die.

The pepsin is coagulated by the alcoholic liquids into a rubber-like mass which cannot be diffused through the liquid. Water is needed in such to make an eligible mixture. Two ounces might be added and the dose doubled.

340.

℞. Hydrarg. Bichlor. . . . . . gr. j.
Potass. Iodidi . . . .
Ferri et Ammon. Cit. . . āā . ʒiij.
Tinc. Cinchon. Comp. . . . ℥iss.
M. Sig.—Sumat drachmam ter in die.

Water must be used to dissolve the salts.

341.

℞. Pepsini Puri . . . . ʒi.
Bismuthi Subnit. . . . . . . ʒvi.
Acid Hydrochloric . . . . . ʒij.
Tr. Cinchon. Comp. ad. . . . ℥vi.
M.

The pepsin is insoluble in the alcoholic liquid and cannot be diffused.

342.

℞. Potassii Bromidi . . . . . .
Chloralis . . āā . . . . . . ʒiij.
Tr. Opii Camph. . . . . . .
Syr. Zingiberis . . āā . . . ℥iss.
M.

Chloral alcoholate separates and floats upon the top of the solution. This would not occur in very weakly-alcoholic liquids.

343.

℞. Acidi Carbolici . . . . ℥ss.
Aquæ . . . . ℥iss.
M. Sig.—Apply with a brush.

Should not be dispensed as written. The carbolic acid, being incompletely soluble in the water, would settle to the bottom, and the last portions are liable to exercise a caustic action. It might be entirely dissolved by the use of glycerin.

344.

℞. Acidi Carbolici . . . . . .
Sodii Boratis . . āā . . . . ʒi.
Cocainæ Hydrochlorat. . . . gr. xij.
Glycerini . . . . ℥ss.
Aquæ Menth. Pip. ad. . . . ℥vi.
M. Sig.—Spray.

The incompatibility between the cocaine and the borax is overcome by the glycerin.

345.

℞. Tinct. Guaiaci . . . .
Tinct. Myrrhæ . . . .
Tinct. Ferri Chlor. . . āā . . ℥i.
Mucil. Acaciæ . . . . ℥iij.
M.

This cannot be mixed to get a satisfactory preparation, the mucilage being incompatible with all the other ingredients. A green color is also produced on mixing tinctures of iron and guaiac.

346.

℞. Strychninæ Sulphatis . . . . gr. j.
Potassii Bromidi . . . . . ʒvii.
Aquæ . . q. s. ad. . . . . . ℥viii.
M. Ft. Solution.

If compounded as written, strychnine bromide is formed and precipitated. If a fluid ounce of alcohol be used in place of one of the eight fluid-ounces of water, the solution is permanent.

(Strychnine bromide is soluble in water, but not in the presence of inorganic salts.)

The two following are permanent solutions because enough alcohol is present in the ingredients to prevent precipitation.

347.

℞. Potassii Bromidi . . . . . ʒviii.
Elixir Strychninæ Valerianat. ℥iv.
M. Ft. solut.

348.

℞. Strychninæ Sulphatis . . . . . gr. i.
Tinct. Cinchonæ Comp. . . . ℥iv.
Potassii Bromidi . . . . . . ʒiv.
Aquæ . . . . ℥iv.
Syrupi . . . . ℥i.
M. Ft. Solut.

349.

℞. Collodii Flexilis . . . .
Tinct. Iodi . . . .
Aquæ Ammon. . . āā . . . . ʒii.

Collodion is incompatible with aqueous fluids. Spirit of ammonia should be used in place of the water.

350.

℞. Chloroformi . . . .
Chloralis . . āā . . . . . . ℥i.
Camphoræ . . . .
Ætheris . . āā . . . . ℥ss.
Mentholis . . . . ʒi.
Alcohol . . . . ʒvi.
Morphinæ Sulphat . . . . . gr. x.
M. Sig.—"Pain paint."

Triturate the chloral, camphor, menthol and morphine together until partially liquefied, then rinse mortar with the mixed liquids and shake together until dissolved. A clear liquid (about 4 fl. oz.) results, which becomes cloudy in about half an hour, and in the course of three or four hours flocculent particles of morphine separate and float upon the surface.

351.

℞. Quininæ Sulphatis . . . . . ʒii.
Strychninæ Sulphatis . . . . gr. ss.
Acidi Phosphorici Diluti . . .
Tinct. Ferri Chloridi . . āā ℥ss.
Vini Pepsini . . q. s. ad. . . . ℥iv.
M. Ft. solutio.

Dissolve the quinine sulphate in the phosphoric acid and mix with the tincture of iron. (This makes a clear solution, but on diluting it both quinine and iron phosphates are precipitated, and the presence of more free acid is needed, in proportion to the amount of dilution, to keep them in solution.) Add ten drops of hydrochloric acid, and to this mixture slowly add the wine in which the strychnine has been dissolved.

If a precipitate occurs which does not redissolve in ten minutes, a few more drops of hydrochloric acid should be added.

352.

℞. Olei Morrhuæ . . . .
Tinct. Gentianæ Comp. . . . .
Syrupi Pruni Virgin. . . . . .
Mucilaginis Acaciæ . . āā . . . ℥i.
M. Sig.—A teaspoonful 3 times a day.
Mix in inverse order as written.

(This cannot be made into an emulsion, and none was expected by the physician. It soon separates, in whatever way it may be mixed, and should be dispensed with a shake-label. The only precaution to be observed in compounding is to avoid adding the tincture directly to the mucilage.)

353.

℞. Euphorini . . . . gr. xviij.
Antipyrini . . . . ʒss.
M. Ft. pulv. vj. no.

On triturating these together a thin paste results (which is solidified by addition of water). By first triturating the euphorine with ʒi of sugar, then adding the antipyrine and mixing, a dry powder results, which may be dispensed in papers.

354.

℞. Ext. Cascaræ Fld. . . . . . .
Ext. Hydrastis Fld. . . āā . . ℥ss.
Glycerini . . . . ℥i.
Aquæ Menth Pip. . . . . . . ℥ii.
M. Sig.—ʒi post edente.

The glycerin prevents precipitation of fluid extracts.

355.

℞. Beta-naphthol . . . . ʒ iv
Sulphuris . . . . ʒ ii
Balsami Peruviani . . . . . ℥ i
Petrolati . . . . ℥ i
M. Ft. unguent.

A homogeneous ointment may be made, but it soon separates, owing chiefly to the insolubility of the Peruvian balsam in the petrolatum.

356.

℞. Potassii Bromidi . . . . . . ʒ iss
Spiritus Æth. Nit. . . . . . . ʒ vi
Syrupi . . . . ad. ℥ iij
M.

Dissolve the potassium bromide in ʒ iiss of water, mix with ʒ xv of syrup, and then add the nitrous ether. If the nitrous ether is added directly to the bromide solution, before diluting with syrup, a milky mixture results, which clears slowly.

357.

℞. Fld. Ext. Gelsem. . . . . ʒ iss
Fld. Ext. Cannabis Ind. . gtt. xviij
Antipyrini . . . . ʒ i
Chloralis . . . . ʒ iss
Aquæ . . . . ℥ i
M.

An oily liquid separates, which subsequently solidifies into a mass of crystals of chloral-antipyrin.

With weak solutions this reaction takes place slowly, or not at all.

This prescription should not be dispensed.

358.

℞. Ext. Buchu Fld. . . . . ʒ ij
Tinct. Cubebæ . . . . ʒ ij
Tinct. Guaiaci Ammon. . . . ℥ ss
Aquæ . . . . ℥ ij
M.

The resins in the tinctures and fluid extract are precipitated in an unsightly mass. Acacia or tragacanth should be added to such mixtures to suspend the resins.

(See under emulsions.)

359.

℞. Ext. Buchu Fluidi . . . . . .
Ext. Cubebæ Fluidi . . āā . . ℥ i
Tinct. Hyoscyami . . . . . . ʒ ij
Olei Terebinthinæ . . . . . . ℥ ss
Mucilag. Acaciæ . . . . . ad. ℥ iv
M.

Mix in the order written, adding the mixture of the first four ingredients slowly to the mucilage. The gum is precipitated in a flocculent condition, but a stringy mass is avoided, as would be the case if the alcoholic liquids were mixed directly with the mucilage. This is a very peculiar mixture. An emulsion cannot be made.

C. Chemical.

360.

℞. Tinct. Ferri Chloridi . . . . ʒ iss
Quininæ Sulphatis . . . . . gr. xv.
Potassii Chloratis . . . . . ʒ iij
Sodii Hypophosphitis. . . . ʒ iss
Aquæ . . . . ℥ ii
M.

This is a generally incompatible prescription, the results of which would be a mixture containing ferric chloride, ferric oxychloride, precipitated sulphur, sodium sulphate, sodium chloride, potassium sulphate, potassium chloride, potassium chlorate and quinine chlorate.

361.

℞. Acid Nitromuriat. Dilut. . . . . ʒ i
Spirit Ammoniæ Arom. . . . . ʒ i
M. Sig.—Two drops in water every four hours.

One ingredient neutralizes the other.

362.

℞. Argenti Nitratis . . . . gr. ij
Morphinæ Sulphat. . . . . . gr. j
M. Ft. pilulæ xij No. Sig.—One every 3 or 4 hours.

The two ingredients are incompatible. Mix the silver nitrate with 10 grains of kaolin or talc, and mass with hard petrolatum. Work the morphine thoroughly into the mass and divide.

363.

℞. Argenti Nitratis . . . . . gr. x
Cocainæ Hydrochlor. . . . . gr. xij
Aquæ . . . . ℥ i
M. Ft. lotio.

Silver chloride is precipitated if dispensed as written. This may be prevented and a clear mixture dispensed (in a bottle protected from the light) by using cocaine nitrate (alkaloid carefully neutralized with nitric acid) in place of the hydrochlorate.

364.

℞. Liq. Acidi Arsen. . . . . . . ʒ i
Acid Nitromur. Dil. . . . . . ʒ v
Pepsinæ in Lamellis . . . . . ʒ ss
Elixir Bismuthi, N. F. . . ad. ℥ vj
M. Sig.—Teaspoonful in water before meals.

The acids will precipitate bismuth from the elixir. The latter is miscible only with neutral or alkaline fluids.

365.

℞. Bismuthi Subnit. . . . . ʒ ij
Spir. Ammon. Arom. . . . . . ʒ i
Tinct. Opii . . . . ʒ ss
Syrupi . . . . ʒ ss
Mist. Cretæ . . . . ℥ iss
M.

The bismuth subnitrate is reduced to oxide by the aromatic spirit of ammonia.

366.

℞. Potass. Bromidi . . . . ʒ iij
Chloralis . . . . ʒ ij
Spt. Ammon. Arom. . . . . . ℥ ss
Syr. Zingiberis . . . . ℥ i
Aquæ . . . . ℥ iss
M.

The chloral is decomposed by the alkaline spirit of ammonia, chloroform being formed. The bottle should be tightly stoppered and kept in a cool place.

367.

℞. Hydrarg Chlorid. . . . . . gr. iij
Tinct. Cinchon. Comp. . . . ℥ vij
Spir. Amon. Arom. . . . . . ℥ i
M.

Both ambiguous and incompatible. If the first ingredient means corrosive sublimate, ammoniated mercury will be formed. If calomel, black oxide of mercury will be formed.

368.

℞. Liq. Potassii Arsenitis . . . . ʒ i
Hydrargyri Bichloridi . . . . gr. j
Aquæ . . . . ℥ iv
M.

Here is an incompatibility between the alkali in the arsenical solution and the mercury salt.

The acid solution of arsenous acid (Valangin's solution) should be substituted for the Fowler's solution and the mixture colored with a few drops of the compound tincture of lavender.

369.

℞. Potassii Bromidi . . . . . . gr. x
Hydrargyri Chloridi Mitis . . gr. iij
M. Ft. pulv. Mitte tales xij

On rubbing these together the calomel is reduced to metallic mercury, with formation of a double bromide of mercury and potassium, which is a powerful poison. $2HgCl + 4KBr = (HgBr_2 2KCl) + Hg + 2KCl.$

This should not be dispensed.

370.

℞. Hydrarg. Perchloridi . . . . gr. ss
Ammon. Carbonat. . . . .
Potassii Iodidi . . āā . . . . gr. v
Aquæ . . . . ℥j
M.

Alkaline carbonates precipitate mercuric chloride, but in this case if the mercuric chloride and potassium iodide be dissolved first, and the ammonium carbonate added to this solution, no precipitate occurs.

371.

℞. Hydrarg. Protoiodidi . . . . . ʒss
Potassii Iodidi . . . . ʒij
Tinct. Cardam. Comp. . . . . ℥i
Syr. Sarsaparillæ Comp. . . . ℥iij
M. Sig.—ʒi quatuor in die.

The potassium iodide changes the yellow mercurous iodide into red mercuric iodide and free mercury. The red iodide is much more powerful, and in the above would make dangerous doses. This should not be dispensed.

372.

℞. Hydrarg. Bichlorid. . . . . . ℈i
Sodii Boratis . . . . ʒij
Aquæ . . . . ℥iv
M.

Oxychloride of mercury, as a brick-red powder, is precipitated.

373.

℞. Hydrarg. Bichlorid. . . . . .
Ammon. Chlorid. . . āā . . gr. iij
Albuminis Ovi . . . . ʒiss
Aquæ Destillat. . . . . ℥i
M.

The ammonium chloride prevents the precipitation of mercuric albuminate and the mixture remains clear.

374.

℞. Hydrarg. Protochlorid. . . . .
Iodoformi . . āā . . . . . . ʒij
M. Ft. pulv. substilis. Sig.—Dusting powder.

These react, on standing, to form mercuric chloride and iodide and chloroform. They should be mixed on paper, without pressure.

375.

℞. Quininæ Sulphatis . . . . . . ʒss
Tinct. Ferri Chlorid. . . . . .
Spt. Ammon. Arom. . . āā . . ʒij
Aquæ Font. . . . . ʒxx
M.

The quinine is precipitated and redissolved by aromatic spirit of ammonium, but the latter precipitates ferric hydrate from the tincture and makes a thick, muddy mass.

376.

℞. Ferri et Potassii Tart. 4
Potassii Bromidi 4
Syrupi 15
Aquæ . . . . ad 60
M.

Dissolve the iron salt in 30 Cc. of water, add the syrup and then add the bromide dissolved in the remainder of the water. If both salts are placed in a bottle and the water added, a dense precipitate results. Mixed as above, the precipitate forms gradually and is less dense.

377.

℞. Tinct. Ferri Chlorid. . . . . ʒiij
Liq. Ammon. Acetat. . . . . ℥iv
Ammon. Carbonat. . . . . . ℥ss
Elix. Curacao . . . . ℥i
Syr. Aurantii . . . . ℥iss
Aquæ . . . . q. s. ut ft. . . ℥viij
M.

Ammonium carbonate precipitates ferric hydrates from the tincture.

378.

℞. Ammon. Carbonat. . . . . . ℈i
Spir. Æth. Nit. . . . . ℥i
Tinct. Ferri Chlor. . . . . . . ʒij
Spir. Mindereri . . . . ad . . ℥iv
M.

The ammonium carbonate is incompatible both with the tincture of iron and the spirit of nitre. Ferric hydrate is precipitated from the first, and the latter is decomposed. Add the tincture to the mixture last.

379.

℞. Liq. Ferri Dialysati . . . . . ℥j
Liq. Potass. Arsenitis . . . ʒij
Aquæ . . . . ℥iij
M.

The first two are incompatible, dialyzed iron being used as an antidote (in some cases) to arsenic poisoning.
The alkali in the Fowler's solution also precipitates the iron in a gelatinous mass.

380.

℞. Ferri et Quininæ Cit. . . . . . ʒij
Acid Phosph. Dil. . . . . . . ʒij
Syr. Zingiberis . . . . . ℥i
Tr. Cardam. Comp. . . . . . . ʒiv
Aquæ . . . . ad. ℥iv
M. Sig.—Coch. parv. t. i. d.

The phosphoric acid precipitates both the iron and quinine, in part.
An excess of potassium or ammonium citrate would hold the iron in solution.

381.

℞. Syr. Ferri Iodidi . . . . ℥ss
Potass. Iodidi . . . . ʒi
Aquæ . . . . ℥iss
M.

The slight precipitate of iron due to the alkali in the iodide may be corrected by adding five grains of potassium citrate to the iodide solution before mixing with the syrup of iron. Any trace of ferric iodide will liberate iodine.

382.

℞. Plumbi Acetatis 0.25
Tincturæ Opii 2.00
Aquæ Destillatæ 200.00
Syrupi 25.00
M. Sig.—"Wash."

Dissolve the acetate of lead in all the water and mix the tincture with the syrup, then mix the two solutions. A cloudy mixture results.

383.

℞. Liq. Plumbi Subacet. . . . . . ℥ij
Tincturæ Opii . . . . ℥ss
M. Sig.—For external use. Teaspoonful to a cup of cold water.

The solution of subacetate of lead will precipitate most of the principles of the opium and leave a nearly colorless liquid.

384.

℞. Morphinæ Sulphatis . . . . . gr. j
Tinct. Lavandul. Comp. . . . ʒi
Aquæ . . . . ʒvii
M. Sig.—ʒi every 4 hours.

Santalate of morphine separates as a red flocculent precipitate (caused by the santalum, an ingredient of the tincture).

385.

℞. Hydrarg. Chlorid. Corros. . . gr. j
Potass. Iodidi . . . . ʒss
Quininæ Bisulphat. . . . . . ʒi
Syrupi Glycyrrhizæ . . . . . ℥i
Aquæ . . . . ℥iij
M.

The alkaloid is precipitated by the double iodide of mercury and potassium.

386.

℞. Hydrarg. Bichlorid. . . . . . gr. j
Potassii Iodidi . . . . ℥ ss
Tr. Cinchon. Comp. . . . . . ℥ ij
M.

No precipitation—only a slight cloudiness—occurs in this case, because the iodo-hydrargyrates of the alkaloids (in the tincture) are held in solution by the alcohol in the tincture. Dispense with a shake label.

387.

℞. Morphinæ Sulph. . . . . . . gr. j
Tr. Catechu Comp. . . . . . ʒ ij
Tr. Zingiberis . . . . ℥ ss
Syrupi Ejusdem . . . . . ad. ℥ ij
M.

Tannate of morphine is precipitated.

388.

℞. Caffeinæ Citratæ . . . . . . gr. xx
Spt. Ammon. Arom. . . . . ʒ ij
Elix. Guaranæ . . . . . ad. ℥ ij
M.

Caffeine forms an exception to the general incompatibility of alkaloids. It is quite soluble in warm water and dilute alcoholic liquids, and does not form salts easily. In the above the citric acid is neutralized by the aromatic spirit, but the mixture remains clear, the caffeine not being precipitated.

389.

℞. Ferri et Quininæ Citratis . . . ℈ ii
Potassii Citratis . . . . ʒ ii
Acidi Citrici . . . . ʒ i
Aquæ . . . . ad. ℥ vi
M. Ft. solut.

Acid citrate of quinine separates in crystals after standing a few hours.

The addition of a small quantity of ammonium chloride was recommended to prevent this.

390.

℞. Potassii Iodidi . . . .
Ferri et Quin. Cit. . . . aa . . ʒ ij
Syrupi . . . . ℥ i
Aquæ . . . . ℥ iij
M.

Quinine iodide is precipitated in a bulky mass. Can be diffused by shaking.

391.

℞. Quininæ Bisulphatis . . . . . ʒ ss
Liq. Ferri et Ammon. Acet. . . ℥ ii
M.

Insoluble quinine acetate is precipitated, and the liquor is partially decolorized.

392.

℞. Quininæ Sulphatis 1.0
Acidi Nitrici Dilut. 1.0
Potass. Iodid 2.0
Aquæ 100.0
M.

Nitric acid liberates iodine from potassium iodide, and the quinine is precipitated. Should not be dispensed, unless for external use.

393.

℞. Iodi . . . . gr. xx
Ext. Opii . . . . gr. x
Camphoræ . . . . gr. xv
Ext. Belladonnæ . . . . . gr. xx
Adipis Benz. . . . . ℥ i
M. Ft. unguent.

If potassium iodide be used to dissolve the iodine, the alkaloids in the extracts will be rendered insoluble. Dissolve the iodine and camphor in a little ether, and incorporate with half the lard, warming gently and stirring until the ether has evaporated. Soften the extracts with water, incorporate with the remainder of the lard and mix with the first.

394.

℞. Cocainæ Hydrochlor. . . . . gr. viij
Sodii Boratis . . . . ℈i
Aquæ . . . . ℥i
M.

The cocaine (alkaloid) is precipitated by the borax. Addition of glycerin will prevent this.

395.

℞. Sodii Salicylatis. . . . . ℥ss
Aquæ Menth. Virid. . . . . . ℈ii
Acidi Sulphurici Dilut. . . . . ʒi
M.

The sodium salicylate is decomposed by the acid, salicylic acid being thrown out of solution.

396.

℞. Sodii Salicylat. . . . . ʒss
Spt. Ætheris Nitros . . . . . ℥ss
Aquæ . . . . ℥iss
M.

The spirit of nitrous ether must be neutral or it will throw salicylic acid out of solution. If acid in reaction, neutralize with sodium or potassium carbonate before adding to the sodium salicylate solution, being careful not to add too much alkali, as an excess will make a dark-colored solution.

397.

℞. Acidi Nitrohydrochlor. . . . . ℥ss
Tinct. Cardam. Comp. . . . . ℥iss
M.

This is likely to explode after an hour or two.

398.

℞. Acidi Chromici . . . .
Glycerini . . . .
Alcoholis . . . . . āā p. e. ad. ℥ss
M. Sig.—Apply as directed.

Very inflammable and explosive. Should not be dispensed.

399.

℞. Bismuthi Subnit. . . . . ʒij
Sodii Bicarb. . . . . ʒi
Aq. Menth. Virid. . . . . . . ℥ii
M.

The bismuth and sodium salts react slowly, forming bismuth oxide and sodium nitrate, with evolution of carbonic acid gas. The bottle should be loosely stoppered.

400.

℞. Bismuthi Subnit. . . . . . . ʒss
Mist. Cretæ . . . . ℥iss
Tr. Opii . . . . ʒiv
M.

The bismuth subnitrate will be slowly decomposed by the chalk in the chalk mixture, carbonic acid gas being evolved.

401.

℞. Potassii Chloratis . . . . . . ʒiij
Tinc. Ferri Chlorid. . . . . . ʒij
Glycerini . . . . ℥ij
M. Sig.—Apply with a camel's hair brush.

Must be kept cold (below 70° F.) to prevent explosion. Stopper loosely as an additional precaution and caution against a possible combustion.

402.

℞. Tinct. Aconiti . . . . . . ♏xvi
Spt. Ætheris Nitros. . . . . ℥ss
Liq. Ammon. Acet. . . . . ℥iss
M.

If the spirit of nitre is old and has become strongly acid, a reaction takes place between this and the solution of ammonium acetate, both being decomposed (the latter partly so) with evolution of mixed gases, consisting of carbon monoxide, carbon dioxide, nitrogen oxides, etc.

403.

℞. Spir. Ætheris Nitros. . . . . ʒ vi
Ext. Buchu Fluidi . . . . .
Ext. Uvæ Ursi Fld. . . āā . . ʒ iv
Syrupi q. s. ut. ft. . . . . . . ℥ iv
M.

A slow reaction between the tannin in the fluid extracts and the spirit of nitre will occur, and the bottle may burst if tightly stoppered. Shake well before delivering, and instruct the customer to keep loosely stoppered.

404.

℞. Potassii Bitart. . . . . ʒ i
Potassii Iodidi . . . . ʒ i
Spir. Æth. Nitros. . . . . . ʒ iv
Syr. Aurantii . . . . . . ℥ i
Aquæ . . . . ad. ℥ x
M.

This cannot be compounded without reaction between the first three ingredients resulting in the entire decomposition of the spirit of nitrous ether, and partial decomposition of the other two. The "Art of Dispensing" directs to proceed as follows: "If compounded at all, dissolve ʒ i of cream of tartar and 8 grains of potassium iodide in 4 oz. of water, add the spirit of nitrous ether, and stir briskly so that the gas may escape. Allow to stand half an hour, in order to get rid of the nitrous fumes. Then make up the rest of the mixture and add to this. The object of this procedure is to limit the action of the nitrous ether, for while theoretically the 4 drachms will liberate the iodine from about 8 grains only of the iodide, the liberated nitrous oxide on coming in contact with the air is changed to higher oxides, which are capable of decomposing iodide, so that if the mixture were made up at once, iodide would continue to be liberated until the whole of the potassium iodide is decomposed."

405.

℞. Ammonii Carbonat. . . . ʒ ij
Syrupi Simplic. . . . . .
Mucil. Acaciæ . . aa . . . ℥ iss
Aquæ . . . . ℥ ij
M.

If the mucilage is old an effervescence may ensue, caused by the acid in the mucilage reacting upon the carbonate.

406.

℞. Syr. Scillæ . . . . ℥ i
Syr. Senegæ . . . . ℥ ss
Potass. Bicarb. . . . . ℈ ii
Tinct. Opii . . . . ʒ ij
Syrupi . . . . ad. ℥ iv
M.

The syrup of squill contains acetic acid, which neutralizes the ammonia in the syrup of senega, and causes an effervescence with carbonates. The bicarbonate should be added first, and when the effervescence has ceased, the other ingredients are added.

407.

℞. Ammonii Carbonat. . . . . . ʒ i
Ammonii Chloridi . . . . . . ʒ ss
Syrupi Scillæ . . . . ℥ i
Syrupi Ipecacuan. . . . . . . ℥ i
Syrupi Pruni Virgin. . . . . . ℥ ij
M. Sig.— ʒ i for cough.

The acids in the syrups of squill and ipecac react slowly with the ammonium carbonate, liberating carbonic acid gas.

408.

℞. Codeinæ . . . . gr. iv
Ammon. Chlorid. . . . . . ʒ iij
Ext. Hyoscyam. Fld. . . . .
Tr. Nucis Vomic. . . . .
Sp. Chloroformi . . . . . .
Elix. Cascar. Sagrad. . aa . . ʒ iv
Aquæ . . . . . q. s. ut. ft. . ℥ vi
M.

The alkali in the elixir of cascara reacts with the ammonium chloride, liberating ammonia gas. Sufficient pressure may be generated, in a warm place, to blow out the stopper of the bottle.

409.

℞. Tinct. Iodi. . . . . ℥ i
Linim. Camph. Comp. . . . . ℥ iij
M.

Compound camphor liniment (Ph. B.) contains ammonia water, and is liable to form the explosive nitrogen-iodine compound (NHI_2) with the tincture of iodide. This compound is an extremely powerful explosive, and very unstable when dry.

410.

℞. Iodol 0.5
Hydrarg. Oxid. Flav. 0.2
Petrolati. . . . . 10.
M. Ft. ung.

If the iodol and oxide of mercury be rubbed together, an explosion will take place. This does not occur in presence of the petrolatum or a portion of it.

411.

℞. Argenti Nitratis . . . . ʒ i
Aquæ Rosæ . . . . ℥ i
M. Ft. lotio.

The silver nitrate is rapidly decomposed by the rose water, the liquid turning black and depositing a heavy sediment. Distilled water should be used and the solution dispensed in an amber or covered bottle, to prevent reduction of the silver salt by light.

412.

℞. Oleatis Morphinæ . . . . . . ℥ ss
M. Sig.—Apply as directed.

If fresh and light-colored when dispensed, this rapidly darkens.

The same change in color occurs with mercury oleate.

413.

℞. Potassii Permanganatis . . . . ʒ i
Glycerini . . . . ℥ i
Aquæ . . . . ℥ ii
M.

The glycerin decomposes the permanganate, entirely discharging the color of the solution and forming a dense brownish precipitate.

If the permanganate is added directly to the glycerin, the latter is liable to inflame.

414.

℞. Bismuthi Subnit. . . . . ʒ ii
Sodii Salicylat. . . . . ʒ ij
Aquæ Cinnamomi . . . . . . ℥ ii
M.

The insoluble bismuth salt gradually turns red, owing to the formation of bismuth nitro-salicylate.

415.

℞. Bismuthi Subnit. . . . . . . ʒ ij
Pulv. Tragacanth. . . . . q. s.
Tinct. Nucis Vomicæ . . . . ʒ ij
Potassii Iodidi . . . . ʒ ij
Spiritus Chloroformi . . . . . ʒ iij
Aquæ . . . . q. s. ut. ft. . . ℥ xij
M.

Red iodide of bismuth is formed in this mixture. The bismuth should be given separately as a powder.

416.

℞. Tinct. Ferri Chlorid. . . . . . ʒ ii
Tinct. Gentianæ Comp. . ad . . ℥ iv
M. Sig.—Teaspoonful after meals.

Makes an inky mixture.

417.

℞. Tinct. Ferri Chlorid. . . . . . ʒ i
Quininæ Sulph. . . . . ʒ i
Tinct. Cinchon. Comp. . . . . ℥ ii
M. Sig.—ʒ i in aq. t. i. d.

The quinine is soluble in the tinctures, but the mixture is inky.

418.

℞. Tinct. Ferri Chloridi . . . . . ʒ ii
Syr. Aurantii Corticis . . . . . ℥ i
Aquæ . . . . . q. s. ad. . . ℥ iv
M.

The tannin extracted from the orange peel makes a dark mixture with the tincture of iron.

Simple syrup flavored with spirit of orange, in place of the syrup of orange peel, will make a much better appearing mixture.

419.

℞. Acidi Carbolici . . . . ʒ ss
Tr. Ferri Chlorid. . . . . . . ʒ i
Glycerini . . . . ℥ i
M. Sig.—Apply with brush every 3 hours.

Makes a deep violet-colored mixture.

420.

℞. Tinct. Ferri Chlorid. . . . . ℥ ss
Acidi Carbolici . . . . ʒ i
Acidi Sulphuros. . . . . . . ʒ iij
Aquæ . . . . ad . . ℥ viij
M. Ft. garg.

Very dark blue at first, but the color becomes discharged after a short time.

421.

℞. Tinct. Ferri Chloridi 2
Acidi Phosphorici Dil. 2
Syrupi 60
M.

The first two are incompatible, insoluble phosphate of iron being formed which is soluble in an excess of phosphoric or hydrochloric acid, making a colorless solution.

422.

℞. Liq. Potassii Arsenitis . . . . ʒ iiss
Tinct. Ferri Chloridi . . . . .
Acidi Phosphorici Dilut. . āā . ℥ i
Aquæ . . . . ad . ℥ vi
M.

The first and second and third are incompatible, but a clear, colorless solution is obtained by first mixing the Fowler's solution and phosphoric acid, then adding the tincture of iron and lastly the water. "*Shake.*"

423.

℞. Tinct. Ferri Chloridi . . . ʒ ii
Quininæ Sulphat. . . . . . gr. xviij
Spt. Chloroformi . . . . . ʒ i
Aquæ Caryophylli . . . ad. ʒ vi
M.

A very dark mixture results, and a precipitate may form on standing, owing to a reaction between the iron and eugenol in the cloves.

424.

℞. Antipyrini . . . . ʒ i
Sp. Ætheris Dulc. . . . . ʒ iiss
Syr. Limonis . . . . ℥ ss
Aquæ . . . . ad. ℥ ii
M.

A green color is developed on mixing the antipyrin with the spirit of nitrous ether, due to the formation of isonitroso-antipyrin. It may be dispensed.

425.

℞. Potassii Iodidi . . . . ʒ iss
Spiritus Ætheris Comp. . . . .
Syrupus . . . .
Aquæ . . . . . āā . . . . . ʒ i
M.

The official compound spirit of ether usuall[illegible] [illegible]lphuric acid, whi[illegible] [illegible]tassium i[illegible]

426.

℞.	Tr. Ferri Chlor.	ʒ i
	Acidi Nitromur Dil.	ʒ iss
	Quininæ Muriat.	gr. x
	Potassii Iodidi	ʒ ss
	Ext. Digitalis Fld.	♏ x
	Syrupi Simplic. . . . . . . ad	℥ ij
M.		

Iodine is liberated from the potassium iodide by the iron and acid, and this, with the undecomposed iodide, precipitates the quinine, making a very unsightly and unpleasant mixture. The iodide should not be included in such a mixture.

427.

℞.	Liq. Iodi Comp.	
	Liq. Potassæ. . . . . āā	℥ i
M.		

The iodine will be partly converted into colorless iodide and iodate of potassium.

428.

℞.	Potassii Chloratis	℈ ii
	Syr. Ferri Iodidi	ʒ iv
	Spiritus Chloroformi	♏ xx
	Syrupi	ʒ iv
	Aquæ . . . . q. s. ad.	℥ ii
M.		

If the syrup of iodide of iron contains any free acid (citric or hypophorous acids put in to preserve it), or if it has oxidized, a reaction is likely to ensue, liberating chlorine from the chlorate, which in turn liberates iodine from the iodide, and the mixture becomes brown, then deposits iodine. This reaction can only be prevented by keeping the solution neutral by addition of a little calcium carbonate or similar neutralizing body.

429.

℞.	Acidi Tannici	1.0
	Tinct. Iodi	0.5
	Glycerini	10.0
	Aquæ	50.0
M.	Ft. lotio.	

The tincture of iodine will be decolorized by the tannin.

430.

℞.	Sodii Salicylat.	gr. x
	Ammon. Carbonat.	gr. iij
	Spt. Ætheris Nit.	♏ xx
	Spt. Chloroformi	♏ x
	Aquæ . . . . ad.	℥ i
M.		

Becomes red in a few hours.

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