# The Art of dispensing: a treatise on the methods and processes involved in compounding medical prescriptions.

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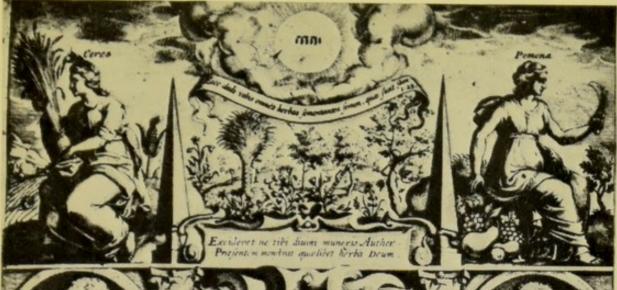
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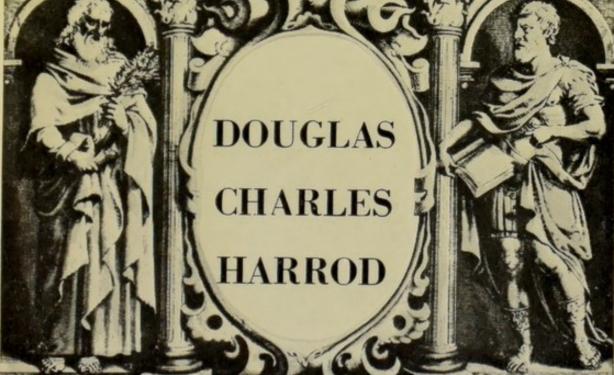


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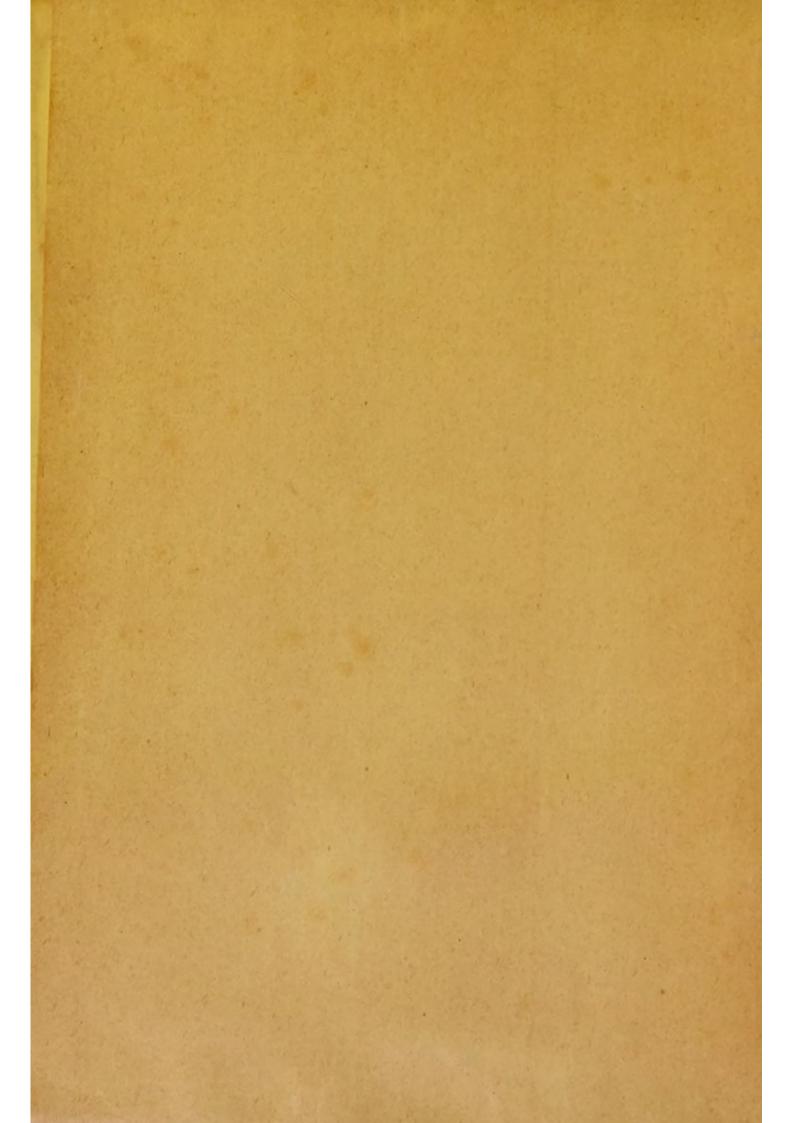
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M. C. Rock? with hers wishes Vincas 1903

THE

ART OF DISPENSING

PRINTED BY
SPOTTISWOODE AND CO. LTD., NEW-STREET SQUARE
LONDON

# ART OF DISPENSING:

A TREATISE ON

THE METHODS AND PROCESSES INVOLVED IN COMPOUNDING MEDICAL PRESCRIPTIONS.

(FIRST EDITION 1888.)

SIXTH EDITION, revised and enlarged by PETER MACEWAN, F.C.S., Pharmaceutical Chemist, Editor of 'THE CHEMIST AND DRUGGIST.'

Published at the Offices of

THE CHEMIST AND DRUGGIST,

42 CANNON STREET, LONDON, E.C.

AND AT MELBOURNE, SYDNEY AND ADELAIDE, AUSTRALASIA, AND NEW YORK, U.S.A.

1901.

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First Edition, September, 1888. Second Edition, October, 1888. Third Edition, November, 1888. Fourth Edition, June, 1889. Fifth Edition, June, 1890.

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- " Second reprint, January, 1892.
- " ,, Third reprint, September, 1893.
- " Fourth reprint, January, 1895.
- " Fifth reprint, July, 1896.
- " Sixth reprint, April, 1898.

SIXTH EDITION.

Published, August, 1900. Reprinted, May, 1901.



# PREFACE.

The history of 'The Art of Dispensing' in book form is graphically represented on the preceding page. But it went through a probationary period before 1888, the germ of it being contained in *The Chemists' and Druggists' Diary* of 1880, which was so well appreciated that the short treatise was augmented for the 1885 *Diary* by extracts from the late Dr. Hermann Hager's 'Teknik der Pharmaceutischen Receptur'; then proofs of the combined work were submitted to twelve pharmaceutical chemists in Great Britain, who commented upon the text, and their annotations were appended in small type to the text. There was thus obtained a symposium on this branch of the pharmacist's art which is probably unique in our literature. The varied experience represented in the treatise may be judged by the names of the contributors, who were:—

Mr. J. F. Burnett.

Mr. A. W. Gerrard.

Mr. W. Gilmour.

Mr. Thomas Greenish.

Mr. Joseph Ince.

Mr. Peter MacEwan.

Mr. T. Maben.

Mr. W. Martindale.

Mr. R. H. Parker.

Mr. Barnard S. Proctor.

Mr. J. H. Webb.

Mr. A. C. Wootton.

This treatise was reprinted as a 196-page pamphlet when the edition of the *Diarv* was exhausted. The present Editor rearranged and augmented the work as published in September, 1888, and prepared each succeeding edition for the press.

Again the book has been entirely recast, and has been expanded from 288 pages to 498 pages. The former style and most of the material have been retained, but at least two-thirds of the book is new. It now begins with a chapter on 'First Principles,' the Legal aspects of dispensing are more fully treated, the chapters on Capsules, Tablets, Incompatibles, and New Remedies are practically new, and the extent of the revision generally is shown by the following contrast:—

				Fifth	edition	This	edition
Pills .				44 ]	pages	68 I	pages
Tablets, &c.				4	,,	12	,,
Capsules.	*			3	,,	9	,,
Powders.				4	,,	14	,,
Suppositories				13	,,	28	,,
Ointments				8	,,	15	,,
Mixtures.				37	,,	77	,,
Applications				5	,,	18	,,
New Remedie	es			13	12	29	,,
Examination	pres	criptic	ns	3	,,	7	,,
Appendix				17	,,	27	"

The fresh material has been largely drawn from the pages of *The Chemist and Druggist*. The Editor desires to acknowledge the advice or assistance which he has received from Mr. J. A. Forret (in regard to capsules), Mr. J. T. Hall (who has written a new chapter on homoeopathic dispensing), Mr. R. H. Parker (who suggested numerous alterations and improvements), and Mr. J. B. Stephenson (who has revised the Latin vocabulary and the posology table).

42 CANNON STREET, LONDON, E.C. August 10, 1900.

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# THE

# ART OF DISPENSING.

# FIRST PRINCIPLES.

STUDENTS of pharmacy may have observed that 'Dispensing' figures in smallest bulk in the examination schedules of the Pharmaceutical Societies. In that for Great Britain we read that candidates for the Minor certificate are required 'to weigh, measure, and compound medicines; write the directions in concise language in a neat and distinct hand; to finish and direct the package.'

The syllabus of the Irish Society is even more laconic, 'to compound and dispense medicines' being all the information vouchsafed to the candidate. This paucity is neither wholly accidental nor wholly intentional, yet when contrasted with the detailed information given in other subjects one is led to inquire why dispensing, the be-all and end-all of the pharmacist as a practitioner, should be treated so barely. The explanation is that every other part of the examination syllabus is applicable and leads up to the subject of dispensing, because this is the art upon which are focussed the pharmacist's knowledge of science, especially of chemistry and materia medica, his intimacy with the Latin language, and his dexterity

as a pharmaceutical manipulator. A fair routine dispenser may get along without such accomplishments, but it is the man who knows the chemical relation of substances to each other who is best able to deal with unusual prescriptions and to dispense the medicine in the form most elegant from the pharmaceutical standpoint and most certain of exerting its full therapeutic action in the time required. These are facts which students of pharmacy should bear well in mind when they are pursuing their scientific studies; and if they endeavour to piece together what they read or hear in lectures on chemical matters, and what they have done at the dispensing-counter, they will find their understanding of the different subjects become much clearer.

It will be observed that the Irish syllabus requires candidates for the diploma to compound and dispense. Two distinct actions are implied. In Ireland the men who work at the dispensing - counter are called 'compounders'; in Great Britain we talk of them as 'dispensers.' The Irish expression is nearer the truth. According to the dictionaries a compounder is 'one who compounds drugs according to a prescription.' The narrow definition of 'dispenser' is the same, but the general meaning is 'one who dispenses, distributes, or deals out,' and in the specific sense the pharmaceutical dispenser is one who compounds drugs according to a prescription and deals the compound out to a customer. The Minor syllabus, in fact, gives the true definition of the art of dispensing, for it is to weigh, measure, and compound medicines according to prescription, write the directions, and finish and direct the package of compounded medicine. It is sometimes called 'extemporaneous pharmacy,' an expression which at least serves to show that the dispenser who receives a prescription to dispense must bring to bear upon it without hesitation the scientific knowledge and manipulative skill which he has acquired through learning and practice.

The prescription is the order of the medical attendant of the patient to the dispenser for the supply of a remedy. In this country the medicinal ingredients are usually written in Latin, prefaced by the sign R, which may originally have implied an invocation to Jupiter, but is now regarded as a contraction for *Recipe*—'take thou.' The quantities are expressed by the old apothecaries' signs for ounce, drachm, scruple, grain, and minim; and some directions, in abbreviated Latin, as to compounding, and directions as to administration, most frequently in English after the abbreviation *Sig.*, complete the prescription. This book does not profess to deal with the construction or rendering of prescriptions, and throughout its pages the initial sign R and the final directions after *Sig.* are omitted, although the latter may occasionally be given if the directions in any way elucidate points which the prescriber's style may leave doubtful.

#### PROPERTY IN PRESCRIPTIONS.

Certain considerations in respect to prescriptions may here be discussed. The property in the prescription is occasionally doubtful, some saying that as it is the order of the physician to the dispenser, the property in it does not pass to the patient. This is erroneous, because a prescription is rarely what the law of contract considers to be an order for the supply of goods. If the physician, say Dr. Brown, gives his patient, Mr. Smith, a prescription to take to Mr. Jones, a chemist, who supplies Mr. Smith with the medicine, and gets payment for it from Dr. Brown, the prescription is an order, and Mr. Jones may legally keep possession of it until Dr. Brown pays. The prescription then ceases to be requisite as proof of Dr. Brown's obligation to pay, and might be treated as most orders are under such circumstances—that is, destroyed—were it not that it may have intrinsic value as a prescription. As such Dr. Brown might reasonably demand its return; therefore it is always advantageous, when such arrangements as that between Dr. Brown and Mr. Jones are entered into, that an understanding should be come to regarding this matter.

Such arrangements, though common, form the smaller proportion of prescription-giving, it being more general for the patient to consult the physician, who gives advice or a prescription in return for his fee, so that the prescription becomes the patient's property, to have and to use within reasonable limits. It would be unreasonable for a patient to get a prescription from Sir William Broadbent for, say, a digestive derangement, and offer the medicine to all and sundry as Sir William Broadbent's Indigestion-cure. The prescriber in this case would have just cause for legally restraining the patient, or even for securing monetary reparation, because the implied agreement between the prescriber and the patient was solely in respect to the treatment of the latter.

When the prescription is taken to the dispenser it is in some cases retained, especially when the prescriber directs the patient to go to a particular chemist. If the prescription is one which any chemist could dispense, its retention would be considered illegal, unless the patient were informed before he received the prescription that it was to be retained by the chemist. But this only seems to emphasise the rule that the prescription is the patient's property, for he may have it dispensed by a chemist who will willingly return it to him; although the patient thus risks losing the prescriber's services.

Copying Prescriptions.—Another point in regard to the property in prescriptions arises when they are copied, and this may usefully be prefaced with some remarks regarding the law as to copying. The Pharmacy Act of 1868 and the Irish Pharmacy Act require prescriptions containing poison to be copied. The former Act (Sect. xvii) says that the provisions as to labelling poisons with the name of the poison and the word 'Poison' shall not apply to 'any medicine supplied by a legally qualified medical practitioner to his patient, nor to any article when forming part of the ingredients of any medicine dispensed by a person registered under the Act, provided such medicine be labelled with the name and address of the seller, and the ingredients thereof be entered, with the name of the person to whom it is sold or delivered, in a book to be kept by the seller for that purpose.'

It is, therefore, obligatory on the chemist to copy in his prescription-book any prescription containing any scheduled poison, and medicine so entered need not be labelled 'Poison.'

The only doubtful point about the provision is as to whose name should be entered in the prescription-book. In practice the name of the patient is entered, and that is the most convenient method for subsequent reference; but that this is not always legally sufficient is apparent when the medicine is for an infant, to whom it cannot be sold or delivered. Therefore the name of the purchaser or his agent should always be entered in the prescription-book as well as the name of the patient for whom the medicine is intended.

In the Case of Repeats of medicines containing scheduled poisons it is not considered necessary to recopy the whole prescription, but to make such an entry as—

Mrs. Thomas William Jones.

Repeat žviij. arsenical mixture as prescription,
Book F, No. 1793. June 20, 1899.

It will be noticed that the address of the person to whom a dispensed medicine is sold or delivered is not required by law. It is customary in some pharmacies where the prescriptions of certain physicians are retained to file them all, and the copying in the book of those containing poisons may be overlooked. This would be an illegal practice, apart from which the noncopying of prescriptions is poor business, because prescription-books may become a valuable trade asset.

The Prescription-book need not be an elaborate affair unless the work to be done is voluminous. In some pharmacies a prescription-register is also kept, and here we reproduce the ruling of a register for which the advantages claimed are: (1) It shows the amount of dispensing done in a day, week, month, or year; (2) the nature of the medicine dispensed; (3) the hour when dispensed (this is a check upon delivery should the

messenger have put off time); and (4) the names of the dispenser and checker. We note the width of each column:—

Date	Name	Address	Medicine	Number	Hour	Dispensed by	Checked by
	Betsy Jones		6-oz. mixture	42,356	10.50	А. В.	C. D.
1/2 in.	13 in.	Place 17/8 in.	I in.	I in.	$\frac{3}{4}$ in.	$\frac{3}{4}$ in.	$\frac{3}{4}$ in.

A great deal is, however, to be said against all methods if they are employed simply with the object of impressing customers with the idea of how careful you are. Remember that every effort should be made to attain absolute correctness in dispensing and promptitude in delivery of medicines; perfect satisfaction is thus guaranteed, and complaints will be extremely rare. If the prescription-records have to be often referred to for the purpose of detecting culprits, that only proves that all precautions have failed to put the dispensers on the alert, or that they have made the dispensers tools of the system or dependent upon it. Mistakes should never be allowed to occur, and the most certain indication of accurate dispensing and careful checking is that the prescription-register rarely requires to be reopened. Good general supervision by the principal for the time being should never be neglected.

It is advisable to enter every prescription and repeat in the prescription-book, for in the event of the business coming into the market for sale, the books may enhance the selling-price. In such sales the prescription-books become the property of the purchaser as part of the business. This brings us to a legal consideration already referred to, namely:—

## GIVING COPIES OF PRESCRIPTIONS.

A subscriber to *The Chemist and Druggist* once asked, 'Has a customer a right to demand a copy of a prescription from a pharmacist?' He had in his books a copy of a prescription entered in 1860. The original owner had been dead three years, and a member of his family asked for a copy to

circulate and do good in a neighbourhood ten or twelve miles away. There being some doubt about the matter, the question was submitted to several experienced pharmacists, and the following are the gist of their replies:—

Mr. F. Andrews (London) was of opinion that it would be

perfectly right to decline to give a copy.

The late Mr. Eve (of Messrs. Allen & Hanburys) said the copies of prescriptions are only made for a definite legal purpose and confer no right upon the owner. When copies have become valuable property no reasonable customer would persist in asking for them.

The late Mr. D. Frazer (Glasgow) held that the patient is the owner of the prescription, not the prescriber or the pharmacist. As to the dispenser giving copies of prescriptions entered in his books, each man must judge for himself. The pharmacist should never hesitate to give a copy when requested by the original owner.

The late Mr. Thomas Greenish, then President of the Pharmaceutical Society of Great Britain, wrote: Prescriptions are copied at the expense of the pharmacist, who has a sole right to the copies, the original prescription only being the property of the patient for whom it was written. To give a copy is a matter of courtesy.

Mr. William Gilmour (Edinburgh): Entering a prescription into a prescription-book in no way invests the chemist with any proprietary right in it. He would not take the responsibility of trading in any prescription or of giving a copy of it to any but

the original holder, or at his request.

Mr. Joseph Ince (London): It is probably not legal that a particular recipe should be retained by the pharmacist. But the book of manuscript copied prescriptions is the property of the dispenser—part of his stock—and can be bought or sold. No one but the original owner has even the claim of courtesy to assert in desiring a copy.

Mr. William Martindale (London): The only persons who can show a title of claim to a copy of a prescription copied in a chemist's prescription-book (and these only by favour) are the

prescriber and the patient. If both prescriber and patient are dead, the copy is ethically the chemist's *in toto*. The copy is no longer a prescription.

The late Mr. R. Reynolds (Leeds) said the chemist might refuse to give a copy of the prescription without anyone having a remedy at law against him. To give away valuable parts of his prescription-books, bought as part of the goodwill, would

be damaging his future and drawing upon his capital.

The late Mr. G. F. Schacht considered the original prescription itself to be the property of the patient, and the copy of that prescription in the chemist's book to be the property of the chemist. The chemist could scarcely refuse to give a copy to the patient; but when the latter dies the chemist's one and only obligation ceases, and it rests entirely upon his judgment and his courtesy whether he shall part with a copy to anyone.

The late Mr. W. Southall (Birmingham) said: The copy of a prescription is an assistance to memory, in which no one can claim any right or property but the copyist. The original holder of the prescription has no ownership in the copy. On the other hand, a chemist has no right to dispense any prescription of which he may possess a copy, as being Mr. So-and-so's, without the owner's permission.

Dr. C. Symes (Liverpool) wrote: As a matter of courtesy it is well to give a copy of a prescription when it is required for a legitimate purpose, always holding the right to refuse it if required for the furtherance of quackery or for use to the direct prejudice of the pharmacist possessing it.

Our Legal Contributor brought to bear upon the question the stern views of property, which dispensers are so apt to forget n the handling of prescriptions. He said: The chemist does not acquire the right to use the property of a patient (whose prescription he has copied) as part of his stock-in-trade, for the purpose of making money thereby. The customer has no right to demand a copy from the prescription-book on the ground that he has lost the original prescription. If a customer allows the chemist to use the medicine for various purposes

#### FIRST PRINCIPLES

and to take the profit arising from the sale thereof, and this continues for a long course of years, in the absence of any proof to the contrary it would be assumed that the owner had given the chemist a general right to make up the medicine for his own profit.

It is not difficult to deduce from the foregoing two sound business tenets:—

- (1) The chemist's prescription-book is his own property, created, apart from legal obligations in regard to poisonous remedies, for the purpose of facilitating business with those for whom he originally dispensed the prescriptions.
- (2) It is permissible, in some cases advisable, to give copies of the prescriptions to the original holders thereof, but it is not advisable to give copies to others.

Generally, it may be said that it is unwise to encourage the use of a medicine prescribed for one individual by others who suppose that they suffer from the same complaint. It may do harm, and the custom is unfair to prescribers. There are exceptions, it is true, for in most towns there is some Mr. Smith's tonic-mixture or some Mr. Jones's liver-pills are to be found which are popular long after the death of the prescribers and the original patients. But in such cases we really pass from the dispensing to the retail counter.

These general considerations on the legal aspects of the prescription need not be extended here to other points, such as the use of poison-bottles, which are treated later. Students will observe that the scheme of the treatise, after general principles are expounded, is to treat solid forms of medicines first, then those which are administered or used in liquid form. Originally 'The Art of Dispensing' was intended solely as a reference-book for the dispensing-counter, but it has become a popular educational work, and it might be possible, therefore, to systematise the information so that the student might work gradually from elementary compounding to that of the most intricate nature. The Editor is convinced that this would be detrimental to the utility of the book, while it would be an encouragement to theoretical dispensing.

# GENERAL SUGGESTIONS.

The Dispenser must cultivate habits of order and cleanliness in respect to his person as well as in his methods of work. Dirtiness and untidiness in dress on the part of the dispenser give an unpleasant impression. Such practices as pressing corks with the teeth, holding powder-envelopes in the mouth, shaking up mixtures with the finger over the mouth of the bottle, and breathing on pills to be silvered should be avoided. Becoming manners and decorous conduct in the pharmacy are essential; anything in the nature of joking is out of place, because if observed by customers, who usually feel that they are on a serious errand, distrust may be created. Dispensing is the most responsible part of the pharmacist's duties, and is considered to be so by doctors and patients alike; the closest attention and the most scrupulous care should therefore be manifested at the dispensing-counter.

Quality of Drugs.—The medicines employed in the preparation of prescriptions should be of the finest quality procurable for money, and official or other preparations made from them should be prepared in strict accordance with recognised methods. Second qualities of some goods may be necessary for certain purposes in other sales, but the pharmacist should not for a single moment permit the thought of second qualities in the dispensing department. Differences will occur in medicines prepared at different establishments, but always at least retain the satisfaction of knowing that these cannot result from the use of inferior drugs in *your* pharmacy. Let the consideration of profit gained from the dispensing of prescriptions be secondary: it will take care of itself. Dispense medicine with the feeling that an artist has in his work, and so will you

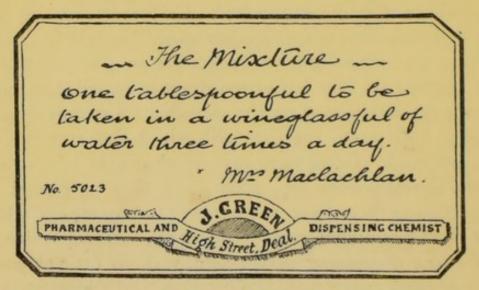
make an art of yours. Ensure by occasional testing that preparations which are liable to deteriorate are of proper strength; this applies particularly to such as acid. hydrocyanic. dil. and spt. æther. nitrosi. Although you pay the best price for your drugs, do not let that prevent you submitting them to examination before placing them in stock.

Style in Externals.—The pharmacist, however, may lose all the pecuniary benefit of his conscientiousness if, after paying the best price for drugs, he should be deficient in style in sending them out. The dispenser who economises on his drugs is a rogue, but he who economises on his bottles, corks, pill-boxes, or paper is a fool. Customers can only judge by the externals, and generally they would be right in concluding that a man who sends out medicine in a low-class bottle with a brittle cork may have used drugs of equally low quality. Evidence of slovenliness on the outside of a packet does not encourage faith as to the care with which the contents have been combined. Good taste may be shown in labels as well as in the boxes, bottles, &c., upon which they are placed. Let the direction to the patient, and not your own name and address, be the most prominent part of the label. Have a nice neat label for the dispensing department, with as little as possible upon it beyond your name, qualification, and address.

On this subject Professor Remington remarks that 'neatness, distinctness, and simplicity are cardinal principles in designing labels, and the reputation of many establishments is frequently judged from the character of the outward signs of neatness and care. For this reason particular attention should be paid to prescription-labels, not only to have the printed address plain, clear, and neat, but to have the handwriting to correspond. In these important particulars patients are exceedingly apt to form an estimate of the qualifications of the compounder of a prescription from the style of his penmanship, reasoning that, if he is careful, clean, and neat in the one particular of which they are competent to judge—i.e., the handwriting on the label—the compounder must exercise similar

qualifications in the more vital operations involved in compounding and dispensing, for upon the technicalities of the latter they cannot hope to pass judgment.'

A Few Examples of Labels will serve to show both good taste in printing and the requisite elegance in writing the directions. The first specimen is a design which secured a first prize from *The Chemist and Druggist* for distinctness. This label exhibits with fair accuracy what an authority has put down as a cardinal principle in writing directions upon a label—viz., to balance the matter so that its parts may form a symmetrical arrangement. All the lines should begin and terminate at the same distance from the margin. If we write



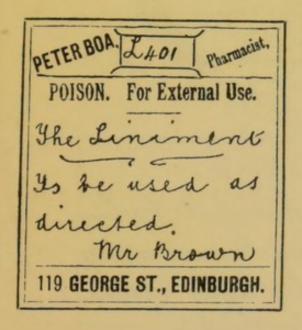
'The Mixture,' or 'The Powders,' we must take care that the words are in the centre, for the appearance of a label is greatly marred by having this superscription nearer to one side than the other. The dispenser should also be careful to adjust the matter so that it may fill the label fairly well. A label with a third of it at the top occupied by writing and the lower space blank looks bad. It is in this connection that a middling writer who has an eye for proportion in form may surpass a good writer in execution of a label. The free and easy writer too often trusts so much to the excellence of his penmanship that he altogether neglects the proper apportionment of the parts of the directions.

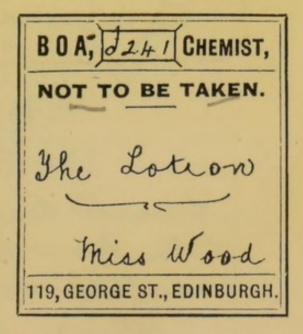
An Irish pharmacist, commenting upon this specimen

(C. & D. xlviii. 75), remarked that it is a capital example of what a label should be, and he gave the useful hint that the writing should be allowed to dry, which recalls the fact that



the best dispensers write the label for a prescription the first thing after reading it, and before they begin the compounding, so that the handwriting is dry and fast when the medicine is ready for the label. The most famous dispensing houses

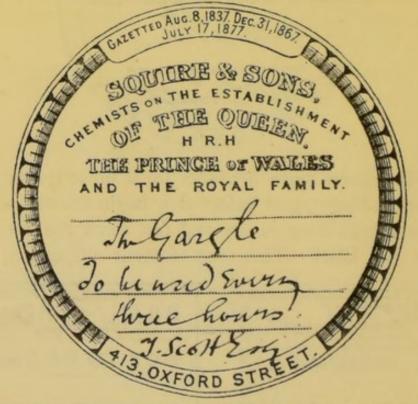




use exceedingly plain dispensing-labels. We are indebted to the principals of several establishments for the specimens which we give, the directions having been written by members JOHN BELL & Cº BM.
PHARMACEUTICAL CHEMISTS.

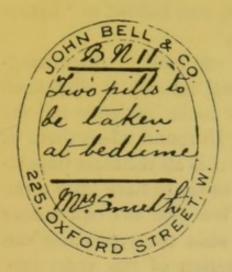
an eighth part to be taken three times a day

225, OXFORD STREET, Opposite Gt. PORTLAND STREET



# The Syrup Asmall teaspoonful to be Stateu two or three times aday in a little water after meals. Copied R 473 M-Robinson ALLEN & HANBURYS LTD Prough Court Lombard St 1 Vere St. Cavendish Sq' LONDON.E.C. 1000000 W

of the staffs, but in the case of Messrs. Allen & Hanburys' label the writing is in lithographic facsimile.



The following is a style of label which suits dispensing-businesses where the physicians' prescriptions are kept and filed, which is practically universal in the United States. The special advantage of the label is that when used on a square

THE MIXTURE.

A Yables poonful
to be taken
three times a
day, after meals.
Thiss fones

FROM PETER BOA,
119, GEORGE STREET,
EDINBURGH

THE MIXTURE.

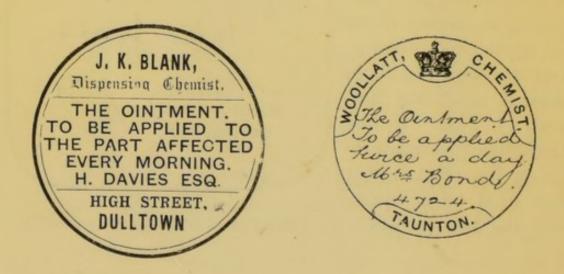
A Yables poonful
to be taken
three
times a

bottle the directions face the reader, and there is no possibility

I. ROE, THE V OF THE CITY NRK, AVENUE, UK.	DIRECTIONS:		61
ARD HAD PHARMAC F NEW YOR YORKTH	Dose	n No.	
COLLEGE OF  2047 I		Prescription Dr.	Date

of complicating reference-matter with directions. We would prefer the label if it were turned round, bringing the blank lines parallel with the chemist's name, and instead of 'Directions' using the words 'The Medicine.'

It is desirable to have more than one kind of dispensinglabel, so that if more than one internal remedy is dispensed for a patient, or if there are two or more patients in one family, there may be distinctiveness. In round labels there is little room for variety, but in this case it is all the more important, owing to the small space for directions, to have little room wasted on the name and address. We give two specimens of round labels, one of which shows what the typewriter can do. This was done following a suggestion of ten years ago, which has never caught on, and deservedly so:—



The foregoing examples show several styles of handwriting. The ability to write neatly is an essential part of the Minor candidate's qualification (see page 1). Bad penmanship is too easily accepted as a sort of natural defect, and a good many people even pride themselves on it. Some perseverance, however, is all that is necessary to make a bad writer into a good one, and the youth who will not take the trouble to cultivate that first branch of his art had better abandon any thought of fitting himself to become a dispenser of medicines.

Labels should always be neatly trimmed by carefully cutting off with a pair of scissors the surplus paper at the margin.

Many pharmacists omit to do this, although it adds greatly to the 'finish' and elegant appearance.

The rare, but not unknown, practice of placing a fresh label over an old one to save the trouble of removing it should on no account be permitted. Apart from the slovenliness, such a habit may produce, and has produced, mistakes from the accidental removal of the top label and exposure of another unlike it in nature or dose. At any rate, the recognised rule in all good pharmacies is to take a clean bottle each time a prescription is dispensed. A customer now and then objects to his bottle being changed, but that is the exception which proves the rule.

'Poison,' 'Shake the bottle,' and other adventitious labels are best placed at the shoulder of the bottle. If placed at the foot, the hand holding the bottle may cover them, or a hurried person may overlook them: at the shoulder they will be read first. Moreover, it frequently happens that the patient will only tear off the upper part of the wrapper; hence a label at the bottom of the bottle in this case would be of no avail, because not seen.

Another plan which is equally efficient, and neater, is to have 'Poison' and 'Shake the bottle' printed on the labels. One series of lotion-labels may be had with 'Poison' at the top, and another series without. In the same way, mixture-labels may be had of two series—one with a plain 'The Mixture,' and the other with 'Shake the bottle before using' printed immediately below 'The Mixture,' or at the bottom of the blank space. Orange-coloured paper is very commonly used for poison-labels, and is undoubtedly very distinctive; but it has the disadvantage that when used for oleaceous liniments the labels are apt to get stained, and the stains almost obscure the printing and writing.

The Poison Regulations of Great Britain now require that embrocations, liniments, and lotions containing scheduled poisons shall be dispensed in bottles 'distinctive to touch.' By this is meant one or other of the poison-bottles. It is common to dispense lotions in flat bottles of green glass corrugated at the back, and embrocations and liniments in the hexagonal cobalt-blue bottles. If registered chemists and druggists in Great Britain do not use these or other distinctive bottles for the medicines specified, they render themselves liable on conviction to a fine of 51. for each offence. Registered medical practitioners are exempt from the regulations. The following is

## THE SCHEDULE OF POISONS.

### Part I.

Aconite and its preparations.
Arsenic and its preparations.
Cantharides.
Corrosive sublimate.

Cyanide of potassium, and all metallic cyanides and their preparations. Emetic tartar.

Ergot of rye and its preparations. Prussic acid and its preparations. Savin and its oil.

Strychnine and its preparations, and all poisonous vegetable alkaloids and their salts.

#### Part II.

Almonds, essential oil of (unless deprived of prussic acid).

Belladonna and its preparations.

Cantharides, tincture and all vesicating liquid preparations of.

Carbolic acid [and in G.B. liquid preparations of and its homologues containing more than 3 per cent.].

Chloral hydrate and its prepara-

Chloroform.

Corrosive sublimate, preparations of.

Morphine, preparations of.

Nux vomica and its preparations.

Opium and its preparations; and

preparations of poppies.

Oxalic acid [and in Ire. oxalates]. Precipitate, red (red oxide of mercury).

Precipitate, white (ammoniated mercury).

Vermin-killers—i.e., 'every compound containing any poison within the meaning of the Pharmacy Act, 1868, when prepared or sold for the destruction of vermin.'

Sulphuric ether.

Phosphorus and all preparations containing it in a free state.

Preparations of strychnine (in Ireland: for G.B. see above).

Biniodide of mercury.

The substances printed in *italics* in Part II. are in the Irish poison schedule, but not in that for Great Britain. It will be understood that in *dispensing* the same rule applies equally to

both parts of the schedule, but in *retailing* those of Part I. may only be sold to persons known to the seller or introduced to him, and they must be entered in the poison-book and signed for. All poisons retailed must bear the name of the poison, the word 'Poison,' and the name and address of the seller. The following are the

#### Poison Regulations.

Regulation 1.—That in the keeping of poisons, each bottle, vessel, box, or package containing a poison be labelled with the name of the article, and also with some distinctive mark indicating that it contains poison.

Regulation 2.—Also that in the keeping of poisons, each poison be kept on one or other of the following systems, viz.:—

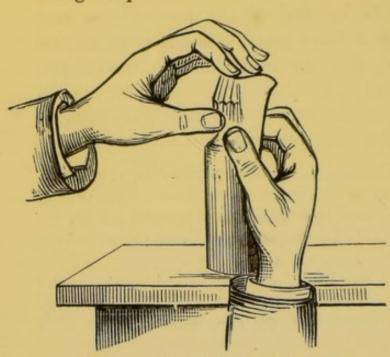
- (a) In a bottle or vessel tied over, capped, locked, or otherwise secured in a manner different from that in which bottles or vessels containing ordinary articles are secured in the same warehouse, shop, or dispensary; or
- (b) In a bottle or vessel rendered distinguishable by the touch from the bottles or vessels in which ordinary articles are kept in the same warehouse, shop, or dispensary; or
- (c) In a bottle, vessel, box, or package kept in a room or cupboard set apart for dangerous articles.

[Each poison is here referred to, so that all systems are likely to be required or used. One will keep oxalic acid in a different way (say, a) from hydrocyanic acid (say, c), although the latter would also be tied over as a requires. Each chemist and druggist may decide within the above lines what is best for his own business.

Clause a.—It is a good rule to keep things not frequently wanted in a cupboard, so that those only which are most often required will have to be dealt with in this clause. Note that the regulation refers to securing the stopper or lid of the vessel, &c., or the vessel itself. This applies to liquids and powders. Ointments and extracts generally kept in pots may be kept according to b or c. One or two pieces of sandpaper placed on plain bottles or pots make them distinguishable to touch, and meet the regulation.—Ed.]

Regulation 3. That in the dispensing and selling of poisons, all liniments, embrocations, and lotions containing poison be sent out in bottles rendered distinguishable by touch from ordinary medicine-bottles, and that there also be affixed to each such bottle (in addition to the name of the article, and to any particular instructions for its use) a label giving notice that the contents of the bottle are not to be taken internally.

Capping Bottles.—In capping bottles with leather it is a good plan to soak the leather for a short time in lime-



HOW TO MAKE A PLEATED PAPER CAP EXTEMPORANEOUSLY.

water, or even in plain water. Crimson paper is generally used for capping (in the manner shown in the accompanying figure), but it is now largely giving way to ready-pleated caps. The cap should be secured with a small indiarubber band, as it can be most readily removed in that way; but if secured with twine, form a loop knot, so that twine and

cap may be easily removed. On the whole, finishing off without a cap is better than with it, from the patient's point of view, and an embossed circular label for the top of the cork is better than a heavy sealing-wax finish, although the latter has the more substantial appearance.

One Thing at a Time.—Never have two prescriptions going at once. Of course, if there is an infusion to make, you will set that on—set the jar on one side, marking on a piece of paper what it is, and place this label between the edge of the cover and the jar. You can then go on with another prescription. But, having finished one, clear up all disorder, and put away bottles, measures, and mortars, before beginning anything else. Indeed, bottles, measures, and mortars should be set aside for cleaning directly after being used, and should on no account be allowed to accumulate on the dispensing counter.

Checking.—It is desirable that one person should copy the prescription, write the labels, and dispense the medicine.

The copying should always precede the dispensing, and the dispenser will then have acquired a general acquaintance with the prescription. If the staff is large enough, it is a very good plan for a second person to examine the medicine, compare the labels with the prescription, and finish off. In any case, the dispenser should never let the medicine leave him without making a final reading of the prescription, concentrating all his attention on it, and considering whether he has exactly followed the instructions. Then he should compare the medicine which he has compounded with the prescription; noting the colour of the medicine, smelling it, tasting it if that is appropriate, and observing whether there is a sediment or not. All these points are good to observe, and when they are made a matter of custom they become a valuable precaution.

It is customary in the best dispensing houses for each weighing or measuring of a poison to be checked by a second dispenser. This excellent rule should be adopted in every establishment.

Precautions.—It is a common plan on the Continent and in the United States to use duplicate numbers for the dispensing department. A certain number is given to the person ordering the medicine, and a corresponding one is attached to the prescription, so as to guard against the possible occasional delivery of the wrong medicine.

Another method of carrying out the same precaution is to attach to the prescription, and then to the finished medicine, a printed form, something like this:—

Prescription received			3.10 P.M.
Medicine ready .			3.30 ,,
Delivered to messenger			4.0 ,,

The advantage of this was demonstrated in the case of a messenger who, having wasted several hours on his errand and delivered the medicine after the patient had died, pretended that he was detained by the pharmacist, but his false statement was refuted by a label like the above.

Another good method is the use of a small adhesive label, marked 'Immediate' in very bold type, as here shown. This

## IMMEDIATE.

Order received at Sent out at is placed outside the parcel in the most prominent position, so that it cannot fail to catch the eye of the messenger and of the person to whom the medicine is delivered at the house. This label should

only be used for parcels of special urgency and those promised for delivery at a certain hour. It is much more effective than the line of small type often heading the prescription-envelope, 'It is important that this medicine be delivered without delay,' which is probably rarely read.

Another important detail, and one which is now commonly adopted in large dispensing establishments, is to attach a small label to each box, bottle, pot, &c., initialed by the dispenser, and also by the checker, previous to wrapping it up and sending it out. Thus:—

Dispensed by A. B. Checked by C. D.

The advantages of this plan are obvious. There is the probability of detecting any serious blunder, while if it is checked by a superior it is calculated to act as a deterrent to slurring the dispensing in any way.

## INCE'S DISPENSING APHORISMS.

Read through a prescription, rapidly and in a manner suggesting no suspicion of doubt.

Write directions invariably before dispensing.

Avoid thus the use of blotting-paper: a good dispenser uses almost none.

If a mixture contains readily soluble ingredients, never use a mortar.

Avoid effecting solution by heat, for fear of recrystallisation. With syrups and also ingredients not water, arrange in dispensing to rinse out the measure and leave it clean.

A skilled dispenser shows very little traces of his work.

Carefully clean and put away weights and scales after each operation.

Hold the scales firmly by the left hand; never lift them high above the counter; and judge of the weight as much by the indicator as by the position of the scale. [This old-fashioned aphorism is dealt with in the next chapter.—Ed.]

Select glass pans for scales—preferably of heavy make—and discard flimsy brass material, which corrodes speedily and becomes inaccurate.

Learn to judge of the quantity to be weighed with tolerable accuracy: train the eye as well as the hand.

If in doubt, always begin with that of which you have no doubt.

Be rapid in manipulation.

Finish wrapping, tying, or sealing quickly.

Slow dispensing is bad dispensing, and arises either from deficient practice or want of knowledge.

Never, when in a shadow of doubt, hesitate to ask advice from a fear of compromising your own dignity.

## WEIGHTS AND MEASURES.

In the British Empire the weights and measures most commonly employed for dispensing-purposes are those of the Imperial system and the old apothecaries' weights and measures. The unit of weight in each is the same—namely, the grain, an entirely arbitrary but exceedingly convenient unit. In the United States similar systems are in use, but the standards employed there are those originally introduced from England when the United States was a British Crown Colony; and as many changes have since been made in our Imperial system, there are differences between the American and British standards, although the designations may be the same. The differences between the two systems are in measures and higher weight denominations than the grain, which is the same in both.

The United States standard for measure is the old wine-gallon, used in England before 1826; this gallon being 231 cubic inches in capacity. It is divided into 8 pints, each of 16 ounces; the ounce is divided into 480 minims, and a minim of pure water at 22° C. weighs 0.9483 grain.

The Imperial gallon is the measure, at 62° F. and normal pressure, of 10 pounds, or 70,000 grains, of pure water—that is, a volume of slightly over 277½ cubic inches. It is divided into 8 pints, each of 20 ounces, the ounce being divided into 480 minims; and a minim of pure water at 62° F. weighs 0'9114 grain, so that 50 Imperial minims equal 48 American minims.

The Imperial ounce is  $437\frac{1}{2}$  grains, but the American is 455.7. The apothecaries' system is used in both countries,

and the weights are the same—that is, one apothecaries grain is equal to one avoirdupois grain in both, and the scruple equals 20 grains, the drachm equals 60 grains, and the ounce equals 480 grains—Americans generally speak of it as the 'Troy ounce,' Britishers saying the 'apothecaries' ounce' or 'Troy ounce' according to the trade in which it is used.

It is the universal custom in the British Empire, France, and the United States, when dispensing to weigh solids and measure liquids, and that is the rule of this book. The weight and measure signs employed in prescriptions are—

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3, ounce = 480 grains by weight or 480 minims by measure.
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gr., grain.

m, minim =  $\frac{1}{480}$  of one ounce by measure, equal in pure water to  $\frac{10}{4375}$  of the avoirdupois ounce.

C., Congus or gallon of 160 ounces (British) or 128 ounces (American).

tb, Libra or pound of 12 Troy ounces.

lb., ,, ,, ,, 16 avoirdupois ounces.

The last four signs are rarely employed in prescriptions.

Signs.—Probably owing to the fact that the retailing and dispensing of drugs go on simultaneously in the same pharmacies, also on account of the fact that few dispensing chemists have sets of apothecaries' weights over the 3ij., while all have complete sets of avoirdupois or Imperial weights, doubt is frequently expressed as to what the signs in prescriptions imply-Once upon a time apothecaries' weights alone were employed in compounding drugs, but the British Pharmacopæia adopted the Imperial, and in 1877 the late Dr. Redwood, then an editor of the British Pharmacopœia, gave an authoritative and reasonable explanation of what is to be understood by the various signs for weights and measures. He pointed out that the British Pharmacopæia adopts the avoirdupois weights, and the signs employed—lb., oz., gr.—apply to the weights of this system. The other signs-9, 3, 3, 16-however, mean what they always meant-namely, the scruple, drachm, ounce, and

 $<sup>\</sup>Theta$ , scruple = 20 ,, ,, ,,

pound of the apothecaries' system. The only difficulties can occur in the ounce and pound. Strictly speaking, therefore, it should be understood that '\(\frac{7}{2}\)' means an apothecaries' or Troy ounce of 480 grains, while 'oz.' means an avoirdupois ounce of 437\frac{1}{2}\) grains. So '\(\frac{1}{6}\)' is the Troy pound of 12 Troy ounces, and '\(\frac{1}{6}\).' is the avoirdupois pound of 16 avoirdupois ounces. The British Pharmacopæia contains the following statement in the preface:—

No alteration has been made in the weights and measures which in the edition of 1864 were directed to be used in the preparation of medicines. The grain weight, established by law in this country, is well known and well defined. It has been in use from a very remote period, and forms a convenient unit for estimating the weight of many medicines. The avoirdupois ounce and pound, being the weights practically used in the sale of medicines and generally in commercial transactions, were adopted in the edition of 1864, and are still retained in preference to Troy weights of the same denominations. It must be admitted that the absence in the present system of any denomination of weight between the grain and the avoirdupois ounce of 437.5 grains, and the fact that the ounce is not a simple multiple of the grain, are grave defects; still it has not been thought desirable to make any change in this respect at present, especially as no practical inconvenience appears to be experienced in preparing by means of these weights the medicines ordered in the Pharmacopæia. It is strongly urged upon all medical men to avoid the use of the terms ounce and pound with reference to any other than the avoirdupois or Imperial standard weight; but it will be optional with the physican in prescribing to use the symbols and 3, the former representing 20 and the latter 60 grains, if such should be found to conduce to accuracy or convenience. In the measurement of liquids the Imperial measure is used for the higher denominations, and the fluid ounce and its subdivisions into fluid drachms and minims for the lower denominations, of volume. These measures are convenient, and have become familiar, having been used throughout the United Kingdom for many years.

It will be seen that the Pharmacopæia discourages the use of the '\(\frac{7}{3}\),' but although the advice was first given in 1867 it has had practically no effect in prescription-writing.

The Pharmacopæia of 1885 introduced for the first time the fluid grain in certain formulæ for preparations, especially some *liquores*. This measure is the volume of 1 grain of water at the normal conditions, and it was officialised in

order to bring potent preparations more into conformity with continental custom. It is not a legal measure, and may only be used in compounding and manufacturing, not for purposes of trade (i.e., buying and selling), nor may measures graduated in fluid grains be verified by inspectors of weights and measures.

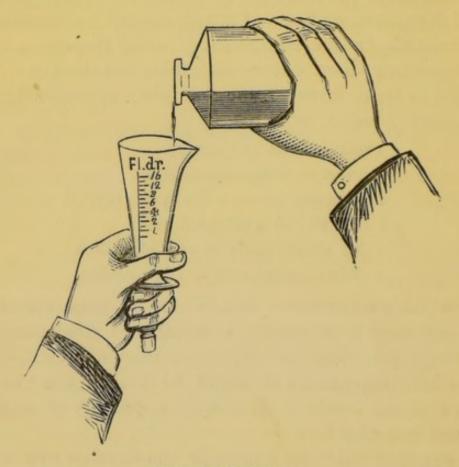
The Metric System is exclusively employed on the Continent, and both liquids and solids are weighed except in France, where the rule 'solids by weight, liquids by measure' also holds good. The use of the system is now legalised in the United Kingdom, and sets of metric weights and measures are more suitable for the equipment of every dispensing counter than depending upon conversion-tables and the like. It may be useful to state, however, the following approximate values of the more common terms:—

I gramme =  $15\frac{2}{5}$  grains. I grain = 6 centigrammes. I kilogramme = 2 lbs. 3 oz. (av.). I lb. (av.) = 456 grammes. I oz. avoirdupois =  $28\frac{1}{2}$  grammes. I cubic centimetre =  $16\frac{1}{4}$  minims.

It is fairly accurate to reckon that 30 grammes of water or liquids near it in density is equal to 1 fluid ounce; but it is always preferable, in dispensing foreign prescriptions, to weigh all the ingredients as would be done on the Continent. The tare of the bottle is taken with a quantity of small shot contained in a chip box.

In weighing fluids for a mixture, the German rule is to put the smallest quantity ordered in the bottle first, then the next larger quantity, and so on. The reason is that the delicacy of the scales diminishes with the increased weight, and as the medicines ordered in small quantities are generally the most powerful, they need to be dispensed with the greatest degree of accuracy. When so many drops of a fluid are ordered it is usual to put the drops in first, so that if a few drops too many fall in they can be returned. Fluids up to 1 gramme are generally dropped, and it is reckoned that of the fatty oils, the heavier essential oils, and tinctures, 20 drops = 1 gramme; of other essential oils, chloroform, acetic ether and spirit of ether, and aqueous fluids, 25 drops = 1 gramme; of ether, 50 drops = 1 gramme. These calculations are not quite accurate, but they accord with the Prussian medicinal tariff, which is understood by the prescriber and dispenser to be a common basis of reckoning.

The rule brings out prominently the superiority of the English system of measuring, and the immense advantage of so



HOW TO MEASURE.

Grasp the measure with the thumb and forefinger of the left hand, and bring the second finger under the measure so as to keep it level. The other fingers thus remain free to grasp the bottle-stopper.

small a unit of measure as the minim. The principle of the rule (taking the smallest quantities first) has its application, however, to our method, the exceptions being where following the rule would give a result not desired. The smaller quantities and thinner fluids should invariably be measured first, or, if this does not quite suit a special method of com-

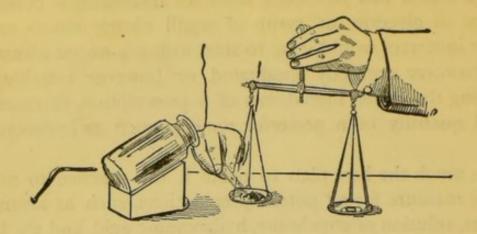
pounding, they should be measured with a fresh measure-glass. To measure, for example, I drachm of hydrocyanic acid in a measure which has just been used for measuring  $\frac{1}{2}$  ounce or I ounce of glycerin or syrup of squill clearly courts error. Equally incorrect would it be to start with a 4-ounce measure-glass, however correctly graduated or however suitable for measuring the other ingredients of a prescription, to measure a small quantity of a powerful remedy, such as hydrocyanic acid.

It is much the best plan to make it the practice to use a separate measure for all potent preparations, such as arsenical solutions, solution of strychnine, hydrocyanic acid, and the like, and, if the nature of the mixture permit it, measure such preparations last—that is, after the mixture is made up with water or other diluent, leaving room for the potent preparation.

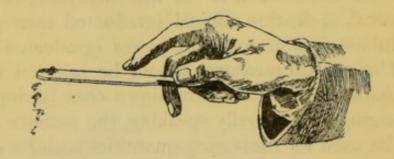
The most useful measures for the dispensing-counter are 2-ounce conical, 4-drachm conical (graduated throughout for each 20 minims), and 20-minim pipettes (graduated for each minim). The conical measures should be selected of rather elongated shape, the inner sides forming a cone having straight sides (no bulging). Generally speaking, the 2-ounce measure should not be used for measuring quantities under 2 drachms, nor the 4-drachm measure for quantities under 20 minims.

How to Weigh.—Mr. Joseph Ince, in one of his dispensing aphorisms (page 23), says: 'Hold the scales firmly by the left hand.' Some present-day students of pharmacy will wonder what that means; so we may explain that up to about forty years ago the scales solely used in dispensing were apothecaries' scales, kept in a box, and held up by the hand when weighing. They are still used in some pharmacies. The first illustration on page 30 is reproduced from Mr. E. W. Lucas's 'Pharmacy' (published by Messrs. J. & A. Churchill), and shows how weighing is done. These old-fashioned scales are rapidly and deservedly giving place to more accurate scales suspended from a pillar, or even to chemical balances, French box scales, and the torsion-balance have been adopted

by those who desire strict accuracy. In using such scales and balances the weights are put into the left-hand pan, the bottle,



if desired, may be held in the left hand, and the powder be taken out with a spatula held in the right hand in the manner shown in the subjoined sketch; the forefinger being left free



to tap the spatula, so that minute quantities may fall into the scale-pan, when the desired weight is almost obtained. Such substances as solid extracts are usually weighed on a tared piece of paper, or on a tared watchglass.

Carelessness in Weighing or Measuring is not to be tolerated. There should be if possible—and there generally is in good pharmacies—a balance for weighing small quantities of alkaloids and other strong remedies. In no case should guesswork exist at the dispensing-counter. With mixtures or solutions generally there is little fear that such a course will be adopted; but we have seen doses of powdered opium guessed at by the spatula, and so dispensed. We have seen more than once a definite weighed quantity of a compound powder subsequently divided without weighing into the

prescribed number of powders. All good dispensers strongly condemn this or any other methods which court danger, and pharmaceutical examiners show their appreciation of it by rejecting candidates who do such things. It is generally safe to give minims when *guttæ* are ordered, because drops vary in size according to the nature of the liquid, the lip of the bottle, the quantity in the bottle, temperature, &c.

In some cases it is desirable to weigh rather than measure a liquid—for example, in the case of a dozen minims of croton oil ordered for pills. Here it is practically impossible to get 12 minims of the oil out of a measure once it is in, but it may be weighed on the glass scale-pan upon some inert powder, such as soap, previously weighed. It should be remembered that a minim of anything lighter than water weighs less than one grain, or more than a grain if the liquid is heavier than water. The average specific gravity of croton oil is 0.950, and the weight of a minim of water is 0.9114 grain, so that 0.950 × 0.9114 × 12 = 10.42 (say 10½ grains), the weight of 12 minims of croton oil. Similar calculations may be made in respect to other things.

Fractions of a Grain are frequently ordered—for example, twenty pills each containing  $\frac{1}{24}$  grain of strychnine. In this case weigh 1 grain of alkaloid and triturate it with 11 grains of sugar of milk (which thoroughly divides it), and take 10 grains of the mixture for the twenty pills. A difficulty sometimes is found when fractions of minims are ordered—for example, two pills are ordered each to contain  $\mathfrak{m} \frac{1}{8}$  of croton oil and  $\mathfrak{m} \frac{1}{4}$  of peppermint oil. The best plan in this case is to rub up 1 grain of croton oil and 2 grains of peppermint oil with 10 grains of soap, and take a fourth part of the mixture for the pills.

Triturations of Potent Remedies.—For general dispensing-purposes triturations of arsenic, strychnine, sodium arsenate, mercuric chloride, &c., are very useful. One part of the medicament is lightly triturated with an equal weight of coarse sugar of milk until thoroughly mixed, then with firmer pressure until an impalpable powder is produced; next

add gradually 8 parts of fine sugar of milk, and continue trituration until uniform, occasionally detaching all powder adhering to the mortar and pestle. Transfer to a bottle, and label distinctly with the name of the medicament on one line, and below it 'Trituration I in Io.'

Percentage Solutions sooner or later become a problem to the dispenser or student, on account of differences of opinion about what they are and complications between our weights and measures.

The percentage solutions employed in chemical or other scientific research are solutions containing a known weight of the dissolved substance, called the 'solute,' in a definite weight of the solvent; thus a 5-per-cent. aqueous solution of borax is made by dissolving 5 grammes of borax in 95 grammes of water, or if glycerin is the solvent, 95 grammes of glycerin is taken. It follows that the volume strength of these scientific solutions varies inversely as the density of the solvent; thus the aqueous borax solution contains 1 of borax in about 100 by volume, and the glycerin solution 1 of borax in about 80 by volume. These are not the solutions required at the dispensing-counter—in fact, they are used in research, and only when all quantitative determinations are made by weighing so as to be independent of the volume changes induced by variation in temperature.

Medicinal percentage solutions are a definite weight or volume of the solute in a known volume of the finished solution. For example, a 1-in-1,000 solution of mercuric chloride would mean 1 gramme of the salt dissolved in sufficient solvent—say, water—to make 1 litre (1,000 c.c.), or 1 ounce dissolved in sufficient water to make 50 pints (1,000 oz.); but if we weigh the mercuric chloride in grains the operation becomes confusing because the minim is not the equivalent of a grain in the sense that the c.c. is the equivalent of the gramme and the oz. of the fl. oz. It is necessary to bear in mind that 1 grain in 100 minims is not a 1-per-cent. solution, but 1 in 91, and 1 grain in 110 minims is approximately 1 per cent.

In preparing percentage solutions at the dispensing-counter in so small quantities that the avoirdupois ounce is inadmissible, the dispenser's easiest plan is to use metric weights and measures; otherwise grains and measures in the proportions mentioned. Thus  $4\frac{1}{2}$  grains of mercuric chloride in 10 ounces of water is a 1-in-1,000 solution—not strictly so, but sufficiently near for surgical purposes, although a pharmaceutical examiner might not pass it. The British Pharmacopæia 1-per-cent. solutions are made by dissolving  $17\frac{1}{2}$  grains of the solute in sufficient solvent to make 4 ounces of the solution.

There is, however, an exception to the rule—namely, when the solutions are to be administered by minims. This is especially the case with hypodermic injections, which are generally given in minims, and physicians who order 1-in-10, 1-in-20, 1-in-100, &c., solutions of this kind reckon that they are to get the unit of weight in the specified number of minims. These give no trouble at the dispensing counter, except when large quantities have to be made up; then the following table will be useful:—

	Fl. oz.
,000 in	25
,000 in	25
,000 in	25
,400 in	25
,000 in	25
,500 in	25
,200 in	25
	,000 in ,000 in ,400 in ,000 in ,500 in

It may be further noted that the British Pharmacopæia invariably uses the word 'fluid' before any denomination (drachm or ounce) when the substance is to be measured; otherwise it must be weighed.

# PRESCRIBERS AND DISPENSERS.

IF more attention were given by prescribers to the possibilities of ambiguous nomenclature, it would be a great boon to pharmacists and would save much worry and occasional maltreatment. For preparations mentioned in the British Pharmacopæia the name there found should be used, and in ordering those not included in the B.P. the initials of the Pharmacopæia or the name of the standard work in which the formula may be found should be appended.

No hard-and-fast rule can be laid down for the dispenser's guidance when he finds an article mentioned by a name which applies to two or more preparations. Probably the date of the prescription may help him. Suppose the following prescription is presented:—

The only official simple tincture existing when that prescription was written was tinctura cinchonæ flavæ. Now this tincture has been expunged from the Pharmacopæia and a tincture of the red bark has taken its place, but there is no law which compels the dispenser to give the latter tincture in such an instance as the above. The patient has used the old tincture and may prefer it. There are other instances, such as the cases of the liquors which were slightly altered in strength in 1885. Here the dispenser may use the new preparations, because there has been no material alteration which would affect the

therapeutic results. The following mixture is a very good example of a case in which the substitution of an altered preparation for an old one gives quite a different result:—

The liquor bismuthi of the 1867 B.P. gave a clear mixture, because it contained excess of ammonium citrate and nitrate which prevented precipitation of bismuth carbonate. The present liquor does not contain the excess, so the mixture made with it has a copious precipitate.

Dr. Whitla says that the dispenser will often be at a loss to understand the meaning of the prescriber when he orders some preparations out of their official names. Then he must either have a consultation with the prescriber or rely upon his experience. Dr. Whitla gives the following examples: When 'magnes. calc.' is ordered, magnesia B.P. should be used; when 'magnes. carb.' the heavy preparation is usually intended; when 'bismuth' or 'bismuth. alb.' is prescribed, the subnitrate is the preparation generally in the mind of the physician; when 'aqua menth.' is ordered, 'aq. menth. pip. should not be used, but aq. menth. sativ. is the intention of the prescriber.'

This is a good example of the difference of opinion amongst authorities. In some establishments aq. menthæ virid. is always dispensed for 'aq. menthæ,' but this custom is not general. Aq. menth. virid. is ordered only by old practitioners, but aq. menth. pip. is decidedly the favourite, and is used officially as a flavouring agent. For these reasons it is advisable to use aq. menth. pip. when 'aq. menth.' is ordered, unless the dispenser knows the intention of the prescriber to be the contrary. In 1888 The Chemist and Druggist obtained the opinions of thirty leading London consultants on the question, 'What is aqua menthæ?' and only two or three said, 'Aq. menthæ vir.'

Dr. Whitla's remarks regarding magnesia recall a comment

which we made in a previous edition. It was then said that some apparent difficulties can be settled by reference to the Pharmacopæia—e.g., magnesia, prescribed as such, means the mag. calc. pond. according to the B.P. The light variety is expressly designated magnesia levis. This no longer strictly applies, for the term 'magnesia' has been changed to 'magnesia ponderosa,' and 'ponderosa' has also been added to magnesii carbonas. Light carbonate of magnesia is so seldom used, except in the special cases of inhalation—e.g., vapor pini sylvestris—that there should be no hesitation in giving the heavy carbonate when 'magnes: carb.' is ordered. Regarding calcined magnesia, however, the dispenser may well pause and consider questions of bulk, date, &c., before he decides whether he will use the heavy or the light.

Amongst other ambiguities of nomenclature, the following are worth notice:—

Acid. nitro-hydrochlor., prescribed without the addition of the qualifying term 'dil.,' is an instance of careless prescribing, but it can hardly occasion a doubt, as the strong compound acid is not official. The acid. nitro-muriat. of the Dublin Pharmacopæia is occasionally prescribed by some of the older race of medical men, but it is usually written in the old style, acid. nit.-mur.

Aloes.—The question as to whether Barbados or Socotrine aloes should be used when 'aloes' only occurs in a prescription is one which at one time presented no difficulty, for Socotrine aloes was most commonly employed, Barbados aloes being more used for veterinary purposes. Prescribers who know the difference between the kinds of aloes, and the milder action o the Socotrine, are careful to specify 'Soc.' in their prescriptions; which fact, in conjunction with the B.P. preference for the Barbados kind, justifies the dispenser in using the latter for 'aloes.' We may, however, explain that the best dispensing houses prefer the Socotrine.

Æther. chlor., formerly a source of some doubt, is now represented in the British Pharmacopæia by spirit of chloroform, the synonyms of which are chloric ether and spirit of chloric

ether. It may here be pointed out that the original preparation made by Messrs. Duncan, Flockhart & Co. is distilled, is not the same chloroform strength of the official spirit, and is soluble in water. Some prescribers still prefer it.

Ferri cit. is sometimes written for ferri ammon. cit., but if a mineral acid be in the prescription the simple citrate of iron makes a better mixture.

Hyd. chlor. may mean calomel, corrosive sublimate, or chloral hydrate, and mistakes have happened in consequence of this wholly unnecessary abbreviation. But there is little excuse for a mistake if the dispenser thinks of what he is about. Corrosive sublimate is never given with a purgative or as a sleeping-draught, and the whole danger really lies in corrosive sublimate. But there may be almost equal danger when the medicine is for external use. For example, the dispenser who got the following prescription gave ammoniated mercury for 'hyd. chlor.':—

 Hyd. chlor.
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 .
 gr. x.

 Camphor.
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 gr. x.

 Ung. cetacei
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M.

It is reasonable to suppose that the prescriber means this to be a camphor-chloral ointment, but calomel and camphor (an excellent combination for piles and *pruritus ani*) were intended.

Liq. cinchonæ.—Should Battley's preparation or the pharmacopœial liquid extract be supplied for this? The reply to this is that since the introduction of a formula for liquid extract of cinchona into the Pharmacopœia liq. cinchonæ and ext. cinchon. liq. are synonymous, and when liq. cinchonæ is prescribed without 'Battley's' the dispenser should use the official preparation.

Liq. ergotæ stands for extract. ergotæ liquidum. There need be no hesitation about the matter in these cases: all that one has to consider is that liquor is a commonly accepted synonym of extractum liquidum, and adherence to the British Pharmacopæia is, in the circumstances, the safest rule for the dispenser to follow.

Liq. morphinæ is very often written in prescriptions, and the dispenser will follow the majority in giving liquor morphinæ hydrochlor. There are exceptions, however, e.g.:—

In this case use liq. morph. acet., as with liq. morph. hydrochlor, there would be precipitation of lead chloride. Some physicians use only the acetate of morphine, but such prescribers are generally very particular in specifying what they want.

Liq. taraxaci.—The difficulty regarding the use of the word 'liquor' gets a new phase when we turn to liquor taraxaci. 'What should be dispensed for this, the succus or the liquid extract?' If the prescription was written before the publication of the 1885 Pharmacopæia, the succus should be dispensed; but if after, the liquid extract. To which a critic replied:—

'The logic of your inference is no doubt correct, but practice negatives it. "Liq. tarax." has long been synonymous with "succ. tarax." Some wholesale houses used to send out the prescription labelled "Liq. Tarax. (Succ.)." Most Westend houses would not hesitate to use succ. tarax. B.P. when liq. tarax. is prescribed.' To this we may add that, so far as appearance is concerned, it does not matter much which is used, the fluid extract being an amber-coloured limpid liquid closely resembling the juice; but there is a proprietary *liquor taraxaci* on the market which is dark and viscid.

Tinct. card. is occasionally prescribed, and the dispenser must use his discretion whether a simple tincture or the usual compound tincture is required. In such a case, if the prescription has been previously dispensed, it is best to explain the doubt to the customer, showing him that, though the appearance may differ, the medicinal importance of the difference is but trifling. So also in such cases as tinct. gentianæ, tinct. guaiaci, &c. Generally speaking, it is correct to assume that the prescriber is quite familiar with the British

Pharmacopæia, and the dispenser is at all events safe in assuming that he is, and using official medicines.

Questions of Measurement.—The dispenser frequently meets with prescriptions in which it is doubtful what size of mixture the prescriber intends. The following is a good example:—

M. fiat mistura. 3j. horâ somni sumend.

Should this be dispensed as written, as a 6-ounce mixture, or as an 8-ounce? If the dispenser cannot communicate with the prescriber, and has no means of knowing what his intentions in the matter are, the safe plan is to dispense the prescription as written. At the same time, this course would be considered pedantic by many pharmacists, because it is apparenthat by making an 8-ounce mixture, a half-drachm dose of ammonium bromide and a drachm dose of syrup of chloral would be contained in each ounce; and these are most likely intended. One pharmacist who holds this opinion remarks: 'There are cases (and this is one of them) where the dispenser must use his own discretion, and be guided by experience, in trying to find out the intentions of the prescriber, and to do this he must go beyond the bare written instructions. If he does this with tact and to the best of his ability, he will ensure the confidence of the practitioner and his patient, and avoid any need for explanation.'

It is also worth keeping in mind that one's care in following the letter of such a prescription is thrown to the wind if the patient gets his doses measured in a domestic spoon; and, after all, in a case of doubt 2 per cent. difference on a dose either way cannot disturb the therapeutic action of the remedy. No alteration should be made in a physician's prescription unless with the prescriber's sanction. Do not of course kill a patient for the sake of a rule.

Familiarity with the prescriptions of a physician obviates difficulties such as that under notice. For example, one

physician almost invariably writes his prescription for a mixture thus:—

Potass. bicarb.				3ij.
Tinct. nuc. vomic.				3ij.
Syr. aurant		- •		3j.
Inf. quassiæ .				ξviij.

Ft. mist.

The literal construction of this prescription is to make a  $9\frac{1}{2}$ -ounce mixture, but the actual intention of the prescriber is known to be an 8-ounce mixture. In all such cases the dispenser should annotate the prescription, so that other pharmacists not familiar with the peculiarities of the writer may not deviate from the original interpretation. This may be done alongside the 3viij., thus 'ad 3viij.,' or inside the date-stamp.

Alteration of Prescriptions.—This raises the question, To what extent is the dispenser justified in effecting the solution or suspension of an ingredient in a mixture which, though prescribed in an insoluble state, should be given in accurately divided doses? The following prescription may be taken as an example:—

Bismuth	i subr	nitrati	s .				3ij.
Magnesi	iæ por	nderos	æ				3j.
Tinctura	e gent	ianæ	comp.				Зj.
Aquæ						ad	Zviij.

Fiat mistura.

Obviously the patient cannot measure out equal portions of this mixture containing equal doses of the bismuth and magnesia compounds, and the dispenser would do him (or her) a good turn by adding a viscous ingredient to suspend it. Acacia mucilage is, on the whole, best for this purpose when bismuth subnitrate is present, as tragacanth mucilage and bismuth subnitrate in aqueous mixture form a glutinous, indiffusible mass at the bottom of the bottle. This appears to be due to the acidity of the subnitrate (a salt that liberates some of its acid in presence of water); but if there is excess of alkali in the mixture the tendency to clotting is reduced.

Compound tragacanth powder is better than the mucilage for suspending bismuth salts. Glycerin, in the proportion of I drachm to the ounce of a mixture, is also a useful suspending agent. Bismuth mixtures are fully discussed later.

Another case may be cited. Is the substitution of liq. arsenici hydrochlor. justifiable in the following prescription?—

The potassium carbonate in the liquor arsenicalis precipitates the mercury, and there is a possibility of the patient getting the whole of it (as mercuric hydroxide) in the last dose.

An analogous result is shown in mixtures of liq. arsenicalis and liq. strychninæ in certain proportions, the alkaloid being in this case precipitated. In both these cases the acid solution should, preferably, be used.

A prescriber gave a patient the following prescription, which was dispensed with liquor arsenicalis, and in due course the patient died, the symptoms being those of strychnine poisoning:—

Here there is between 2 and 3 grains of strychnine, and at least 2 grains of it is precipitated, as the solubility of strychnine in water is not much more than  $\frac{1}{16}$  grain per ounce. The prescriber in this case was charged with culpable homicide of the woman, and in the course of the defence he alleged that he meant the hydrochloric solution of arsenic when he wrote 'liq. as.,' but that a drunken assistant gave liquor arsenicalis. He was acquitted. A notable point for dispensers is that the strychnine in the mixture separated in crystals. Such prescriptions are very dangerous, because they often 'go all right' in dispensing, being quite clear when sent

out, because the precipitation of the alkaloid is delayed. The following are the solubilities in cold water of the toxic alkaloids:—

Aconitine (crys	st.)				1 in 2,500
Apomorphine			. :	about	1 ,, 800
Atropine.					I ,, 500
Cocaine .					1 ,, 1,300
Codeine .					1 ,, 80
Coniine .					1 ,, 100
Homatropine				about	I ,, I,000
Hyoscine				,,	I ,, I,000
Morphine					1 ,, 1,000
Physostigmine					1 ,, 350
Pilocarpine			less	s than	I ,, I,000
Strychnine					1 ,, 6,000 to 8,000
Veratrine					insoluble

Most of these solubilities are from Squire's 'Companion,' and from these data the dispenser will be able to judge whether precipitation is likely to take place or not in simple mixtures of alkaloidal salt solutions and alkalies. The presence of alcohol promotes greater solubility.

Careless Prescribers.—It would save the pharmacist a great deal of anxiety if prescribers would take the trouble to initial unusual doses, for many instances occur where it is impossible for the dispenser to know whether the dose is safe or not; for instance, the official dose of potassium iodide is 5 to 20 grains, yet 30 grains is a frequent dose, and even 1 or 2 drachms twice or three times a day, while some patients experience very unpleasant effects from a single dose of 2 grains. Again, the official dose of ext. ergotæ liq. is 10 to 30 minims, although 1 drachm is a very common dose, and in some cases 4 drachms or 1 ounce may be given with impunity.

Another example :-

Pil. coloc. co.				gr. ij.
Pil. cambogiæ o	co			gr. j.
Strychninæ .		1	1.1	gr. $\frac{1}{24}$
Ext. bellad	1000			gr. ij.

Ft. pil. in arg. Mitte xxiv. Sig. : One at bedtime.

Two grains of ext. bellad. (the green extract being intended) for a dose is unusual, but as the pill was for an adult, and was given only once a day, it might have been dispensed. But the dispenser happened to know that the prescriber gave only *small* doses of belladonna; the prescriber was therefore consulted, and the dose altered to  $\frac{1}{4}$  grain.

We know of another case in which an M.D. ordered 'ext. belladonnæ q.s.' to make a mass, and he meant it. The quantity required varied in his prescriptions, and his pharmacist made it a rule never to give more than I grain.

Where unusual doses are prescribed, the quantity should be indicated in words as well as figures. No emphasising of a badly written or smudged figure will render it less ambiguous; but if it be indicated in both ways it is scarcely possible that there could be any doubt of the interpretation. Thus—

would save the dispenser from any hesitation as to whether the quantity was L. or 4.

Cipher Prescriptions are, happily, not common, and are usually a convenience to the prescriber rather than an intentional concealment of his intentions in favour of a particular pharmacist. They are annoying, nevertheless, to those who have to tell customers that they cannot dispense the prescriptions without consulting the prescriber or the pharmacist who first dispensed the prescription. The best course to adopt with customers when such prescriptions are received is to say that this is a special preparation of Dr. So-and-So's, about which you will need to write to him. Then write to the prescriber, enclosing a stamped and addressed envelope for a reply. No physician of standing can afford to decline to give a recipe in such circumstances, as it is against professional etiquette to prescribe secret remedies, and any member of the Royal Colleges who does such a thing commits a grave offence.

Extra Doses.—In the German Pharmacopœia a table of maximum doses of certain powerful medicines is given, and

if the prescriber desire to exceed the quantities there set down he is required to mark the quantity. If this be not done the dispenser is held responsible for the consequences if he dispense the dangerous dose. Two curious cases are mentioned by Dr. Hager. In one, an extra dose of cyanide of potassium had been ordered, and the prescriber had several times underlined the quantity. The patient died, and the dispenser was condemned to a year's imprisonment because he had dispensed the medicine without the proper mark (!) being attached. In the other case, the physician meant to order 4 grammes of chloral hydrate, and he should have written grm. 4.o. He omitted the decimal point, however, and the dispenser gave 40 grammes. At that time chloral hydrate was not included in the German Pharmacopœia, and therefore was not in the table of dangerous substances. But the dispenser was sentenced to a long term of imprisonment.

It is indeed a constantly recurring difficulty to dispensers of limited experience to know whether certain quantities prescribed are not either unusual or dangerous doses. The British Pharmacopæia does not profess to do more than give average doses for the guidance of the inexperienced, and in the preface it recognises that skilled practitioners may prescribe those doses which they from experience know to be best for the intended purpose. Provincial dispensers may generally feel safe when the autograph prescription bears the business-stamp of some London house. It has probably been dispensed many times; and the pharmacist is advised not to indicate by his manner, still less by any direct question to the patient, that there appears to him to be anything remarkable in the prescription which he is called upon to dispense.

But do not follow the example of the London house if you think that there is a possibility of poisoning the patient. For instance, a prescription was given in to a provincial house which ordered a large dose (about an ounce) of aq. laurocerasi. It bore the stamp of a leading London house, and appeared therefore to have been taken by the patient with safety. Not being satisfied, the provincial chemist inquired about the matter, and

found that the London house had omitted a considerable quantity of the aq. laurocerasi. This incident emphasises the aphorism: If a prescription be altered it should be so marked.

Many examples of large doses could be cited. Two grains of extract. cannabis indicæ have been given every two hours in a case of tetanus, but the case was watched by several medical men. A well-known Edinburgh doctor regularly prescribed teaspoonful doses of subnitrate of bismuth. In some cases ordinary doses of narcotics cause great excitement. For example, 30 grains of chloral hydrate has made a man most obstreperous, but drachm doses induced sleep. A well-known authority states that he has seen 5 ounces of the juice of conium ordered and taken daily,  $\frac{1}{2}$  grain of pure hyoscyamine for a dose, and 1 drachm of tincture of Indian hemp three times a day. The patients who took these doses were, of course, under special observation.

The following prescription was given to dispense as a draught:—

No directions were given. On the pharmacist expostulating with the customer as to the largeness of the dose of iodide, it was most strenuously affirmed that it was for one dose only. It had been dispensed before for a friend, who lent it to the customer. Probably there was here a little attempt at economy, the customer intending to add the necessary water.

At the Minor examination on one occasion, a candidate got the following prescription to dispense:—

Ol. ricini		,			ъij.
Pulv. acaciæ					3j.
Pulv. opii					gr. v.
Aq. menthæ	pip.				<b>3</b> j.

Fiat haustus. Statim sumendus.

M.

The candidate told the examiner before compounding the draught that it should not be dispensed, because it contained

too much opium. He was told to dispense it as written, and did so. Before he left the dispensing-counter, the examiner asked the candidate what he had to say about the prescription, and the candidate repeated his objection to the large dose of opium, which he considered to be a probable fatal dose. 'Quite right,' said the examiner; 'and what would you do in the circumstances?' 'Consult the prescriber,' was the reply, which satisfied the examiner, and the candidate passed.

The foregoing fairly indicates how the dispenser should act when exceptionally large doses confront him. Nothing about the matter should be said to the customer, but delay should be secured if possible in order that the prescriber may be consulted. This is the more difficult part of the matter, because some medical men strongly resent any interference, as they consider it, by the pharmacist; the fact being that in most of such instances they feel hurt that their blunders have been detected. The pharmacist should have little difficulty in knowing what to do with such men's prescriptions, for if the prescriber places his assumed dignity before the comfort and, maybe, life of his patient, the pharmacist may reasonably act upon his own responsibility, taking the British Pharmacopæia as his guide in respect to doses. See the note on 'Errors in the Prescription.'

General Directions are as a rule unsatisfactory and often lead to mistakes. We have been asked, If a doctor sends a prescription for a mixture (not dangerous) marked 'Special: To be taken as directed,' is he justified in condemning the dispenser as an unpardonable offender for sending the mixture to the patient without further instructions respecting dose? The censure is unwarranted. 'To be taken as directed' implies that the prescriber has given directions, but it is not uncommon to find that the prescriber has omitted to do this, and for that reason it is always safe for the dispenser to ask the customer how the medicine is to be used, and so ascertain whether the directions are sufficient or not. If the mixture is dangerous and the

directions have been omitted, a polite note may be sent to the doctor, or the customer may be asked to call upon him for instructions.

Errors in the Prescription.—If possible, reference should be made to the writer. Caution must be used in concluding that a fancied error or omission is real. 'Common sense' is frequently appealed to, but this indefinable judge cannot be called into operation unless the 'sense of the community' on the point in question has been obtained. Too many people confound their own individual opinion with the dictates of 'common sense.' For instance, some dispensers invariably add acid to a mixture containing quinine, although solution of the alkaloid is not prescribed. Now, many physicians prefer administering quinine in suspension, and it is decidedly less disagreeable taken in this manner, especially when large doses are exhibited. Moreover, when quinine is given to a woman nursing it is usual on the part of the prescriber to avoid an acid, as it checks the secretion of milk.

Wishes of Patients.—On this point Dr. Whitla says, 'Where a prescription is repeatedly compounded the patient often asks for the dose to be increased, or some other change to be made. The dispenser should not accede to such a request, no matter how simple it may appear, without a consultation with the prescriber; nor is it advisable for him to inform the patient (even when pressed) of the ingredients in any prescription. He can refer them to the physician, or do as the writer has done long ago, when it was impossible to avoid such a revelation—read it in full Latin to the patient.' This ruling is somewhat stringent. One frequently meets with customers—they are generally regular customers—who may safely get a hint as to what a medicine is composed of.

Repeating Prescriptions.—There is no rule against repeating a prescription as often as may be desired by the patient, but a conscientious regard should be had in such cases to his ultimate good. The majority of prescriptions, fortunately,

may be repeated without warning or comment; but there are some, such as those containing arsenic, digitalis, strychnine, &c., which, from their cumulative tendency, may produce serious consequences if repeated too frequently; and in such cases it is, we believe, not more to the interest of the patient than of the dispenser that the suggestion be made to again consult the physician as to their continuance. There are other prescriptions, such as those containing chloral, morphine, and other narcotics, the repetition of which is apt to engender the worst of vices on the part of the patient. A little reflection will show the responsibility incurred where repetition may lead to the formation of a bad habit. In regard to the repetition of medicines containing poisons, see the comments on page 5.

Proprietary Preparations.—There is no rule regarding the dispensing of proprietary preparations, and the dispenser must act according to circumstances in each case, endeavouring whenever possible to dispense the medicine as if it were compounded by himself. Preparations which are subject to medicine-stamp duty are exempt from that duty when they form part of the ingredients of a medicine dispensed—that is, are mixed with something else:—

This should be dispensed in the chemist's own bottle with his own label, and does not require a medicine-stamp; but a prescription such as—

—cannot be dispensed in Great Britain without a medicine-stamp in proportion to the charge made ( $1\frac{1}{2}d$ . for 1s. and under, 3d. for 2s. 6d., and 6d. for 4s.). The fact that the medicine may have already paid duty does not alter the case, as the Board of Inland Revenue do not permit a stamped medicine to be rebottled, reboxed, &c., without fresh stamps

being applied. This rule also prevents such medicines as lactopeptine being dispensed in powders or cachets without the appropriate medicine-stamps. Whether the rule is strictly followed in practice or not is another matter; indeed, it is open to question whether the Board of Inland Revenue could or would insist on duty being paid on a medicine which has already paid duty, and which forms part of prescription dispensed without revelation of the name to the purchaser. Such a sale can scarcely be regarded as a sale of a proprietary medicine.

Another aspect of the matter is, How should proprietary medicines be dispensed—in the original package or in a fresh package? This depends, in part, upon the prescription. Some prescribers are in the habit of writing such orders as—

Syr. hypophos. co. (Fellows) . . . . 1 bot.
Sig.: A teaspoonful in a glass of water at 12 o'clock and 4 o'clock.

The dispenser has no option in this case but to remove the wrapper and place his own label upon the bottle, but if the prescription at all permits, this practice should be avoided: it is not good pharmacy.



# SPECIAL DRUGS AND DISPENSING CONVENIENCES.

#### WATERS.

Aqua.—There is no ambiguity as to what is meant when 'aqua' is ordered in a prescription, distilled water alone being recognised by the British Pharmacopæia, which is authoritative in such matters. Distilled water is, according to the British Pharmacopæia 1885, made by taking 10 gallons of water and distilling it from a copper still with block-tin worm, rejecting the first ½ gallon and collecting the next 8 gallons. It is distinguished from ordinary water by containing no solid constituent, and should be free from ammonia and other impurities.

As supplies of distilled water are generally obtained from wholesale houses it should never be stocked without examining it. Frequently it is simply the condensed vapour from steamheating pipes or steam boilers; consequently it is liable to contain impurities. Ammonia and nitrites are the most common, the latter giving very strange results in mixtures containing iodides. Moreover, such distilled water has a tendency to become viscous, owing to the formation of thread-like organisms. The best plan is to distil water as it is required, adding to every 5 gallons of water in the still 10 grains of potassium permanganate (or a drachm of potassium bichromate) and a drachm of sulphuric acid. This ensures the destruction of organic matter, the products of which remain in the still.

Aqua Fontana should not be used unless when ordered. The varying quantity of calcareous matter which different natural waters contain is alone a sufficient reason for excluding them from the dispensing-counter, because some mixtures com-

pounded with such water differ in appearance according to the amount of calcareous matter contained in the water. The following are examples of what may be expected when distilled water and spring-water are used indifferently.

Tinct. lavand. co. gives a bright mixture with distilled, but a muddy one with tap-water. Tinct. cardamom. co. produces with distilled water a reddish-brown colour, but with tap-water a brilliant crimson, as if ammonia had been added.

Liq. arsenicalis gives a precipitate of calcium carbonate with tap-water, which will probably be regarded by any nervous patient who knows what is in the mixture as the arsenic imperfectly dissolved, if it has been previously obtained without such a deposit owing to the use of distilled water.

Liquor hydrargyri perchloridi gave a lot of trouble until the 1898 Pharmacopæia removed the ammonium chloride from it. The older solution contained a double salt which reacted with earthy carbonates, giving a precipitate of mercuric oxide, so that when diluted with tap-water the old solution deposited. Mr. W. Martindale showed that this does not happen with solution of mercuric chloride alone, and his suggestion was adopted by the B.P.

Such prescriptions as the following are occasionally seen at the dispensing-counter :-

Argent. nit	I.	III.	
Syr. ferri iod 3j. Spir. chlorof 3j. Aquæ ad 3jv. Inf. gent. co 3vj.	Aquæ · · · · · · · · · · · · · · · · · · ·	Sp. vin. rect 3. Aquæ ad 3.	j.
Aquæ ad živ. Inf. gent. co		Ammon. carb 3	
	1 71		

It is sometimes advisable to boil distilled water, so as to get rid of carbonic acid, which it may contain, and which causes precipitates in Nos. I. and II. In dispensing No. III. the rectified spirit should be mixed with the water before the acetate of lead is dissolved in it. The spirit furthers the expulsion of the air and carbonic-acid gas, and so prevents

precipitation of lead as carbonate.

If the infusion of gentian in No. IV. be made with tap-water, the result will be that the calcium bicarbonate present in tap-water, and which is only deposited on prolonged boiling, reacts with the ammonium carbonate with precipitation of calcium carbonate, which makes the mixture slightly turbid.

Extemporaneous Aromatic Waters.—Distilled aromatic waters have a finer flavour than those prepared by the mixture method, and in some cases, notably rose-water, the odour of the extemporaneous preparation is quite different from the distilled. Various substances of an alkaline-earthy nature are added to the oils in the mixture method in order to render them soluble, and, as has been shown by Shuttleworth, these substances generally keep back a portion of the oil, so that the water takes up no more, or little more, than it would do if the earthy powder were not added. It should also be remembered that the powder dissolves to some extent, and therefore affects mixtures containing alkaloids and other substances precipitable by alkalies. This may be obviated by the adoption of either of the following processes.

The amount of oil used in most cases is 1 part to 500 of water (say, a drop to the ounce), which is sufficient to saturate water. The simplest plan is to put 2 drachms of the essential oil in a gallon earthenware jar, and pour upon it 120 ounces of boiling distilled water. Allow to stand for a few minutes, then cork and shake well, repeating the shaking occasionally until the water is cold. Then set aside for twelve hours and draw off the clear water. This has an excellent aroma. In the 'Art of Pharmacy' was published a method which is very simple, and gives excellent products. In this an excess of oil is used, the reason being that the excess gives much finer waters than are obtained by using a smaller amount. Prepare a solution of 6 drachms of essential oil in 4 ounces of rectified spirit (90 per-cent.) and of this add 1 ounce to 4 pints

of water. Shake well, and allow to stand until clear, then syphon off the clear water.

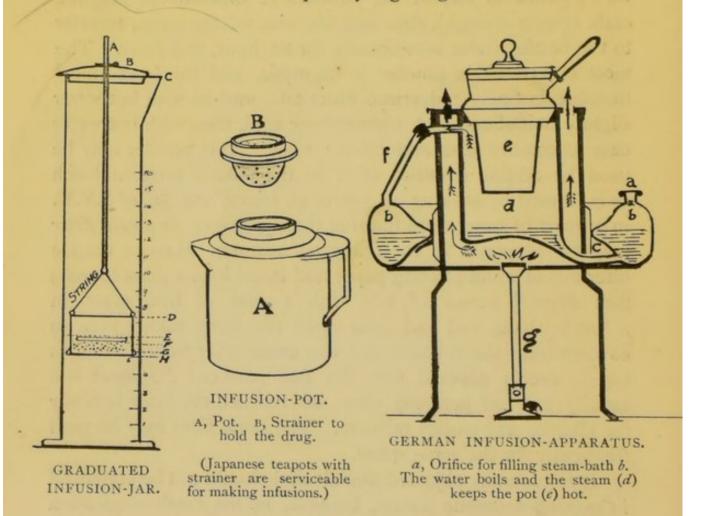
The earthy powders which are most used for rendering essential oils soluble are light carbonate of magnesium, powdered pumice-stone, kaolin, silica, phosphate of calcium and talc (French chalk). The method to be followed for a pint of any water is to dissolve from 20 to 40 minims of the oil in four times as much spirit, add an ounce of water, and triturate with  $\frac{1}{2}$  ounce of any of the powders (2 drachms of magnes. carb. levis is enough), then add the rest of the water, transfer to the bottle, shake occasionally for an hour, and filter. most objectionable powder is magnesia, and the least objectionable is finely pulverised white talc, washed with hot water slightly acidulated with hydrochloric acid, then with hot water only to remove acid, and dried for use. Talc powder may be used by adding \frac{1}{2} ounce of it to the cloudy mixture (such as is formed by shaking up 3ss. of ol. anethi and 3ij. of S.V.R. in a quart of water) and filtering through paper, or a talc filter may be prepared in the following manner: Make a double filter out of white filtering-paper and insert it in a glass funnel; mix about 1 ounce of talc with 1 pint of hot water in a bottle, shake well and pour upon the filter, taking care to so distribute the mixture that the entire filter from bottom to top is evenly covered with the fine powder; the water will rapidly pass off perfectly clear, after which the filter is ready for filtering any cloudy mixture. The same filter may be used frequently for the same water.

It is generally objected that alcohol should not be employed in making aromatic waters, because, in the small proportion employed, it is exceedingly liable to become changed into acetic acid. Concentrated waters are weak alcoholic solutions of the essential oils, about ten times stronger than the waters, yet ' 1 to 40.'

### CONCENTRATED INFUSIONS.

In most of the large pharmacies the duty of preparing infusions for use during the day falls to the assistant who has been on night-duty. The question whether the dispenser is justified in using concentrated infusions or not has been answered with much circumspection by an experienced pharmacist, who said, 'Never use concentrated infusions when time allows of fresh ones being made. The aroma of the recent infusion is often wanting, whilst the difference in appearance is in most cases very marked.'

The British Pharmacopæia, in order to meet the objection of loss of time, which is frequently urged against fresh infusions,



has reduced the period of infusion so much that even the most urgent physic can now be dispensed in half an hour.

When 8 ounces of any infusion is required, 10 ounces at least should be made, as the marc absorbs a good deal of the menstruum, and the Pharmacopæia does not direct it to be pressed out.

In some parts of the country it is quite the exception to

use anything except concentrated infusions in dispensing, and this fact is recognised by the prescribers. The B.P. has so far bowed to the demands of the times as to provide formulæ for concentrated liquors which, on dilution with water, yield liquids resembling infusions; but it is specially provided that these should not be used when infusions are ordered.

Infusion of Digitalis is one of the most active preparations of this valuable drug. It should always be freshly prepared, and dispensers should not use concentrated preparations as the equivalent of the fresh infusion, although the B.P.C. gives a formula. In 1888 Professor Kobert, one of the greatest authorities on the characters of glucosides, showed that in weak alcoholic menstrua the active principles of digitalis undergo such change as to render them almost valueless as heart-stimulants. Apart from this, infusion of digitalis is frequently prescribed because the physician does not wish alcohol in the medicine.

Infusion of Gentian (Compound).—There is no con-. centrated liquor in the B.P. to represent this, although it is the most frequently used infusion. The fact is, it is difficult to prepare a satisfactory concentrated preparation which is not more of the character of a tincture than of an infusion.

Infusion of Senega.—A little ammonia is generally added to the concentrated preparation to prevent precipitation of senegin or its decomposition-products.

Infusion of Serpentary should, preferably, be made from the whole rhizome, because if bruised the starch granules are freed, and so some of the starch gets into solution, and the infusion strikes a blue colour with iodine. It is sometimes advised to make the infusion with the old rhizome because, unlike the young rhizome, it contains no starch; but the dispenser will seek in vain for commercial varieties known as 'young rhizome' and 'old rhizome.'

#### SOLUTIONS.

It is usual for dispensers to keep solutions of salts often required in prescriptions. These are not only convenient, but frequently impart to a mixture a bright appearance which otherwise would be wanting. No one would recognise a mixture made with infus. rosæ acid. and a solution of Epsom salt as the same preparation as one made by dissolving the salt in the infusion of roses. The same is true, in greater or less degree, of very many other previously made solutions; to a large extent this accounts for the physical differences observed in mixtures dispensed at different establishments.

The following are the solutions which are in most common use. It should be noted that solids for any quantity in ounces should be taken by apothecaries' weight—that is, 480 grains; for example, sol. ammon. brom. I in 4 means 480 grains ammon. brom. in 4 fluid ounces of the solution. The solutions should be made from the unpowdered substances, as commercial powders frequently afford muddy solutions:—

Sol.	Acidi tann	nici .		٠.		1 in 2 (S.V.R.
,,	Aluminis					1 in 16
,,	Ammonii	bromidi				I in 4
,,	Ferri tarta	rat				I in 4
,,	Ferri et qu	uininæ citr	at.			I in 2
,,	Magnesii s					I in 2
,,	Plumbi ac					1 in 16
,,	Potassii a					I-in 2
,,	,, bi	icarbonati	s .			I in 4
,,		romidi.				
,,	***	nloratis				I in 24
,,	**	didi .				I in 2
,,	**	itratis .				I in 8
	Sodii bicar					1 in 16
	Zinci chlor					
		natis .				I in 4
,,	,, surpr	iaus .				I in 8

Solutions containing 10 grains of the solid in each fluid drachm are on the whole most convenient, provided they keep, for in many instances concentrated solutions keep much

better than weaker solutions. Quinine and iron citrate is a notable example, a solution of 1 part in 2 keeping for weeks, while a weaker solution quickly becomes bad.

The solutions of alkali bicarbonates are liable to change, with formation of carbonate and consequent introduction of all sorts of unexpected reactions, not to mention the distinctly greater alkalinity of the carbonate. It is better not to keep the bicarbonates in solution. It is a good plan to keep all these dispensing-solutions in a dark cupboard: many of them are affected by light.

Potassio-tartrate of antimony (1 in 50) is also sometimes kept in solution, and this too spoils in a short time, but the addition of I ounce of S.V.R. to each pint is helpful.

In weak solution chloral hydrate soon decomposes and becomes acid, acquiring an odour not unlike a mixture of tolu and benzene. We prefer not to keep this chemical in solution, but in powder form, so that it dissolves readily.

Solutions should be made either by stirring the solid with the solvent in a measure, or by shaking the two together in a bottle. It is a mistake to use a glass mortar, or any mortar. Very frequently glass mortars are disrupted with explosive force when solids are rubbed or dissolved in them. This is especially the case with hypophosphites. Wedgwood mortars should not be used for making solutions until they have been carefully washed out in hot water and a little alkali (liquor potassæ).

Solution, it may be noted, is, so far as dispensing is concerned, the mixture of a solute (gas, liquid, or solid) with a solvent so as to form a clear product termed a solution. The quantity of a solute which dissolves in a solvent is constant for each substance under particular conditions. The solubilities of chemicals in water are usually determined at 15.5° C. (60° F.), and represent the weight of the substance dissolved by a weight of water. In this case the weight and volume of the solvent are synonymous, but in the case of alcohol, glycerin, and other solvents whose densities are less or more than unity, text-book figures as to solubility may be doubtful, because

continental workers and many in this country invariably mean the solvent by weight. Figures employed in this book represent liquids by volume. Some knowledge of the phenomena and principles of solution is of great value to dispensers, who may frequently by the application of that knowledge avoid or overcome difficulties otherwise unexplainable.

The theories of solution need not trouble the dispenser, because they have little direct bearing upon pharmacy. The more important theory is the one known as the hydrate theory, in which it is assumed that in the course of solution of substances in water the substances undergo hydration, and, in fact, chemically combine with the water. This is well exemplified in solutions of alcohol in water, of caustic potash in water, and of sulphuric acid in water, much heat being evolved during solution. This proof of chemical action has had corroboration in the isolation of hydrates of the dissolved substances; thus the alcohol in proof spirit does not exist as C<sub>2</sub>H<sub>6</sub>O, but as C<sub>2</sub>H<sub>6</sub>O.xH<sub>2</sub>O, and so also with sulphuric acid and caustic potash, each of which in aqueous solution is chemically associated with several molecules of water. Whatever the theory of solution may be there is at least agreement amongst the theorists in regard to the promotion of solution by certain forces.

Fine division of the solute has a great influence in promoting solution; powdered chemicals are more easily dissolved than the crystals, and although, as already mentioned, some powdered chemicals do not yield clear aqueous solutions, that is because the chemicals have been soiled, as it were, by the mills in the course of grinding. The preparation of aromatic waters, upon which we have just touched, affords an admirable example of the advantages of fine division in promoting solution. If we rub up an essential oil with talc or calcium phosphate, we simply coat the particles of the solid with a film of the essential oil, so that when water is added a very large surface of the oil is offered to the water and solution is rapid. So also if the oil is dissolved in rectified

spirit and poured into the water; here the oil separates in minute globules, hence is more quickly taken into solution. It is obvious, however, that the powder method ensures the larger surface, hence quicker and better solution.

Agitation is another important solution-promoting factor, but all that agitation does is to bring the solute into contact with fresh portions of solvent. It stands to reason that if a salt lies at the bottom of the solvent it will take a long time before it is dissolved. One might keep an ounce of potassium chlorate at the bottom of 24 ounces of water for many days without complete solution being effected, because a layer of the water next to the salt would become saturated, therefore more dense than the solvent above, and we should have to rely entirely upon the slow process of diffusion to bring fresh molecules of water into contact with the undissolved chlorate. From this the value of agitation added to fine division may be judged. Any method which brings fresh solvent into contact with the undissolved substance answers the purpose, as, for example, in percolation; or suspending the solute or solid in the solvent-which is the course adopted in making infusions, whereby the solution as it is formed sinks to the bottom of the vessel, and thus starts convection-currents in the whole fluid which amount practically to automatic agitation.

Heat is one of the most potent factors in promoting solution, and one of the most dangerous for dispensers to use, because, with very few exceptions, substances are more soluble in hot liquids than in cold, so that when hot solutions cool they deposit the excess of solute which they contain. Hence if the dispenser wishes to expedite matters by using hot water, he should assure himself by reference to the Pharmacopæia solubilities that the amount of substance taken will remain in solution at 60° F.

Many examples of solution-phenomena are described throughout this work. It will be especially noted that the relations of alcohol to water in the solution of substances require all the dispenser's intelligence, especially with the view of ensuring that the patient gets the full dose of the active

ingredient of an alcoholic medicine which has to be taken in water. The most familiar example of this group is tinct. quininæ ammon., which is virtually a solution of quinine hydrate in alcohol. Quinine hydrate, like all other alkaloidal hydrates, is but feebly soluble in water, consequently on diluting this tincture with water the alkaloid is precipitated; but if the dose be added to the water, the precipitate is in finer division and remains sufficiently long in suspension to admit of the dose being swallowed, which is not the case when the water is added to the tincture. The same order holds good with resinous tinctures or fluid extracts. may also be observed that some solvents change the chemical characters of the solutes. This is virtually the case in tinct. quininæ ammon., and when we add a dilute acid to quinine sulphate in mixture we promote solution of the salt by changing it into the much more soluble acid sulphate. Some changes in solution are apt to be overlooked; for example, stock solution of butyl-chloral hydrate made with glycerin and rectified spirit is very convenient, as when first made it mixes quite clear with water; but ere long on adding the solution to water, there is a precipitate of oily drops which are most intractable. These drops are really butyl-chloral alcoholate, formed by the alcohol molecule displacing the water molecule in the hydrate; and the alcoholate is much less soluble in water than the hydrate. A general idea of the substances which are less soluble in alcohol than in water is a good acquisition to the dispenser. This is the case with many colloidal substances; pepsin, for example, is precipitated from its solutions by 25 per cent. of alcohol.

Precipitation is almost as important as solution, for knowledge of the conditions controlling it is of distinct value in enabling the dispenser to judge when he may or may not filter mixtures. All the conditions which determine precipitation cannot be dealt with here, but it may be noted that saline substances tend to throw extractive matters out of solution. For example, if one were to saturate a fresh and cold vegetable infusion with magnesium sulphate, a muddiness would be

produced which in few cases would be due to precipitation of active principle; on the other hand, the alkaline sulphates are employed for precipitating pepsin from its aqueous acid solution. Acids, alum, and some other substances are employed to secure more complete precipitation of resinoids. Alkalies are the best precipitants of most alkaloids, but they have a wonderful effect in clearing many aqueous mixtures, especially those containing traces of resinous and glucosidal bodies.

Applying such facts as these to dispensing, there should be some hesitation in filtering mixtures in which a precipitate forms in the course of compounding; but one would not hesitate to filter a tincture of nux vomica and acid mixture, because the precipitate cannot be the active principle, but traces of resin and fat which are soluble in the alcohol of the tincture and insoluble in the aqueous and acid liquid. Other instances of trivial and potential precipitations which call for the dispenser's attention will be noticed later.

Scale Preparations can with care be readily and easily dissolved in the bottle in which they are to be dispensed. A little of the water or aqueous vehicle should be put into the bottle first, being careful not to wet the neck; or, if this be done, dry the glass with a cloth, else the scale preparation will adhere and block the neck of the bottle. A solution is readily formed if the salt falls upon the water and is quickly agitated-not allowed to 'cake' at the bottom.

There are exceptions to every rule, however, and the slow solubility and extreme frothiness on agitation of sulphate of beberine with water mark it out as a decided exception to the other scale preparations. The better plan with this salt is to rub it down into fine powder in the mortar, then add water with constant stirring so as to prevent it forming an adhesive mass on either mortar or pestle. If this be done properly, it will dissolve quickly and without the least trouble; if any other plan be tried it will certainly cake and cause no end of trouble. A few drops of diluted sulphuric acid is or was (for beberine is dying out) sometimes added.

Ferrum tartaratum dissolves with difficulty in cold, but very readily in hot, water. The most satisfactory method of manipulation is to put it in a dry mortar and pour hot water over it, when it goes down with the least possible trouble. With distilled water it gives a perfectly clear solution, but with tap-water the solution never becomes clear.

A Supply of Hot Distilled Water is a great convenience at the dispensing-counter. Where space permits, a gas-stove and boiling-vessel (preferably with a tap) of suitable size should be set apart for this purpose, and the heat adjusted so as to keep the water nearly boiling. A small vessel may be fitted over the sealing gas-jet, thereby utilising its waste heat. An extremely useful arrangement is a circular ring tripod, 8 inches in diameter, fitted with a set of water-bath rings; the legs of the tripod should be of such length that the top of the gas-flame, when full on, reaches a little higher than the rings. The exact quantity of water required should be placed in an evaporating-basin, resting on the tripod (using a ring of smaller diameter than that of the surface of the water) and set over a gas-stove; then, by the time the labels are written and the solid ingredients weighed, the hot water is ready.

# CONCENTRATED MIXTURES, &c.

Where much dispensing is done daily, and there is an occasional 'rush,' the need for keeping certain articles ready prepared is universally recognised. It is even more necessary in cases where dispensing is spasmodic, but the difficulty of keeping certain articles fresh is considerable. This is especially the case with aqueous mixtures, which begin to ferment after a few days. Some of these keep well in a concentrated condition, and other articles may also be kept ready for diluting or massing as the case may require. The following hints may be useful to some who have not seen the ideas carried out in practice. It is a great help to expeditious dispensing to have ready prepared mixtures which are frequently ordered by local physicians, and generally it is

possible to make these of the 1-to-7 type so that they may be diluted with an aqueous vehicle as required.

Liquors for Syrups.—Many syrups which are rarely required, and which are apt to decompose on keeping, may be prepared from the liquors, provided the dispenser assures himself that the finished product is similar to the official one, and does not contain added preservatives which may interfere with other ingredients in dispensing. Such liquors are now easily obtainable.

- Mist. Ammoniaci.—A 1-to-7 preparation is made by taking I ounce of picked white tears of the gum resin, powdering, rubbing down with 11 ounce of water, and adding syrup of tolu to 4 ounces. In dispensing add 1 part of this to 7 parts of water.
- Mist. Cretæ.—The powders for chalk mixture may be kept ready mixed, so that \( \frac{3}{4} \) ounce and 15 grains of the powder with 71 ounces of cinnamon-water will make mistura cretæ.
- Mist. Ferri Co.—Use only picked pieces of myrrh for this-good rich ambery and oily like pieces-and powder fresh. Proceed as directed in the B.P., but omit the ferrous sulphate, which add in proper proportion to the emulsive mixture when it is dispensed.
- Spt. Ætheris Nitrosi.—Concentrated preparations of nitrous ether are more prone to decomposition than the B.P. spirit when exposed to the air and light. If, therefore, concentrated preparations are employed at the dispensingcounter, they should be used in the diluted state only, and the greatest care should be taken to ensure their preservation by keeping in small, well-stoppered and inverted bottles in a cool, dark place. Amber glass bottles are best.
- Syr. Croci.—A concentrated infusion (1 to 4) saturated with chloroform keeps much better than the syrup.
- Syr. Ferri Iodidi.—This is now largely prepared from the liquor, which is kept permanently bright and free from oxidation by means of a trace of hypophosphorous acid.

Syr. Ferri Phosph.—This darkens very much on keeping, but a concentrated solution of pure iron in phosphoric acid eight times the strength of the syrup changes very slowly, especially if kept in bottles quite full. This may be diluted with simple syrup as required.

Syr. Ferri Phosph. c. Quin. et Strych.—This also darkens rapidly, but if the ferrous phosphate be omitted and the syrup made up to 7 parts instead of 8, and filtered through paper, a brilliant syrup is obtained which keeps indefinitely. Seven parts of this should be mixed with 1 part of liquor ferri phosph. as required.

Syr. Rhœados and Syr. Violæ, unless in frequent demand, are much better made from liquors.

There are many other preparations which may be conveniently kept in the concentrated or 'liquor' form. Some manufacturers have made this class of preparations a speciality. It would be out of place to speak of their products here, but it may be said that if the dispenser is seldom called upon for certain preparations, such as syrups, which on keeping undergo apparent alteration, these may be kept in stock in the permanent 'liquor' form, to be diluted as required. The dispenser should, of course, satisfy himself that the finished product answers to the official requirements.

### FURTHER MEMORANDA.

Acacia is rarely prescribed per se in mixtures, and when it is it may be as either an emulsifying or a suspending agent. If the former, either the powder or the mucilage may be used, according to the nature of the substance to be emulsified; if for suspending, use the mucilage. For making mucilage small picked gum ('Trieste grain,' it is called) is excellent. Allow it to macerate in the water till dissolved, aiding the solution by occasional stirring with a bone spatula. Strain through muslin. This mucilage will keep any reasonable length of time, and is

remarkably clear and bright. Flake or scaled gum is also good.

An excellent plan for making and preserving acacia mucilage is to keep two wide-mouthed bottles—of capacity equalling two or three days' supply of mucilage—one with a tin cap to dispense from, the other corked for making, and labelled with the quantities of ingredients that will fill it; when filled, lay the bottle on its side in a drawer which is frequently opened and shut, then the gum soon dissolves. When the dispensing-bottle is empty, thoroughly cleanse it, strain the reserve supply into it, and start a fresh batch in the making-bottle. Five to 10 minims of formalin to the pint keeps mucilage for a long time.

Bismuth Salts.—The subnitrate and salicylate readily give up part of their acid when treated with water, and the result is that unexpected difficulties sometimes happen which trouble the unreflective compounder. The salicylate may be entirely freed from salicylic acid by washing with alcohol or water.

Butyl-chloral Hydrate dissolves so slowly in water (its solubility is 1 in 50) that it is usual to expedite solution by heating. Care should be taken not to use water exceeding 170° F. in temperature, otherwise the solution is opalescent and more acrid to the taste than when cold water is employed. Glycerin is the best solvent.

Caffeine Citrate forms a clear syrupy solution with three times its weight of water, but on adding more water caffeine hydrate is precipitated, and does not dissolve until more than ten times the original amount of water has been added and the mixture well agitated. The salt is, therefore, easily dissociated.

Calamine for face-lotions should not have a pink colour. One of the best varieties is that sold by Messrs. Corbyn, Stacey & Co., which has a flesh tint.

Carbon Bisulphide B.P. has an odour resembling that of chloroform. A bad odour is due to excess of sulphur. A

little mercury kept in the bottle combines with the sulphur and keeps the bisulphide sweet without injuring the liquid. The bisulphide should be kept in opaque bottles away from sunlight in order to minimise decomposition.

Copaiba varies greatly in viscosity, some kinds being almost limpid. These should not be used for pill-making. The best copaiba for pills is the thick Maranham kind. Viscosity is inversely proportionate to the amount of essential oil in the copaiba.

Extract of Belladonna.—Dispensers should be careful in regard to what they give for this. The British Pharmacopæia, 1898, changed the old title 'Extractum belladonnæ' to 'Extractum belladonnæ viride.' This is the article mostly used for pills. The amount of alkaloid in the commercial green extracts varies from 0.5 to 1.7 per cent., while the alcoholic extract of the root is standardised to contain 1 per cent.

Ferri et Strychninæ Citras.—There are two commercial varieties of this, one green, the other brown. The former is preferred. It contains I per cent. of strychnine.

Ferrous Sulphate.—A very small amount of sulphuric acid in aqueous solution of this salt serves to keep it bright and green. For pills the dried salt makes a better and less crumbly mass than the powdered crystals.

Gelatin varies considerably in gelatinising-power, and compounders should always keep to the brand which they have found to meet their requirements, as a change may greatly alter the character of jellies, suppositories, and the like.

Glucosides.—Most of the medicinal glucosides undergo hydrolysis somewhat readily, especially when alcoholic preparations of them are mixed with water. Unexpected therapeutic results sometimes occur. For example, tincture of strophanthus in aqueous mixture in a short time seems to be so changed as to set up intestinal irritation.

Glycerin is a useful and powerful solvent, acting at the same time as an antiseptic. It is largely used as a sweetening-agent in mixtures. It is the best and most appropriate solvent and preservative of the peptic and pancreatic ferments. Pill-masses containing a little glycerin do not harden, but care must be taken to avoid excess, as too much makes the pills hygroscopic. For dispensing it is best kept diluted with an equal volume of water, as then it is easily poured, and there is less loss from part of it remaining in the measure.

The following table shows the capabilities of glycerin as a solvent. It represents the weights in grains of the substances named which dissolve in 1 fluid ounce of glycerin sp. gr. 1.260, heat being used to promote solution:—

Substance	Weight	Substance	Weight
Acid. arsenios	100	Morphinæ acetas	100
,, benzoic	50	,, hydrochloridum	60
,, boric	110	Phosphorus	I
,, gallic	40	Plumbi acetas	100
,, salicylic	$2\frac{1}{4}$	Potassa sulphurata	50
,, tannic	250	Potassii arsenas	240
Alumen	200	,, bromidum .	120
Ammonii carbonas	100	,, chloras	175
,, chloridum .	100	,, iodidum	200
Antim. tartarat	20	Quinina	21/2
Atropina	15	Quininæ sulphas	10
Atropinæ sulphas	160	,, tannas	I
Barii chloridum	50	Sodii biboras	300
Calcii sulphidum	25	,, bicarbonas	40
Cinchonina	2 1	Sulphur	I
Cinchoninæ sulphas .	33	Sulphuris iodidum	8
Cocainæ hydrochloridum	145	Strychnina	14
Cupri sulphas	150	Strychninæ nitras	20
Ferri sulphas	120	,, sulphas .	100
Ferrum tartaratum .	40	Veratrina	5
Hydrargyri iodid. rub	11/2	Zinci chloridum	240
,, perchlor	35	,, iodidum	200
Iodum	$7\frac{1}{2}$	,, sulphas	160
Morphina	21		

Glycerin is not by itself a good solvent, as its thickness prevents diffusion, which is necessary in practice. Glycerin solutions which are used as topical applications have given results obtainable by no other preparations of the same active constituents, but recent observations have proved that these are due to the glycerin itself, which stimulates the osmotic process in cellular tissue, and so relieves congestion. The use of glycerin suppositories and injections for constipation is a familiar example of this.

Iodine dissolves in water only slightly, but is freely soluble in aqueous potassium-iodide solution. It is soluble in alcohol, ether, chloroform, carbon bisulphide, glycerin, and fixed and essential oils. With fixed oils it chemically combines to a small extent, also with essential oils, and some care should be observed in mixing it with the latter or their alcoholic solutions. Free iodine is not often given internally, but if it occurs in a prescription for an aqueous mixture without any solvent see the prescriber, and suggest the addition of sufficient potassium iodide to dissolve the iodine.

Manna is rarely required in solution in English practice, but in continental dispensing it is more needed, especially in Germany. Direct heat should never be applied to effect its solution. Allow the manna to macerate in just as much cold water as will change it into a soft pasty mass; then add the rest of the water required and dissolve by a gentle heat. Strain through fine muslin. Squire recommends manna to be purified by dissolving it in as little water as possible, straining, and evaporating to the original weight. Manna is sometimes given along with magnesium sulphate in mixture; in this case beat up the manna with the sulphate, then add the water and dissolve.

Morphine Salts should be dissolved without heat, for at a temperature above 104° F. (40° C.) their solutions are apt to turn yellowish or even brown. With care beautiful solutions may be made. Morphine meconate is least affected by heat, but the solution of this salt should only be filtered through paper which has previously been washed free from iron by means of hydrochloric acid and water, otherwise the solution

will be coloured red. The following are the better-known salts of morphine and their solubility in water at 60° F. (15.5° C.):-

> Acetate [B,CoH4Oo,3HoO], I in 21 Hydrobromide [BHBr,2H2O], 1 in 25 Hydrochloride [B,HCl,3H,O], I in 24 Lactate [BC<sub>3</sub>H<sub>6</sub>O<sub>3</sub>], 1 in 8 Meconate [B,C,H,O,,5H,O], I in 40 Oxalate [B2C2H2O4, H2O], I in 20 Sulphate [B2H2SO4,5H2O], 1 in 21 Tartrate [B2C4H6O6], I in II

In these formulæ B stands for the morphine molecule C<sub>17</sub>H<sub>19</sub>NO<sub>3</sub>. Morphine acetate is the least stable of the salts of the alkaloid, and the tartrate is best for hypodermic solutions because it is stable and exceptionally soluble.

Nitroglycerin.—Although this is a pharmacopæial article no pharmacist may undertake its preparation without first obtaining the sanction of the Home Office. Permission is not at all likely to be obtained. A 10-per-cent. alcoholic solution can be obtained through wholesale houses.

Physostigmine Salts and their solutions become red on exposure to the air, through formation of rubeserine owing to action of ammonia in the atmosphere. A mere trace of hypophosphorous acid added to the solutions (a single drop of 10-per-cent. acid to the ounce) prevents the change of colour. Extract of Calabar bean is sometimes prescribed in aqueous solution. This should have I grain of salicylic acid added to each ounce, and should be filtered, as the water-insoluble matter is merely fat and resin which would irritate the eye.

Quinine Salts.—Of all the salts of quinine the sulphate is most used. It is one of the least soluble of the salts. Other salts are prescribed either owing to their combination with a special acid (such as valerianic acid) or because the prescriber has some special reason for preferring them.

may be useful to summarise here the properties of the more important salts of the alkaloid:—

Quinine, C20H21N2O2,3H2O. Practically insoluble in water.

Acetate. Soluble in water, but, like caffeine citrate, hydrolyses with separation of quinine hydrate. Contains 84 per cent. of quinine.

Arsenate. Soluble in hot, sparingly soluble in cold, water. Contains

66 per cent. of quinine.

Benzoate. Soluble I in 373 of water. Contains  $72\frac{1}{2}$  per cent. of quinine. Carbolate. The salt generally sold as such is a sulphocarbolate containing  $75\frac{1}{2}$  per cent. of quinine. More soluble than the sulphate.

Chlorhydrophosphate. Soluble I in 2 of water. Contains 50 per cent. of quinine.

Chlorhydrosulphate. Soluble in a little over its own weight of water. Contains 74.2 per cent. of quinine.

Citrate. Two salts—(1) neutral or dibasic is less soluble in water than the sulphate (about 1 in 1,000 or less), and contains 72½ per cent. of quinine; and (2) the acid or monobasic citrate, soluble 1 in 650 of water. The former is the commercial salt.

Glycerophosphate. Soluble I in 353 of water. Contains 68 per cent. of quinine.

Hydriodide or Iodide. (1) Neutral, soluble about 1 in 900 of water; (2) acid, soluble 1 in 20 of water.

Hydrobromide. (1) Neutral (the commonly used salt), soluble 1 in 55 of water, contains 76 per cent. of quinine; (2) acid salt, soluble 1 in 6.

Hydrochloride. (1) Neutral, soluble I in 35 of water, contains 83 per cent. of quinine; (2) acid salt, soluble less than I in I of water, and contains 81 per cent. of quinine.

Hypophosphite. Soluble I in 250 of water.

Lactate. Soluble about I in 8 or 10 of water.

Phosphate. The English salt contains 76 per cent. of quinine, the German contains 79 per cent—i.e., I of phosphoric acid to 2 of quinine, the English being 2 to 3. The English is soluble I in 420 of water, the German I in 784.

Salicylate. Solubility about the same as the sulphate. Contains 70 per cent. of quinine.

Sulphate. (1) Neutral or B.P. (the 'quinine' of the public), soluble I in 800 of water, contains 74 per cent. of quinine; (2) acid salt into which the former is converted on mixing with sulphuric acid and water, soluble I in 10 of water.

Tannate. Insoluble in water, therefore tasteless.

Tartrate. The commercial or neutral tartrate is less soluble in water than the sulphate, but the acid tartrate is very soluble.

Valerianate. Soluble I in 110 of water. Contains 51 per cent. of quinine.

For the dispensing-counter it is a good plan to rub down quinine sulphate in a mortar, so as to get it into smaller bulk, when it is easier weighed. Dispensing-solutions should not be made stronger than 4 grains in 1 fluid drachm, 4 minims of dilute sulphuric acid being used to dissolve the sulphate.

If a prescription contain nothing which will dissolve the quinine sulphate, the salt should merely be rubbed down, suspended in the water, and a 'shake the bottle' label used. If you know that the prescriber wishes acid to be added, add it and note the fact on the prescription. Never dissolve quinine sulphate with hydrochloric acid if that acid is not ordered: such a solution is not fluorescent, and if the prescription happens to have been dispensed before with sulphuric acid, the patient may notice the difference.

Quinine sulphate is soluble 1 in 40 of glycerin, and this combination has been suggested as a means of getting over the acid difficulty, also to give the dose in sweet spirit of nitre, an ounce of which dissolves 20 grains of quinine sulphate. This latter combination is used in fevers. All such suggestions for getting round the insolubility of the sulphate are now somewhat out of date considering that the readily soluble hydrochloride is a commercial and official product.

Quinine salts are prescribed on the Continent in combination with extract of liquorice. In this case first dissolve the extract in ten times its weight of water, then add the solution of quinine, as both the alkaloid and the acid tend to throw out a dirty-looking precipitate of glycyrrhizin.

Salicylic Acid and Salicylates.—The question occasionally crops up as to whether natural or artificial acid should be or has been used, owing to the practice in a few dispensing houses of using the former exclusively. Between the 'physiologically pure' artificial acid and the natural there cannot be detected any difference in therapeutic action; and as the British Pharmacopæia permits either to be used, the dispenser must allow common-sense or sentiment to decide the matter for him-the customer's ability or otherwise to pay for the

natural being taken into account. The red to brown colour produced in salicylate mixtures containing spirit of nitrous ether never becomes quite so dark with the natural acid (see page 299). Salicylic acid dissolves to a slight extent in water (1 in 500) but very readily in solution of ammonium acetate. In the latter case ammonium salicylate is really formed, acetic acid being set free. So also when other alkali salts of organic acids are combined with salicylic acid. Some salicylates are but slightly soluble in water-e.g., antipyrin salicylate or salipyrin—and when the readily soluble sodium salicylate is added to an equally soluble body (by itself) the mixture may not be clear. The powerful antiseptic propertyof salicylic acid suggests its addition to solutions which are prone to decomposition; when so used it is a good plan to prepare salicylic water by boiling a pint of distilled water in a flask and adding to it 16 grains of the acid; plug the flask with a piece of cotton wool which has been scorched in the Bunsen flame, and set aside to cool. This water is sterile, antiseptic, and saturated with salicylic acid. Microbes cannot live in it, but it is possible to introduce along with the microbes something upon which they may live, as is the case with ergotin.

Spirit of Nitrous Ether is one of the most troublesome products which the dispenser has to handle; but during the past twenty years a flood of light has been thrown upon it, so that it is no longer the 'dark continent' which it was to our forefathers. The spirit is essentially a solution of ethyl nitrite and aldehyde in rectified spirit. When fresh there is little aldehyde in it (less than ½ per cent.), but the water in the rectified spirit, under the influence of light and air, decomposes the ethyl nitrite,  $C_2H_5NO_2$ , which splits up, forming alcohol and nitrous and nitric acids. The acids at once react with alcohol to form fresh ethyl nitrite and a little aldehyde; some of the ethyl nitrite is dissipated. As some of the nitric acid remains in the spirit for a long time, when it is compounded in a mixture with an alkaline iodide, the acid and iodide react,

nitrite of the alkali being formed, and iodine and nitrous oxide liberated. This reaction, which has been the bugbear of dispensers for generations, is now utilised by the Pharmacopæia to estimate the percentage of ethyl nitrite in the spirit by measuring the volume of nitrous oxide evolved (see page 241). Spirit of nitrous ether should be kept in well-filled and inverted bottles, and the dispenser should bear in mind that although it is a weak diuretic it is a powerful chemical agent, especially prone to decomposition through mixture with water, which simply hydrolyses the ethyl nitrite. The old-fashioned prescriptions for diaphoretic mixtures such as the following were really scientific :--

```
Liq. ammon. acetatis
Spt. æther. nitrosi . . . .
Spt. chloroformi .
Aquæ . . . .
```

Hydrolysis (or decomposition) of the ethyl nitrite quickly begins in this mixture, but the nitrous radicle as soon as it is liberated combines with the ammonia of the ammonium acetate, hence the mixture retains a large measure of its potency because the ammonium nitrite has the same, though milder, action upon the arterial system as the ethyl nitrite.

M.

In mixtures containing antipyrin and spirit of nitrous ether, the latter, if acid, reacts with the former, iso-nitroso-antipyrin and a cyanogen compound being amongst the products, and the mixture becomes green. Some dispensers keep a crystal or two of potassium bicarbonate in the spirit, and thus have it always neutral; that does not of course prevent decomposition of the ethyl nitrite, but as hydrolysis proceeds nitrite of the alkali is formed, so that the spirit may on analysis show less loss than when alkali is not employed.

Silver Nitrate in solution should be sent out in ambertinted glass bottles, which glass minimises the action of light on the solution, and, being more transparent than blue-glass bottles, the contents may be more easily seen.

Silver Oxide parts with its oxygen so readily when brought into contact with certain organic matters as sometimes to induce an explosion. The subject is fully treated in the section on pills; but here the student is especially warned regarding the reducing-power of the compound.

Sugar for pharmaceutical purposes should be the kind made from cane. It is purer and less liable to alteration than beetroot sugar. It rarely happens that solid sugar is prescribed, except in the form of pulv. sacchari albi in powders. Should it occur in any mixture, the best plan to follow is to take the equivalent of syrupus B.P., 3ix. of which is equal to a avoirdupois ounce of sugar, or mlxviij. equals 60 grains of sugar.

Sulphonal.—The light powder should be used for dispensing in preference to the heavier crystals, because the former dissolves more easily.

Tannic Acid does not readily yield a bright solution with water; a stock-solution (1 in 2 of proof spirit) may be used, and yields, with water free from ammonia, a brilliant solution of a light-yellow shade. Tap-water makes an opalescent solution.

Zinc Chloride of commerce contains some basic salt, so that when treated with water the chloride does not completely dissolve. It should be strained from the insoluble oxychloride and no attempt made to clear it by the addition of acid.

Dispensers should remember that the water of crystallisation in many chemicals suffices, when certain of them are mixed, to produce apparent decomposition. This fact is taken advantage of sometimes, as in the granulation of effervescing preparations, where the water of crystallisation in the citric acid leaves it to join the sugar or alkali, thus helping to mass the mixture. There are many similar instances. The lique-faction of camphor and chloral hydrate, phenol and quinine sulphate, and many other organic substances, when mixed

together, is not of the same nature, but appears to be due to molecular rearrangement in some cases, and to actual chemical change in others. Young dispensers will find it advantageous and instructive to write out for themselves paragraphs similar to those in this chapter regarding peculiarities in chemicals and drugs which they may observe or learn. There is much to be gained by a methodical system of annotation.

This chapter is a direct proof of the remark made earlier -that the art of dispensing is the focussing upon the compounder's duties of the knowledge of chemistry and kindred subjects required by the Boards of Examiners. The connection between the laboratory bench and the dispensing-counter is exceedingly intimate, and the cleverest pharmacists find in compounding a ceaseless source of suggestive inquiry and professional pleasure.

# PILLS AND THEIR EXCIPIENTS.

#### GENERAL OBSERVATIONS.

A PILL is a mixture of substances, generally powders, with a sufficiency of a paste or liquid of some kind to bind it into a spherical mass. The active ingredients may be liquids (e.g., essential oils), pastes (e.g., extract of belladonna), or powders (e.g., quinine sulphate or powdered rhubarb); but, whatever the active substances are, a powder of some kind is generally contained in pills.

The preparation of good pills always requires much practical judgment and experience, and is, indeed, one of the most important parts of pharmacy, for it is here that the prescriber depends upon the superior knowledge of the pharmacist.

The characteristics of well-prepared pills are (1) they are not too soft, (2) do not stick together nor flatten, (3) are smooth and round, (4) are all of the same size, and (5) all contain similar proportions of the ingredients. These characteristics are not the sole objects to aim at, however. The dispenser has to remember that a pill is a thing which has to do something, and that in the process of making it elegant its therapeutic properties may be annihilated by (1) the production of an insoluble mass or (2) using an excipient for the active ingredients which induces chemical change. A general knowledge of the therapeutic action of drugs is of service in this connection, especially as to whether a remedy is expected to exert its influence in the stomach or other parts of the alimentary canal. It is possible to localise the action, and necessary in some cases. For example, pills of pepsin must dissolve in the stomach because its fermentative action is only exerted in an acid medium; on the other hand, purgative medicines need not, if in pill form, begin to dissolve until they reach the duodenum or intestine, hence they are frequently made somewhat hard.

It is advisable to dispense pills of the weight prescribed, and as inspissation is inconvenient at the dispensing-counter, this object is attained by keeping the more common extracts both in a soft condition and in a state sufficiently hard to roll into pills with but little addition of powder. Ext. coloc. co. may conveniently be kept in powder form, as may also several pill-masses—e.g., pil. asafet. co., pil. cambog. co., pil. aloes et ferri, pil. aloes et myrrhæ, pil. hydrarg. subchlor. co., and pil. rhei co. State clearly on the label how much of the pill-mass the powder is equivalent to—for example, 'Pulv. pro pil. hydrarg. subchlor. co., 4 grains equal 4½ grains of pill-mass.'

Before rolling out the mass into pills it is a good plan to weigh it in order to see that it corresponds with the total weight of the ingredients. This is a wise precaution, and especially checks careless weighing. Unless the prescriber order to the contrary, it is advisable to make up to I grain all pills less than that in weight. This is done by adding some inert powder, such as liquorice or sugar of milk, with an appropriate excipient; and if a note is made in the prescription-book, and on the prescription, of the size of the pills, it ensures the same size pill always being dispensed. In Germany pills are seldom prescribed above 2 grains each in weight, and this also is the tendency of British pharmacy.

Where no excipient is ordered the simplest should be selected, and that which least augments the size of the pill. Generally speaking, a dispenser has one excipient that he prefers and uses in the majority of cases. It may not be the best in every case, but, because he is in the habit of using it, and knows well its massing-powers, he can produce better results with it than with any other. Citrate of iron and quinine, for example, may be made into a good working mass and keeping pill with almost any excipient not having glycerin for its basis; but if a dispenser tries to make a mass of it with an

excipient which he is not in the habit of using, the chances are that the attempt will end in failure. It is necessary to point this out, as in none of the cases afterwards mentioned should we consider the excipients recommended the best unless this element of familiarity in their use were also taken into consideration.

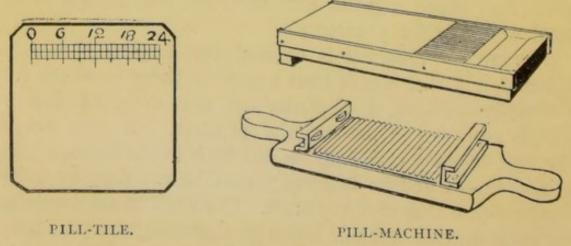
To make pills that will keep their shape for a reasonable time they ought to have some fibrous vegetable powder in their composition. Where such is not ordered the dispenser has often to use it, but, of course, what he uses must be both medicinally and chemically inert. Paper-pulp—blotting-paper or filtering-paper scraped into fluff—has also been recommended.

For massing pills a Wedgwood mortar and pestle with a narrow head and long handle are best. The fat-headed pestle with short tapering handle does not enable the compounder to exert the kneading force and leverage which are obtained



with the modern pill-pestle. A short strong spatula, such as is here illustrated, is also a necessary weapon: flexible spatulas have a short life at the dispensing-counter.

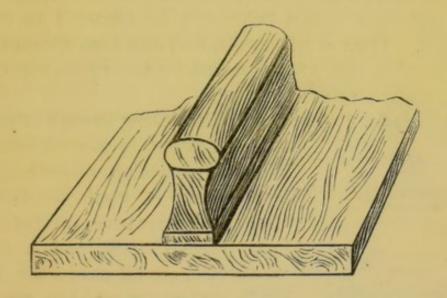
Rolling.—The pill-tile and the pill-machine are the next instruments required in pill-making, for the purpose of dividing



the mass into the requisite number of parts. The tile is an exceedingly useful bit of apparatus in the hands of some

dispensers, for they can with the spatula roll and cut a tiny mass on it quicker than with the machine. Where little dispensing is done, so that there is not a variety of rolling-machines, the tile is almost indispensable. The form of pill-machine almost universally used is also illustrated. The kind with adjustable edges and the tray movable is the best. For oval pills the cutters are made wider and shallower. In cutting the roll should occupy fully the number of spaces actually required.

It is difficult to roll a mass for 1 or 2 grain pills upon a 4 or 5 grain pill-machine. To meet this disadvantage the pill-roller next figured in section has been suggested. This little



instrument is a roller made of hard wood 3 inches broad, and as long as desired, the handle being securely fixed into the bottom piece with glue.

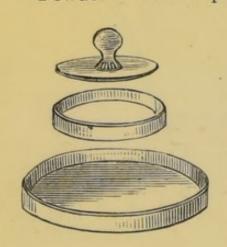
Another good idea for a roller is a piece of beechwood about \(\frac{3}{8}\) inch thick, 6 inches long, and 4 inches broad. A leather strap is nailed to each side, and goes across the top. Under this four fingers of the hand are placed, and the thumb fits on one side to steady it. For working up masses or rolling weighed portions into pipe it is capital, because the pressure can be applied as desired.

Still another idea has been put forward. It is to insert into the bed of the machine a piece of mahogany board (about inch thick) made the required size so that it may slip into

the machine and be a tight fit. By this arrangement the ordinary roller can be used, and 1-grain pills are rolled out quite easily. The same end is attained by the machine with adjustable sides; the disadvantage of it is that the cutters are too wide, and each pill has to be rounded with the fingers.

Rounding.—Pills are generally rounded with a pill-rounder. Rounding pills with the fingers is only permissible in such a case as has just been mentioned or when the mass crumbles under the rounder—which is not good pharmacy. The ordinary rounder has a deep and a shallow side, so that large and small sizes may be rounded with it; but if either side is too deep, a piece of cardboard may be inserted. The French pill-roller shown below can be adjusted to suit any size of pill. The cut pills are laid on the tray, sprinkled with a little powder, and, when covered by the roller, are rapidly, and with slight pressure, revolved.

Powder is used to prevent pills sticking to each other, and,



to some extent, to conceal their taste. When no particular powder is ordered, lycopodium is used in Germany. Cinnamon, liquorice, magnes. carb. levis, French chalk, and a mixture of starches are all used—the French chalk, perhaps, more than any other. The objection to it is that it makes the slab very slippery; but this can be overcome by the addition of a

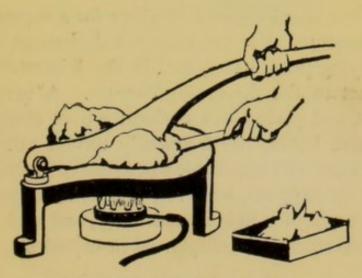
little powdered starch. Two parts of powdered starch with one of French chalk makes a good pill-powder; another is a mixture of equal parts of powdered sugar and cornflour. Use a powder-dredger for distributing. A pill-sieve is sometimes employed to remove excess of powder.

Pills with hygroscopic, strong-smelling, or volatile ingredients should always be dispensed in bottles.

Small quantities of ingredients, such as a fraction of a grain of a powerful medicament (strychnine, mercury per-

chloride, calcium sulphide, &c.), should be intimately mixed with sugar of milk and massed with soft manna. Sugar of milk, in crystals or coarse powder, is most useful for dividing any active ingredient when making pills. A mortar and pestle with perfectly smooth grinding-surfaces should be selected, and the strychnine (for example) lightly powdered; an equal quantity of coarse sugar of milk should be added, and lightly triturated until none adheres to the mortar; then powder carefully, add a little more coarse sugar of milk, triturate lightly until mixed and detached from the mortar, then powder, and mix thoroughly with any other powders that may be ordered in the pill.

Hot-plate.—A casserole water-bath (see page 184) is convenient for evaporating certain pill-masses to suitable consistence, adding a little tragacanth if necessary. Many operations in pill-making, especially in the case of large masses, are greatly facilitated by the use of a smooth slab of iron—say, 9 inches square of \(\frac{1}{4}\)-inch boiler-plate; it is quickly warmed over a gas-furnace, and as soon as the plate is hot enough (as may be judged by the finger) the gas is put out, and the mass placed upon it. The mass is then thoroughly kneaded with a



HOT-PLATE FOR PILL-MASSES.

spatula. The illustration given here shows the hot-plate kneader made by Pindar and the manner of using it. Pill-manufacturers employ this apparatus for massing some kinds of pills, such as those containing much aloes, colocynth,

asafetida, or galbanum. It is useful to employ heat in massing resinous substances, which are hard and brittle in the cold. They may be rolled on the hot iron slab and made into pills without addition of a liquid excipient, but most of them require the addition of fibrous material, such as liquorice powder or lycopodium, to prevent their falling. The hot-plate should not be used for masses containing aromatic or other volatile active principles.

Substances which are decomposed by iron, such as corrosive sublimate, calomel, silver nitrate, copper and bismuth salts, must not be mixed in an iron mortar.

Salts easily soluble in water require very careful addition of any aqueous excipient, and excipients containing glycerin should be avoided or used very sparingly with soluble salts.

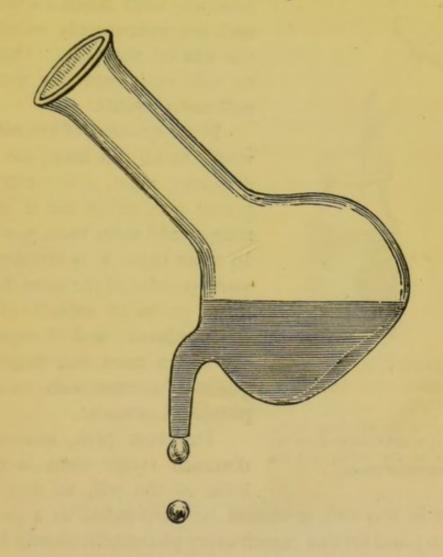
Soft Masses.—Crystallised salts, fluid acids, and soft extracts, with a vegetable powder, often make a mass of pasty consistence, which may right itself on standing ten to fifteen minutes. Time should always be given for a vegetable powder to imbibe moisture. For soft masses a desiccator, such as that in use for drying precipitates, &c., in the laboratory, is a most useful adjunct to the dispensing-counter. A very soft mass, cut into pills, and placed in a desiccator over strong sulphuric acid for twelve hours, has frequently turned out well. This treatment is especially applicable when pills contain deliquescent salts. It rarely happens, however, that one can wait a day in order to get a pill of suitable consistency, and such soft masses can more conveniently be dispensed in capsules.

Liquid Excipients.—The illustration, page 83, shows a dropping-bottle which is useful for adding water to pill-masses. An eye-drop bottle, made by inserting a piece of glass tubing, with capillary point, in a perforated cork fitted to a phial or small flask, is equally good.

At well-appointed dispensing-counters several bottles con-

taining syrup, mucilage, glycerin and water, glucose syrup, tragacanth paste, and other excipients are kept. The illustration on the next page shows a suitable bottle for the purpose.

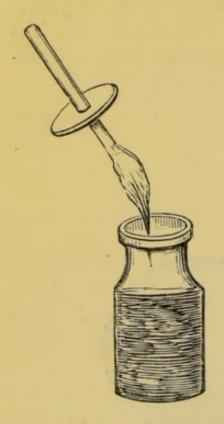
When fluids require to be added to form a pill-mass, it is risky to add them direct to the mixed powders from a stock-



bottle, as one may pour in too much; so, when a dropper is not available, drop the fluid excipient first on to the point of the spatula, and from it to the mortar in the necessary quantity.

Pill-masses containing vegetable powders take a few minutes to absorb the added water (as already noted), so that a nice plastic mass may become quite crumbly in ten to fifteen minutes. It is customary, therefore, to make such powders as rhubarb into a rather soft mass at first. If the exact quantity of water or syrup required for massing a powder be known,

the pills may be made of smaller size, and in less time, by adding the required quantity at once, and rapidly mixing and



AN EMPTY I-OZ. CITRATE OF IRON AND QUININE BOTTLE.

The cover made of sheet indiarubber, a little larger than the mouth of the bottle, and the dipping-rod of glass. cutting before the mass has become too firm by absorption. The addition of the excipient little by little generally adds much to the labour, and not infrequently much also to the size of the pills. This applies to soft excipients like extracts, as well as to liquids.

If the quantity of extract ordered would make the mass too soft, the dispenser must, if the extract be a potent one, either use it in a drier state or add some inert powder to it. In other cases it is common to use some powder of the same drug—e.g., if 20 grains of extract of gentian were ordered, and it would make too soft a mass, one might use 10 grains of extract with 10 grains of powdered gentian.

The best plan, however, is to diminish rather than increase the bulk of the pill, so that when an

extract is too soft, it should be evaporated to a proper consistence; and for this reason every pharmacist should have some simple and ready appliance for accomplishing this without risk to the extract. It is well to remember that some extracts are highly hygroscopic after evaporation, and if allowance is not made for this, pills massed with them may become semi-fluid on keeping.

Never use the same spatula to scrape the mass from the pestle and to dip into the extract-pot.

#### EXCIPIENTS.

Acacia Powder by itself is an excipient of very little value for the purpose of giving consistence; but, with the addition of 10 per cent. of powdered althæa-root, or half its weight of finely-powdered liquorice-root, it makes a good binder for soft masses. The pills formed are apt to become hard.

**Breadcrumb** is stated to be an excellent excipient for many things. As a matter of fact it is useless, and is never used.

Calcium Phosphate possesses in a remarkable degree the property of giving a greasy substance, such as lard or mercurial ointment, a good pilular consistence, when added in comparatively small quantity. It is also useful for essential oils; mix it, in this case, with half its weight of wheaten flour.

Compound Decoction of Aloes, especially the concentrated kind, is useful where a considerable quantity of oil has to be combined with a rather soft mass. It is an excellent excipient for most pills containing aloes, but is to be avoided where the potassium carbonate contained in it would prove an incompatible.

Confection of Roses and Confection of Hips increase the bulk of pills more than is liked nowadays.

Extract of Malt is a capital excipient for general use.

Fullers' Earth is a convenient inorganic and inert powder for massing substances of a fatty nature.

Glucose (or Honey) is a serviceable excipient in many cases. Glucose syrup is now prescribed by the British Pharmacopæia for several pills. It is a mixture of 1 ounce of liquid glucose of commerce with 2 ounces of syrup (both by weight). It is not sufficiently adhesive for some purposes.

Glucanth is an excellent binding excipient. The formula for it is as follows:—

	Powder	red	tragac	anth			$\frac{1}{2}$ oz.
	Glyceri	n					$I^{\frac{1}{2}}$ oz.
	Water						1 OZ.
	Liquid	glı	icose				$3\frac{1}{2}$ oz.
Mix.							

Remington's General Excipient is also very good, and somewhat more binding than the foregoing. Its formula is—

Benzoic acid			-	I gr.
Powdered acacia				90 gr.
Glycerin .				I oz.
Liquid glucose				4 OZ.
Mix.				

All these glucose mixtures are good for massing vegetable powders alone or mixed with chemical powders.

Glycerin keeps pills soft, and being a very hygroscopic body itself, it cannot be used with other hygroscopic bodies. Glycerin ceases to exhibit this character when it contains half its weight of water. Whenever it is used alone as an excipient, add sufficient powdered tragacanth to bind after the action of the glycerin has taken place, not simultaneously; but it is better to start with glycerin of tragacanth. Careful dispensers are shy about using glycerin alone in pill-making. It is fatal to the silvering or varnishing of pills. Glycerin 1 part, with treacle 3 parts, is an excellent excipient for pil. aloes et myrrhæ.

Kaolin, being an inert earth, has come into use for combining with oxidisable or reducible substances, such as potassium permanganate, which cannot be massed with extracts or carbohydrates, but with fats, such as lanoline or vaseline.

Kieselguhr (fossil earth) is a splendid absorbent for liquids, and the mixtures formed may be massed with a fat or glucanth.

Liquorice Powder is largely used as an absorbent and slightly binding excipient. Its fibrous nature plays a part in the internal disintegration of the pills. Powdered extract of liquorice is a favourite American excipient.

Manna is as good an excipient as anything for calomel and similar heavy white compounds.

Mucilage of Acacia as an excipient should be avoided. It makes pills too hard; indeed, with some substances (such as calomel) it forms a perfect cement.

Powdered Althæa, if used freely, has a tendency, in consequence of its large proportion of mucilage, to interfere with the solubility of the pills, and to reduce their activity. Besides, it is apt to make a mass too elastic to work well into shape, and which hardens too much afterwards. Not more than 1 grain to 5 or 10 grains of the active ingredients should be used. Three parts of powdered althæa require 2 parts of water to form a mass. In German pharmacies the following powders are sometimes kept ready for pills that require a binding excipient:—

FOR WH	FOR COLOURED PILLS.								
Pulv. althææ				10	Pulv. althææ				15
Farinæ secalinæ				10	Farinæ secalinæ				10
Sacch. alb				10	Sacch. alb				10
Pulv. iridis .				70	Pulv. iridis .				50
M. Fiat pulv. subtil.				Pulv. gentianæ				15	
			J	M. Fiat pulv.	subti	1.			

Another good excipient powder for such things as carbolic acid is a mixture of equal parts of althea and liquorice.

Resin Ointment makes good pills of ferri et quininæ citras and similar articles which cake with aqueous excipients.

Soap-powder makes the best pill-mass with vegetable powders, extracts, and gum resins. In using soap care must be

taken not to add too much water. Soap-masses at first appear dry and crumbly, so that the dispenser is tempted to add more water, and finds afterwards that he has too soft a mass. A little spirit has a similar effect to a greater extent, so that it must be used very carefully. Powdered curd soap is better than hard olive-oil soap, especially for creosote and essential oils. As soap is decomposed by acid salts, acids, many metallic salts, and tannin substances, it is not suitable for masses containing these.

Spirit should not be used when there is much resin in the pill, and masses made with it should be rolled off very quickly, or they will crumble. Proof spirit is, on the whole, better than rectified spirit for resinous masses.

Many substances do not require the addition of an adhesive excipient—e.g., the extracts of aloes, pulv. pil. coloc. co., pulv. ext. coloc. co., &c., form a good mass with water (about miv. to 3j.); pulv. pil. asafet. co. is readily massed with rectified spirit.

Sugar without some mucilaginous addition is not good. Syrup, however, with powdered althæa is very useful.

'Dispensing-syrup' is the best form for using sugar. The formula for it is:—

This binds (owing to the acacia), keeps the mass from hardening (glycerin) and from oxidation (sugar).

Theriacanth is made thus: Rub I drachm of powdered tragacanth with 2 drachms of rectified spirit in a mortar; then add quickly 2 ounces of treacle (previously made more fluid by warming), and thoroughly mix. This soon sets into an adhesive mass which is excellent for such intractable things as reduced iron,

Tragacanth gives solidity and elasticity to a mass which is on the soft side, but if too much be added the pills become so elastic that it is almost impossible to round them. Tragacanth is especially to be recommended when the mass is too soft, and when it is desired not to increase the weight too much. If masses crumble, a little tragacanth powder, with a few drops of glycerin, will bind them.

The compound powder of tragacanth is more to be relied on than the pure gum, especially if the starch be replaced by wheaten flour as in the following:—

Mix.

This is absorbent, binding, and preservative.

Tragacanth (Glycerin of).—Nothing has yet proved of such general usefulness as this invention of Mr. Barnard Proctor, the Newcastle-on-Tyne pharmacist. His formula differs slightly from that in the British Pharmacopæia, being as follows:—

Mix the gum and glycerin till smooth before adding the water.

Mr. Proctor remarked of this: 'Four ounces of the dry materials require exactly I ounce of this mucilage to form a convenient mass, which retains its plastic condition, its solubility, its retentiveness of shape, and a ready miscibility with other aqueous masses, if that were necessary.' The glycerin is the best excipient for salts and metallic oxides, such as potassium bromide and bismuth subnitrate. The mass should be well kneaded, or more of the excipient will be used than is really necessary. This may be remedied by the cautious addition of a little glycerin and water to the pill-ingredients.

Water is a vehicle rather than an excipient. It is used along with substances which contain within themselves a binding material, such as gum, or in masses containing soap. As a rule 3 minims of water suffices for a dozen 5-grain pills.

Wax or Cocoa Butter is useful to thicken essential oils and the like before kneading them into a mass with powdered althæa. Melt the wax or cocoa butter by a gentle heat, add the oil, stir, and mass with the powder—one grain of wax for 2 minims of oil. Cocoa butter is excellent as an excipient for oxidising-substances—e.g., silver oxide.

#### HINTS BY MR. JOSEPH INCE.

The following remarks by Mr. Joseph Ince, formerly Lecturer on Pharmacy at the School of Pharmacy, Bloomsbury, were contributed to the treatise published in 1884:—

Excipients to be Avoided.—(1) Those incompatible with any of the ingredients of the pill-mass. Thus, confection of roses must not be used to make up iron compounds; acetic extract of colchicum must not be stiffened with magnesia.

- (2) Those which make the pills either too hard or too soft.
- (3) Those which unduly increase size.

Cera Flava will bind any coloured essential oil into a convenient mass; while Cera Alba is used with the colourless oils. Wax has come into disfavour for internal use. It is effectual as an excipient, but not a necessity.

Decoct. Aloes Comp. is invaluable as an excipient for pills containing aloes and gum resins. Wonderfully small quantities are required, and it is not only effective, but a brilliant, glossy appearance is communicated. Where soap is also present still smaller quantities must be employed.

Liquor Potassæ has deservedly gone out of repute. Its convenience is undoubted, but its chemical action is regarded with suspicion. Pills made with it frequently become tough.

Ol. Ricini, with or without soap, forms a good excipient for camphor pills.

Pulv. Tragacanthæ.—In sparing quantities, and employed with discretion, there is no more serviceable excipient. The chief caution is to allow time, for it is surprising how small quantities will prove effective. Take this difficult formula as an illustration:—

Camphoræ . . . . . . . . . gr. vj.
Pil. galban. comp. . . . . gr. xviij.
Ext. cannabis ind. . . . . gr. iij.
Pulv. tragac. . . . . gr. iij.

M. Fiat pil. vj.

Let the camphor and extract of Indian hemp deliquesce; add the galbanum, previously warmed gently; when the inevitable action has taken place add 3 grains of powdered tragacanth and beat into a mass.

Water alone may be used as an excipient, as in opium pills, but the use of water needs a very practised hand to make it successful. The mass may be as soft as paste or as hard as flint. 'In medio tutissimus ibis.' The real use of water is by partial solution of the ingredients to diminish bulk, after which add the proper excipient. One drop of water or one drop of glycerin will often effect wonders in this way, and pills that otherwise would be of inconvenient size can be most elegantly dispensed.

# HINTS BY MR. A. W. GERRARD.

What are the conditions required of a well-made pill? This was a question asked in the original treatise by Mr. A. W. Gerrard, then head dispenser at University College Hospital, London. He answered it as follows:—

(1) The ingredients of which it is composed should be worked into an intimate admixture, no individual particles being discernible.

(2) The parts should be held together by some cohesive

force, sufficient to withstand the process of rolling and cutting without undergoing crumbling or cracking.

(3) The pills being formed should retain under ordinary

conditions a perfectly globular form.

(4) The excipient, whether indicated by the prescriber or left to the discretion of the dispenser, should be chemically and therapeutically compatible with the other ingredients.

(5) The pills should disintegrate readily soon after ingestion. Failure to produce these conditions may be ascribed to a variety of causes—as, for example, excess or deficiency of a moist extract; presence of hygroscopic or deliquescent bodies; chemical incompatibility of ingredients; excess of essential or fixed oils; injudicious choice and use of excipients, or bad manipulation.

The following are some prescriptions illustrating cases of failure, and the means of overcoming it :--

```
Ext. nucis vom. . . . . . . . . gr. ss.
Ext. hyoscy. . . . . . . . gr. iij.
Pulv. ipecac. . . . . . . gr. ss.
Fiat pilula.
```

Pills made from these ingredients soon lose their round form, becoming moist and unsightly; the addition of ½ grain of tragacanth powder sets all right, by absorbing moisture and imparting solidity.

```
Ext. colch. acet. . . . . . . . . . . gr. ss. Ext. hyoscy. . . . . . . . . gr. iij. Pil. hydrarg. . . . . . . . . . gr. ij.
```

Fiat pil. Mane et nocte sumend.

This pill has the same defects as the previous one, but the materials of each pill,  $5\frac{1}{2}$  grains, make it too bulky to risk an addition. The difficulty can be got over by drying the extract of henbane on a pill-tile over a water-bath. Bear in mind volatile bodies must not be so treated.

```
Argenti oxidi . . . . . . . . . gr. ij.
Pil. rhei co. . . . . . . . . . . . . gr. ijj
Fiat pil. Sumend, ante cibum.
```

Of all masses this is one of the most obstinate and vexing, as it becomes rapidly tough and unmanageable, owing to the silver oxide being slowly reduced. A small admixture of confection of hips with the oxide at starting generally gives a good result.

Ol. caryoph. . . . . . . . . . mj.
Ext. col. co. . . . . . . . . . gr. ij.
Ext. anthem. . . . . . . . . gr. ij.

Here essential oil is in excess, and the ingredients refuse to form a tenacious mass. In such a case the addition of grain of soap per pill brings them under control. Soap should not be used for salts of iron, lead, bismuth, copper, or mercury, as oleates would be formed.

For this pill nothing is better than 2 grains of compound tragacanth powder and 1 grain of soap. This excipient subdues croton oil perfectly, and it is equally suitable for creosote and carbolic acid.

Compound tragacanth powder is about the best general pill-excipient. The simplicity of its constituents admirably adapts it as a diluent of all substances given in small doses; whilst under its influence, in the presence of a little water, the most obstinate ingredients are brought under control. Solubility with easy disintegration is another of its characteristics. When oils have to be dealt with, a little soap may be added to the compound tragacanth powder with advantage.

# INGREDIENTS OF PILLS AND HOW TO MASS THEM.

From what has already been said regarding excipients it will have been seen that dexterity in the art of pill-making largely depends upon knowledge of the physical properties of the ingredients and their relations to the excipients. It is the dispenser with one universal excipient who brings pharmacy into disrepute by turning out pills that disgust the customer by the stickiness which comes over them or disappoint the physician through their marble hardness. Mr. Gerrard's remarks in the previous chapter regarding the essentials of a pill are to the point.

General rules are, however, like the general excipient, a failure now and then. Thus it is good to use glycerin of tragacanth as an excipient for water-insoluble chemicals, and this is admirable and true for bismuth subnitrate, cerium oxalate, and many other inorganic chemicals, also for organic compounds such as quinine sulphate; but the rule breaks down with mixtures of certain powders each of which is sparingly soluble in water—for example, camphor and menthol, which when mixed together liquefy, thus overthrowing the rule as to the excipient.

In this chapter ingredients which behave in an abnormal manner, and exceptional combinations of ingredients are treated. The side-titles to the paragraphs are given in Latin when specific articles are dealt with, and in English when groups of a kind are the subject of treatment. Dispensers are advised to add examples from their own experience.

Acetanilidum.—Is sparingly soluble in water. Reduce to fine powder and mass with glycerin of tragacanth.

Acids.—The mineral acids are rarely, if ever, prescribed in pill form in this country, but it sometimes happens that a German prescription of this nature turns up. With the addition of powdered althæa and glycerinated water good plastic masses are obtained, as in the following:—

M. Fiat pilulæ 100.

Send out such pills in a bottle.

The following is a curious English prescription:-

```
Acid. sulphuric. fort. . . . . gtt. vj. Extracti aloes . . . . gr. xxiv.
```

M. Fiat pil. xij.

The procedure is: Rub the powdered extract with the acid for a few seconds, and mass with the smallest possible quantity of rectified spirit and syrup (equal parts). The well-known Easton's syrup pill is another good instance of the use of mineral acids as excipient:—

Fiat massa et divide in pilulas viginte.

Mix the solids thoroughly, add the acid, and beat well. The mass is too soft at first, but soon begins to harden, and should be rolled and cut before too late.

Acidum Arseniosum.—When medicines are given in doses of a fraction of a grain the dispenser has to consider

whether they are very soluble in any inert solvent which will not prevent them being made into a mass, for if they are of this nature it is obviously advantageous to dissolve, add a powder, and a suitable paste excipient to mass. Arsenious acid is not one of those substances, therefore before attempting to mass it it must be well triturated with any powders prescribed along with it. For example, in the familiar Asiatic pill, the arsenious acid is combined with ten times its weight of powdered black pepper, the resulting pill containing 16 grain of the acid. Here we take the prescribed amount of arsenious acid and triturate intimately in the mortar with its own bulk of the pepper, then as much again, and so on until all the pepper is used up, finally massing with glycerin of tragacanth (a better excipient than gum and water). treatment of more soluble substances is exemplified in Atropine (which see).

Acidum Benzoicum—Five grains makes a fair mass with a drop of glycerin, but theriacanth gives the best results. For a white pill use glucanth.

Acidum Carbolicum.—Phenol is one of the most troublesome things which the dispenser has to make into pills, owing to the fact that it tends to or actually does liquefy when rubbed in a mortar with other substances. With some extracts it forms a syrup; with alkaloidal salts, especially sulphates, it liquefies; and its behaviour towards many other organic substances is so precarious that dispensers will do well to reflect upon the table (Dr. E A. Ruddiman's) printed on the opposite page, which shows that when any two of the substances named are mixed they form—P, a dry powder; L, liquid; DP, damp powder; PM, pasty mass. Alkaloidal salts behave similarly to antipyrin.

Phenol in detached crystals is the most convenient form for the dispensing-counter, especially for making pills. The excipients for it are about half a dozen—viz., wheaten flour, powdered soap and liquorice, soap and tragacanth with glycerin, powdered althæa and a trace of glycerin, kieselguhr

																			1
Urethane	Ь	L	r	L	Ь	L	٦	L	Ь	Ь	Ь	L	Г	L	L	L	Ь	L	Ь
Thymol	L	7	Ь	7	L	L	T	L	Ь	Ы	Ь	7	Ь	Ь	Ь	F	Р	Ь	r
Sodium	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	P	Ь	Ь
lola2	Ь	DP	Ь	L	L	L	L	Ь	Ъ	L	Ь	r	Ь	Ь	Ь	Ь	Ь	L	L
Salicylic acid	d.	Ы	Ь	Ь	Ь	Ь	L	Р	Ь	Ъ	Ь	Р	Ь	Ъ	d	Ь	Ь	Ь	L
Resorcin	DP	PM	Ъ	L	Ь	Ь	L	L	DP	Ь	Ь	L	Ь	Ь	Ь	Ъ	Ь	Ь	L
Pyrogallol	Ь	PM	P	L	Ь	Ь	L	L	Ъ	Ь	Ь	L	Ь	Ь	Ь	Ь	Ь	Ь	r
Phenol	L	L	L	L	7	L	L	L	L	L	L	Ь	L	L	Ь	L	Ь	L	L
Phenacetin	Ь	Ь	Ь	Ь	Ь	L	Ь	Ь	Ь	Ь	Ь	L	Ь	Ь	Ь	Ь	Ь	Ь	J.
Naphthalin	Р	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	Ь	L	Ь	Ь	Ь	L	Ь	Ь	Ъ
Methacetin	Ь	Ь	Ь	Ь	Ь	L	Ь	Ь	Ь	Ь	Ь	L	Ь	DP	Ь	Ь	Ь	Ь	Ь
Menthol	Б	Ъ	L	L	L	L	L	Ь	Ь	Ь	Ь	L	L	L	Ь	Б	Ь	L	L
Exalgin	Ь	Ь	L	Ь	Ь	L	Ь	L	Ь	Ь	Ь	L	L	7	L	7	Ь	L	T
Chloral	DP	Ъ	Ь	L	7	Ь	L	L	L	Ь	L	L	Ь	Ь	Ь	L	Ь	L	L
Camphor	Ь	Ь	Ь	Ь	Ь	L	Ь	Ь	Ь	Ь	Ь	L	Ь	Ь	Ь	L	Ь	L	Ь
Сятрьют	Ъ	Ь	L	Ь	Ь	L	Р	L	Ь	Ь	Ъ	L	L	L	Ъ	L	Ь	r	L
Beta-naphthol	Ь	L	Ь	L	Ь	Ь	L	L	Ъ	Ъ	Ь	L	Ь	Ь	Ь	Ь	Ь	Ь	L
nityqiinA	Ь	Ь	I,	Ь	Ь	Ь	Ь	Ь	Ъ	Ь	Ь	L	PM	PM	Ь	DP	Ь	L	L
Acetanilide	Ь	Ь	Ь	Ь	Ь	DP	Ь	Ь	Ъ	Ъ	Ь	L	Ь	DP	Ь	Ъ	Ъ	L	Ь
								. :			,								
	•//				Camphor monobromate			٠.											
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			hol		non	Chloral hydrate				1921					pi		Sodium salicylate		
	lide	in	pht	or	or n	hye		. 1	etin	alin	etin		lol	n.	cac		sal		ne
	tani	ipyr	Beta-naphthol	hdu	uph	oral	Exalgin	Menthol	Methacetin	ohth	Phenacetin	lou	Pyrogallol	Resorcin	cyli	10	ium	Thymol	Urethane
	Acetanilide	Antipyrin	Bet	Camphor	Can	Chl	Exa	Mer	Met	Naphthalin	Phe	Phenol	Pyr	Res	Salicylic acid	Salol	Sod	Thy	Ure
The second second			-	227						ACCOUNT NO.								100	

and powdered curd soap, and paraffin with wheaten flour. Success with any of these greatly depends upon habit: the dispenser who is successful with soap and liquorice sticks to that excipient as the best, and so with others. For plain white pills the following are hard to beat:—

I.	II.	
Carbolic acid 3j. Wheaten flour 3ij. Powdered tragacanth 3ss. Liquid glucose . a si Mass.		gr. xij. gr. xlv. gr. iij.

The second of these masses is Mr. F. W. Lucas's 50-per-cent.

The excipient to be used must depend greatly upon the nature of the mass. For example:—

```
Bismuthi subnitrat. . . . . . . gr. iij.
Acid. carbol. . . . . . . gr. j.
Fiat pil.
```

This makes a good pill by rubbing up the acid with half a grain of powdered curd soap, adding the subnitrate, and massing with a very little glycerin of tragacanth.

```
Podophylli resinæ . . . . . . . . . gr. \frac{1}{6}
Pil. rhei co. . . . . . gr. iij.
Acid. carbolic. . . . . . . . . mj.
```

Rub the phenol with an equal weight of soap; then add the powdered ingredients of the rhubarb pill, the podophyllin, and a little powdered tragacanth. Mass with a little treacle.

Divide in pilulas xij.

On mixing the camphor and phenol they liquefy. It is then difficult to combine the extract, therefore mix the three

together, and triturate until uniform, add the powdered capsicum and 6 grains of powdered curd soap, mix and mass with kieselguhr. This is substantially the procedure with most of the liquefied phenol combinations, but soap is not always a desirable addition and hard paraffin is the best substitute for soap, and next to it compound tragacanth powder.

Acidum Gallicum makes a good mass with a sixth to an eighth of its weight of glycerin.

Acidum Oxalicum.—Powder well and mass with kaolin ointment or cocoa-butter.

Acidum Salicylicum.—Reduce to fine powder and mass with glycerin of tragacanth.

Acidum Tannicum.—If massed with mucilage, the pills dry, crack, and crumble to powder. A mixture of glycerin and mucilage of acacia (or dispensing-syrup) makes an excellent exc pient.

Aloes.—Pills containing aloes in any fair proportion, and particularly when in combination with colocynth, scammony, and soap, are best made with decoct. aloes comp., which an eminent pharmacist has called their 'natural excipient.' It has great solvent power, and must be used in very sparing quantity. Aloes, mastic, and soap are best massed with this excipient. Decoct. aloes comp. owes its value as an excipient chiefly to the presence of potassium carbonate, which is an active solvent of organic substances, but not in every case a desirable addition to a pill-mass. Aloes alone, or the extract, in pill, is the better for the addition of some fibrous material, such as about a tenth of its weight of althæa or liquorice: mass with spirit. This helps to keep the shape of the pill when formed.

Aloinum.—This active principle is practically aloes free from resin and extractive matters, therefore is devoid of the

binding-materials which make solvent excipients appropriate for aloes. Glycerin of tragacanth masses aloin well.

Ammonii Chloridum.—This salt is sometimes prescribed along with quinine sulphate for a neuralgic pill, as in the following:—

```
Ammonii chloridi . . . . . gr. iiss.

Quininæ sulphatis . . . . gr. j.

Extracti belladonnæ viridis . . . gr. ½
```

Fiat pilula.

An aqueous or glycerin excipient is useless owing to the solubility of the ammonium chloride. A good pill is obtained by mixing all the ingredients together with I grain of powdered myrrh, and massing with rectified spirit.

Antipyrinum.—Use I grain of tragacanth for each 5 grains, and mass with as little water as possible; or use glucanth alone.

Argenti Nitras.—Two facts have to be taken into consideration regarding the massing of silver nitrate—first, the dose of the nitrate is a fraction of a grain only; and, second, the salt readily decomposes in presence of organic substances; therefore it should be rubbed to fine powder along with twice its weight of kaolin and massed with paraffin ointment or resin ointment. The following are typical combinations:—

```
I.
                                                  II.
Argenti nitratis
                                  Argenti nitratis
                      . gr. vj.
                                                          . gr. 1
Pulv. digitalis.
                                  Cupri sulphat. .
                      . gr. iii.
                                                          . gr. j.
Ext. nuc. vom.
                     . gr. vj.
                                  Ext. hæmatox.
                                                         . gr. ij.
Pulv. capsici . .
                      . gr. xij.
                                  Pulv. ipecac. .
                                  Pulv. opii . . . gr. ss.
 In pil. xij. divide.
                                     Fiat pilula. Mitte tales xij.
```

In the case of No. I. the nitrate was mixed with 12 grains of French chalk and massed with resin ointment, the rest of the ingredients being mixed and massed with the same excipient, then the two masses were intimately blended. No. II. could

not be treated that way, as the prescriber wished the pill to be not larger than a 5-grain one. In this case the copper sulphate is rather a protection to the nitrate, and the dispenser's only plan is to get the ingredients together in the simplest way, therefore the excipient must be what will best suit the logwood extract. This may be 6 drops of proof spirit or 5 drops of glycerin for the dozen pills: either makes a nice mass.

Argenti Oxidum parts with its oxygen rather quickly when brought into contact with some things—e.g., creosote—and when massed with extract of gentian or confection of roses the pills have been known to explode. The best excipient is kaolin ointment. When extract of gentian is prescribed along with the oxide, Mr. Harold Wyatt, jun., recommends that the oxide be massed with resin ointment, the extract stiffened with powdered gentian, and the two masses mixed and divided. It would do, however, to add powdered gentian to the fatty mass in sufficient quantity to soothe the dispenser's conscience without disturbing the pill, for in all likelihood the prescriber of extract of gentian along with silver oxide has not the slight tonic properties of the extract in view, but desires to sport his galenical skill.

Atropinæ Sulphas.—Plain atropine and its sulphate are frequently prescribed in pill, the doses ranging from gr.  $\frac{1}{50}$  to gr.  $\frac{1}{120}$ . The pills are usually made  $\frac{1}{2}$  grain to 1 grain in size, and the alkaloid or its salt should be dissolved, the alkaloid in rectified spirit (1 grain dissolves in 4 minims) and the sulphate in water (soluble in its own weight). Triturate well with wheaten flour (or powdered liquorice if a white pill is not particularly desired) in the proportion of  $\frac{1}{2}$  grain to each pill, and mass with glycerin of tragacanth. A trituration of the alkaloid, prepared as mentioned on page 80, may be kept ready. This paragraph may be regarded as applicable to other alkaloids of similar potency to atropine when given in pill form.

Balsams, Oils, &c.—Pill-masses are sometimes required with fluid or soft resins, fluid balsams, oils, or fats as in-

gredients. When the quantity of these is too large to admit of the formation of a mass by the addition of any reasonable quantity of powder, recourse must be had to wax, in the proportion of one-third up to an equal weight of wax, according to the fluidity of the stuff. The wax, with the medicament, should be melted in a porcelain dish on a water-bath, as the application of a strong heat would be likely to depreciate the medicinal properties of the ingredients through evaporation. In using wax the dispenser must be careful that he does not bring the resulting mass to such a degree of hardness that the pills will not disintegrate in the alimentary canal—the melting-point of the mass should not be above 100° F. An ordinary pill, though much harder than a wax pill, may dissolve in the stomach, because its ingredients are soluble in water.

Balsamum Peruvianum. — The following formula makes a good pill-mass: Balsam of Peru, gr. xxx.; slaked lime (in fine powder), gr. xv.; castor oil and rectified spirit, of each 2 drops. This forms a mass which does not become hard, and is of good pilular consistence. It requires to stand for an hour before being rolled out. The following prescription shows a difficulty:—

Ferri redact. . . . . . . gr. iij.

Bals. Peru. . . . . . . m ss

Pulv. amyli . . . . . q.s. ut fiat pilula

Mitte xxxvj.

Starch-powder is not the best absorbent in this case, because it is too gritty for pill-masses and rather retards than aids the binding of the mass. Liquorice-powder is much better. After rubbing the reduced iron to ensure fineness of division, the balsam and half its weight of black treacle are added and well beaten together. The resulting mass is soft and oily in appearance, but not crumbly, and the addition of liquorice-powder, q.s., gives the required stiffness. The small percentage of alkali in the treacle seems to combine with the resin of the balsam, thus making a good binding excipient.

Beta-naphtholum.—Triturate with a fourth of its weight of kaolin before massing with tragacanth. The compound becomes pasty or liquefies with some things, such as—

Fiat massa et divide in pilulas xij,

This masses nicely with 3 grains each of powdered acacia and althæa, and 2 grains each of powdered soap and sugar.

Bismuth Salts.—Subcarbonate and subnitrate are readily massed with a fifth of their weight of glycerin of tragacanth. Cerium Oxalate is treated similarly.

Butyl-chloral Hydras (Croton Chloral).—In conformity with the rule that white substances should be made into white pills, butyl-chloral hydrate should not be massed with such excipients as confection of hips or extract of gentian, which would give a dark-coloured mass. Equal parts of powdered acacia, tragacanth, and syrup make good pills. Glycerin in any form makes a troublesome buttery mass (a matter of solution). A pill containing 2½ grains each of butyl-chloral hydrate and quinine sulphate is a good example of self-excipiency. For a dozen mass use 3 drops of rectified spirit, which partly dissolves the butyl-chloral hydrate, making a sticky excipient which binds the quinine sulphate into a white plastic mass that divides well into a small 5-grain pill. Butyl-chloral hydrate and exalgin liquefy when rubbed together, and should be treated like similar pills of carbolic acid.

Caffeina.—This alkaloid and its citrate present no difficulty when prescribed alone (glycerin of tragacanth is the excipient), but, the citrate being a feeble salt (the acid is potentially free), strange things happen in combination. For example:—

```
Ferri sulphatis exsiccat. . . . . gr. j.

Caffeinæ citratis . . . . gr. j.

Zinci valerianatis . . . . . . gr. ij.
```

Fiat pilula. Mitte tales xxiv.

M.

When this is massed valerianic acid is liberated by citric acid pushing it out from the zinc salt. The best plan is to use instead of caffeine citrate an equivalent amount of the alkaloid—viz., 14 grains—and mass with tragacanth and syrup.

Calcii Chloridum.—Pills of this salt do not silver well unless special precautions be taken. Make a mass with Canada balsam. When rolled out and well rounded, coat the pills with tolu and ether, and after five minutes moisten them very slightly with thin mucilage, applied by the finger and thumb, drop them in the silver leaf, and proceed secundum artem. Send the pills out in a well-corked bottle, as they are likely to deliquesce.

Calcii Sulphidum.—Fractions of a grain are given at a time, and the pills are usually less than I grain in size. Triturate the sulphide with  $\frac{1}{2}$  grain of sugar of milk for each pill, then add  $\frac{1}{24}$  grain of powdered tragacanth, and mass with glycerin. This makes an odourless mass; the presence of water in any form, even as in confection of roses or an aqueous extract, decomposes the sulphide with evolution of sulphuretted hydrogen, and the virtue of the pill is thereby more or less destroyed.

Camphor generally gives trouble, and is the rock upon which many candidates for examination are stranded. In the first place powder the camphor finely—it is preferable to use flowers of camphor—by the aid of a little spirit; then, if the pill contains camphor simply, mass with glycerin of tragacanth. This also serves well for such a pill as—

```
Ammonii carbonatis . . . . gr. iss. Camphoræ . . . . . . . . . gr. ss.
```

Some dispensers prefer to use an excipient consisting of soap and a little fixed oil for camphor alone, as in the following formulæ:—

		0	)rd	ina	ry-size	Pills.		
Camphoræ								gr. xviij.
Ol. olivæ								gtt. iij.
Saponis								gr. iij,
Fiat pil. v	j.							

## Large-size Pills.

Camphoræ				gr. xxiv.
Ol. ricini				gtt. iij.
Saponis				gr. ij.

M. Fiat pil. vj.

When extract of henbane (or other green extract) is ordered along with camphor, powder the latter with the addition of a little soap instead of spirit. The extract will then make a good plastic mass which retains its consistence for some time. If the extract should make the mass too soft, it may be stiffened with powdered curd soap, or a mixture of the soap with liquorice.

When there is a large proportion of gum resin in the mass, rectified spirit is a good excipient, as in the following:—

Pulv. asafetidæ				Эv.
Pulv. zinci oxidi				gr. xij.
Pulv. camphoræ				gr. vj.
Ext. belladonnæ		,		gr. iij.
nil vviv				

Fiat pil. xxiv.

## Another example :-

Ext. belladonnæ.			gr. iv.
Pulv. camphoræ.			3ss.
Quininæ sulph			3j.
Zinci sulph			gr. x.

M. Fiat mas. et div. in pil. xxx.

In this case powder the camphor by aid of a drop or two of water and the zinc sulphate, add the quinine and extract, with a few grains of tragacanth, and make a softish mass with a mixture of 2 parts of simple syrup and 1 part of glycerin.

The phenol table (page 97) shows that camphor liquefies with chloral hydrate and other substances. The following prescription gives considerable difficulty:—

Fiat massa et divide in pilulas viij,

The resulting mixture absorbs more than double its weight of powdered liquorice. Soap is inadmissible for such a mass, as the trace of alkali in it splits up the chloral hydrate. A good mass was made by adding 16 grains of powdered liquorice, 4 grains of powdered tragacanth, and 2 drops of water. Beaten well, the mass was soft at first, but turned out all right.

Camphora Monobromata.—Reduce the monobromate to fine powder, mix with it pulv. tragac. co. 1 to 7, and mass with glycerin of tragacanth. A pill containing 1 grain each of menthol and the monobromate gave some trouble, as the ingredients liquefied. It made a good mass (twelve pills) with curd-soap powder 8 grains, powdered tragacanth 2 grains, water 1 drop, and kieselguhr to stiffen.

Cinchonidina, and other cinchona alkaloids, may be treated as quinine (which see).

Codeina.—Alone this presents little difficulty: mix the powdered alkaloid with half its weight of powdered liquorice, and mass with glucanth or glycerin of tragacanth. The following combination is very hygroscopic:—

```
Codeinæ . . . . . . . . . gr. xij.
Ext. nucis vomicæ . . . . gr. viij.
Ext. cascar. sagrad. . . . . . . . . . . . gr. xij.
```

Fiat massa et divide in pilulas xij.

The best plan is to work the whole together with 6 grains of compound tragacanth powder and 1 drop of proof spirit (if required), divide, and varnish.

Copaiba was at one time ordered very frequently in pill form, and magnes carb levis was the favourite excipient, but the mass so made becomes as hard as stone and is not disintegrated in the alimentary canal. Probably a part of the volatile oil may be assimilated, but this is doubtful. A better plan is to make a gum emulsion of the 'balsam,' and then add I part of calcined magnesia to every 10 parts by weight of

'balsam.' In about twelve hours the emulsion should be of the consistence of a thick salve. Now, by the addition of a very small quantity of borax, a pill-mass is obtained which leaves nothing to be desired. A pill taken in the mouth is at once brought to the condition of an emulsion, and the mass will keep for a long time, only requiring when it is old to be worked up in a warm mortar. Phosphate of calcium is also a good excipient.

Creosotum.—Mr. W. Martindale states that the best material for combining creosote into pills is powdered curd soap. Put the soap and the creosote in equal parts into a widemouthed stoppered bottle; mix well; and digest on a waterbath till they combine. This, on cooling, forms a plastic mass suitable for forming pills, and can be combined with other ingredients, preferably in powder. A few shreds of yellow wax, with a little powdered soap, makes good pills, but the mass is somewhat insoluble unless liquorice is added. Mr. Lucas recommends creosote 50, powdered curd soap 35, and wax 15 to be melted together, and kept in stock for use as required. This mass contains 1 in 2, and gives a good pill with liquorice. Light calcined magnesia (1 grain with 2 minims of the creosote) solidifies in a few hours, and can then be easily worked into pills; but the pills thus made are as insoluble as marbles. Always be careful about using such articles as magnesia for pill-massing: in most cases a chemical change is the result. Powdered soap gr. ss. and . powdered liquorice gr. iiss. make a good mass with I minim of creosote. Animal soap is better than Castile soap. For example: Creosote mxij., curd soap, dried and powdered, gr. vj., phosphate of lime, q.s. This makes a good mass and a small pill, but Castile soap does not. Lycopodium and animal charcoal in equal parts are an excellent absorbent; so is kieselguhr.

Creosoti Carbonas (Creosotal).—This may be treated like creosote, but its oily nature is rather a hindrance. A grain

of the compound makes a 3 grain pill. The following is a practical example:—

```
Creosot. carb. . . . . . . . . gr. iiss. Ac. arseniosi . . . . . . gr. \frac{1}{60} Misce. Fiat pil. Mitte xxiv.
```

Forty-eight pills had to be made out of the twenty-four in order to get them of a reasonable size. The creosotal, 20 grains of wax and 40 grains of curd soap, were placed in a wide-mouthed corked bottle and heated in a water-bath, with occasional shaking, till they combined. When cold, 30 grains of powdered liquorice and 5 grains of powdered tragacanth were added, and the whole well beaten in the mortar.

Crystalline Salts, soluble in water, require a little care. They should be very finely powdered, and massed with glycerin of tragacanth and an inert powder. If to be silvered, they must be varnished with tolu, and allowed to dry, before using mucilage, or else silvered with the varnishing solution alone.

Fiat pilulæ xv.

In this instance double decomposition takes place between the two salts, the water of crystallisation in the sulphate of iron being liberated; consequently, a very small quantity of extract suffices to make a mass. As ferrous bromide is formed, the pills should be varnished and sent out in a bottle.

Fiat pilulæ xxiv. Varnish with tolu.

This is likely to prove troublesome. The ferrous iodide (recently prepared) should be powdered in a warm mortar, the

other ingredients added, together with 5 grains of glycerin of tragacanth; the whole is to be vigorously worked together until it becomes plastic, rolled quickly, and varnished. Dispense the pills in a bottle. Six or eight grains of extract of gentian also makes a good mass.

Ergotinum,—This is supplied of different consistencies, some samples being quite thick and granular like extract of beef, others smooth and semi-fluid. In either case it requires the addition of an inert vegetable powder, such as powdered althea or liquorice—our favourite excipient is a mixture of powdered ragacanth, I part, and powdered liquorice, 19 parts, this generally sufficing for 20 parts of ergotin. If there be more than 2 grains of the ergotin in each pill, it requires evaporation in order to keep the pill of a reasonable size. The addition of about a twentieth part of tragacanth to each part of ergotin is an improvement. The following are typical combinations prescribed as uterine stimulants:—

		I.			II.
Ergotini.				gr. ij.	Potass. permanganat gr. xij.
Ferri redacti				gr. ij.	Ergotini gr. xij.
Strychninae				gr. $\frac{1}{32}$	Fiat massa et divide in pilulas
Fiat pilula.	. 1	Mitte t	ales	lx.	duodecim.
Silver and	sen	id out i	n a	bottle.	

Reduced iron, being non-absorbent, rather hinders the massing of No. I. The best result is obtained by triturating the strychnine well with the reduced iron, adding 10 grains of powdered tragacanth, then the ergotin, and sufficient powdered liquorice to mass. No. II. is a wretched incompatible, as the permanganate oxidises the ergotin. Mr. Harold Wyatt, jun., dispensed the prescription by massing the permanganate with resin ointment, dividing into pills which were well rolled in French chalk. The ergotin was massed with althæa, cut, and the pills flattened into discs. Each permanganate pill was then coated with an ergotin disc. This exquisite plan may be adopted as the last resort in the case of other incompatibles.

Essential Oils.—The addition of wax or resin should be the last resort, but this is sometimes unavoidable, as in the following case, where the use of soap is objectionable owing to the double decomposition which would result between the ferrous sulphate and the soap:—

```
Ferri sulph. exsic. . . . . . gr. 15

Ext. aloes aq. . . . gr. j.

Olei sabinæ . . . mj.
```

M. Fiat pil. Mitte cxliv.

Melt 72 grains of yellow wax on a water-bath, and add the oil, gently beating if necessary till they are thoroughly mixed. Mix the aloes and ferrous sulphate with 12 grains of powdered tragacanth. Pour upon this the oil and wax. Mix well, and mass with a little glucose syrup. This makes a beautiful 4-grain pill. Soap is generally all that is required to make a tractable mass, but a mixture of powdered soap, 1 part, and powdered liquorice-root, 5 parts, is better. Three grains of this makes a good mass with 1 minim of an essential oil and a little water or rectified spirit. In such a case as the following the liquorice should of course be omitted, seeing that the fibrous vegetable material is already provided:—

Misce. Fiat pilula.

Rub up the oil with I grain of powdered soap, add the powders, and mass with the smallest possible quantity of treacle.

When the powders in a pill are resinous, as is the case with aloes, ext. coloc. co., and pil. asafetid. co., they should be triturated with the oil for a few minutes, and the remaining ingredients, if any, added; then, if too hard, use rectified spirit, or, if too soft, a sufficiency of liquorice and soap. Such addition is not required in the following, where the essential oils are really the excipients.

## INGREDIENTS OF PILLS AND HOW TO MASS THEM III .

Pil. hydrarg Pulv. ext. coloc. co Podophyllin Olei anthem	. gr. iv. . gr. vj. . gr. ½ . mj.	Ext. nucis vom. Creosoti Asafetidæ Pulv. glycyrrh.	gr. ¼ mj. gr. iij. gr. ij.
Fiat pilulæ ij.  Pulv. pil. aloes et ferri Pulv. guaiaci res.  Ol. sabinæ  Fiat pilulæ xxiv.	. 3j. . 3j. . mxv.	Fiat pilula.  Ext. hyosey.  Pulv. pil. coloc. co.  Ol. cajuputi  Fiat pilula.	gr. j. gr. iv. mj.

A little solution of potash is often of great service in a mass containing much essential oil. Its use, however, in the majority of cases is to be deprecated.

Extracts.—These are amongst the most commonly prescribed excipients. When they occur as active ingredients in pills, the quantities are frequently much in excess of what would be required to make powders into pills of reasonable size. One part of extract will mass at least 2 parts of a powder, or more if the powder is largely water-soluble, so that if more than 2 grains of an extract is prescribed in one pill it is often necessary to evaporate carefully on a water-bath, and mass with tragacanth and liquorice as in the case of ergotin.

Ext. Cannabis Indicæ.—When prescribed alone this extract makes a good mass with powdered liquorice. If aqueous extracts are present, a troublesome mass frequently results. The addition of 5 or 10 per cent. of powdered tragacanth and sufficient dispensing syrup answers in many cases.

I.		II.							
Ext. cannabis indicæ Quinin. sulphatis , Ext. hyoscyami . Ft. massa et div. in	gr. iij. gr. xij. gr. xij.	Zinci valer gr. xij. Ext. cannab. ind gr. xij. Ft. pil. Mitte xij. in arg.							

Although both extracts for No. I. were soft, a crumbly unworkable mass resulted. The addition of 1 drop of a mixture of glycerin and spirit (equal parts) acted like magic and gave a splendid mass. Rectified spirit made a very good mass of No. II. Ext. Cascara Sagrada.—Stiffen with tragacanth and liquorice, and varnish the pills. Thus made they keep their shape perfectly.

Ext. Lactucæ.—The following prescription gave unexpected trouble to the compounder:—

Misce et divide in pilulas xxiv.

The pills, although made hard and varnished, were returned soft and adhering to the box; but when rolled in lycopodium and sent out in a bottle almost filled with lycopodium, they did not become soft, although not in this instance varnished.

Ext. Taraxaci.—This preparation is one of the worst extracts in the Pharmacopæia, because it is generally in a state of inc pient fermentation, and merely requires dilution with anything to become quite active, giving strange results, as in the following instance:—

```
Ext. nucis vom. . . . . . . . . . . . gr. iij.
Ext. tarax. . . . . . . . . . . . . . gr. xij.
Ext. aloes aq. . . . . . . . . . . . gr. iij.
Ext. hyoscy. . . . . . . . . . . . . q.s.
```

M. Fiat pil. xij. (in arg.).

The mass was made with liquorice, and the pills split after being silvered, even though varnished. The swelling was no doubt due to evolution of gas from the extract of taraxacum. It may also be noted that extract of taraxacum is generally acid, and the acidity may give rise to peculiar and unexpected changes in a mass. Some powdered tragacanth should be used along with a fibrous powder in massing; the mass should not be made too hard, and the pills should be allowed to stand for half an hour before they are silvered or coated.

Fel Bovinum.—The best excipient is a sufficiency of equal parts of tragacanth and acacia. The ox-gall may be bought in a dried and powdered state. In this condition it is

INGREDIENTS OF PILLS AND HOW TO MASS THEM 113

very convenient, and forms an excellent mass with dec. aloes co. conc.

Ferri Bromidum.—The Société de Pharmacie de Paris recommends a hot strong solution of the bromide to be mixed in a dry warm porcelain mortar with liquorice-powder and gum arabic, in equal parts, sufficient to make a mass. The pills should be rolled in lycopodium or, better, coated with sugar, and preserved in a well-dried bottle.

Ferri Carbonas.—The old-fashioned saccharated carbonate of iron has now been largely displaced through the popularity of Blaud's pills. Five grains of the saccharated carbonate makes a good pill with I grain of theriacanth. The original Blaud's pill was made by heating together sulphate of iron and carbonate of potash in honey, then adding other ingredients, and evaporating to a pilular consistence. It is about twenty years since physicians in this country began to prescribe a similar combination of sulphate of iron with an alkaline carbonate or bicarbonate. To the dispenser it mattered much whether carbonate or bicarbonate was ordered. Thus, with sodium carbonate the reaction is according to the following equation:—

 $FeSO_4$ ,  $7H_2O + Na_2CO_3 = FeCO_3 + Na_2SO_4 + 7H_2O_4$ .

With sodium bicarbonate it is as follows :-

 $FeSO_4$ ,  $7H_2O + 2NaHCO_3 = FeCO_3 + Na_2SO_4 + CO_2 + 8H_2O$ .

In the latter case the freed carbonic-acid gas greatly affects the resulting mass. Either the salts must be allowed to lie until all the gas is expelled (whereby the ferrous salt is much oxidised by exposure) and then massed, or the mass may be made right off, the consequence being that the pills are much larger than they should be, owing to occluded gas. It is apparent also that, owing to the liberation of water of crystallisation, soft excipients are inapplicable. About 1887 the pill had become so popular that the British Pharmaceutical Conference devised a formula which comprised most of the good points brought

forward by dozens of pharmacists from time to time, and in due course the formula was introduced into the British Pharmacopæia. It was improved in the 1898 edition. We append the B.P.C. original and the present B.P. formulæ:—

B.P.C.	B.P.
Ferrous sulphate . 60 gr.	Ferrous sulphate (dried) . 150 gr.
Potassium carbonate . 36 ,,	Dried sodium carbonate . 95 ,,
Sugar, in powder . 12 ,,	Sugar 150 ,,
Tragacanth, in powder 4,,	Tragacanth, in powder . 15,,
Glycerin $2\frac{1}{2}$ min.	Acacia, in powder 50 ,,
Distilled water a sufficient	Glycerin 10 ,,
quantity	Distilled water 20 ,,

The B.P.C. directions were: Reduce the sulphate of iron to fine powder, add the sugar and tragacanth, and mix intimately. Finely powder the carbonate of potassium in another mortar, and thoroughly incorporate with it the glycerin. Transfer this to the mortar containing the sulphate of iron, beat thoroughly until the mass becomes green, add water sufficient to impart a soft pilular consistence, and divide into twenty-four pills.

The B.P. directions for making the pill are: Mix the ferrous sulphate with the sugar, glycerin, and water previously mixed, add the sodium carbonate, mix, set aside for fifteen minutes to complete the reaction, and mass with the gums.

The first edition of this work contained nearly three pages about this pill, as there was much conjecture in the eighties as to what the composition of the mass should be—whether a mixture of ferrous sulphate and alkaline carbonate (as the B.P.C. pill was to some extent), which would form ferrous carbonate in the stomach, or a pill of ferrous carbonate like the B.P. one. The officialising of the pill and settling of the principle now render so much comment unnecessary. The B.P. method is good pharmacy for the dispensing-counter or the laboratory.

Ferri Iodidum.—Blancard's iodide-of-iron pills were formerly prescribed to be made as follows: Combine 4 grammes of iodine with 2 grammes of iron filings in 8 grammes of

water, filter upon 5 grammes of honey, evaporate to 10 grammes, and make into pills with althæa and liquorice. A shorter and equally good method is to stir 2 grammes of iron with 4 grammes of iodine in 4 grammes of distilled water in a porcelain mortar until the brown colour has disappeared. Then add 4 grammes white sugar, 3 grammes althæa, and 7.5 grammes liquorice. Make 100 pills, roll them in talc, and dry in a warm place. The dried pills to be varnished with tolu and ether. At the dispensing-counter the ready-made ferrous iodide is usually employed, in which case powder with its own bulk of sugar of milk and liquorice, and mass with dispensing-syrup. The following is an exceptional prescription:—

Misce et in pilulas triginta dividenda.

First make a mixture of yellow wax 4 parts, powdered curd soap I part, and balsam of tolu I part, by melting in a waterbath. Mix the carbolic acid with 35 grains of this, and mass with the rest of the ingredients previously mixed together. Roll and cut quickly, and coat with French chalk or gelatin.

Ferri Oxalas.—The ferrous salt, as used in photography, is recognised by the United States Pharmacopæia, and is given in doses of 2 to 4 grains in pill. Kaolin ointment makes a good and permanent mass.

Ferri Phosphas.—A good mass is made with glycerin of tragacanth or theriacanth. Phosphoric acid is also used (see page 95). The soluble phosphate (pyrophosphate or citrophospate) is much used in the United States, as in the following:—

Fiat massa et divide in pilulas xl.

Mix the oil and extract with the calcium phosphate, add the iron phosphate, and mass with dispensing-syrup. Lactate and Malate of iron may be massed in the same way as the phosphate.

Ferri Protochloridum.—This is very deliquescent, and may contain a considerable amount of absorbed moisture. The following makes a good pill:—

Ferri protochloridi			gr. ij.
Pulv. sacchari albi			gr. j.
Pulv. tragacanthæ		1	gr. 1/10
Pulv. glycyrrhizæ			gr. j.
Ciat massa			

In cases where the protochloride pill is very moist it should be dried carefully on a water-bath, powdered, and massed quickly with a very small quantity of mucilage of acacia; roll in lycopodium, place in a bottle, and nearly fill up with lycopodium. An ordinary coat of varnish is almost useless for a very deliquescent pill: it is much more important to exclude the air which supplies the moisture.

Ferri et Quininæ Citras.—Good pills, which keep their shape and do not deliquesce, can be made by using resin ointment as an excipient. Even better are lanoline, 3 parts, and water, 1 part, for 30 parts of the citrate. Mix the citrate with the lanoline first. Proof and rectified spirits make a good mass, but in both cases the mass must be rolled out quickly. Avoid glycerin.

Ferri Sulphas.—The granulated sulphate is best for pills; it is generally free from adhering moisture, can be readily reduced to impalpable powder and massed with glycerin of tragacanth with the addition of a little powdered sugar. When 5 grains of the sulphate is prescribed for one pill it is necessary to use the dried salt, of which 3 grains equals 5 grains

of the undried. One peculiarity of the dried sulphate when massed is that the pills are apt to crack:—

This was made into a mass with 4 grains of tragacanth and a little glycerin, but after about three weeks the pills cracked. A mixture of glycerin (1 part) and water (2 parts) makes a much better mass in this case, especially if a few grains of powdered acacia is used along with the tragacanth, and triturated with the iron salt before the other ingredients are added.

A favourite pill of Sir Andrew Clark's :-

Aloin					gr. ss.
Myrrh					gr. ss.
Ext. nucis	vomi	cæ	1		gr. ss.
Ferri sulpha	atis				gr. ss.
Saponis.					gr. ss.

Fiat pilula.

If an aqueous excipient be introduced the soap and sulphate of iron react, forming oleate of iron, and producing a very crumbly mass; but if massed with a drop or so of glycerin and spirit a capital pill results.

Ferrum Redactum.—A gritty, intractable substance. It should be rubbed down to fine powder, a little powdered liquorice added, and a mass made with glycerin of tragacanth or liquid glucose. Extracts should as far as possible be avoided, as they may be sufficiently acid (although they should not be) to react with the iron and develop hydrogen, thus causing the pills to swell. The following was quite intractable to the first dispenser:—

```
Ferri redacti . . . . . . . . . . . . gr. ij.

Ext. nucis vomicæ . . . . . . gr. ss.

Ext. hyoscyami . . . . . . . . . . . gr. j.

Olei carui . . . . . . . . . . . gtt. ‡

Fiat pilula.
```

If dried extracts are used glycerin of tragacanth makes a fair pill, but a better is produced by drying the extract of henbane, mixing the oil with the iron, adding the extracts and a third of a grain of lanoline, and massing.

Gingerinum.—This oleo-resin of ginger may be treated like an essential oil, curd soap and althæa making a good mass. It is less troublesome than essential oils, but in such a combination as the following it is worse:—

Fiat pilula. Mitte xxiv.

Here the gingerin liquefies the thymol. A fair pill is obtained by mixing the gingerin and extracts, separately mixing the rhubarb and thymol, adding to the extract, and beating with a sufficiency of powdered althæa. [Note.—'Gingerinum' is dog-Latin; zingiberis oleo-resina is the proper name of the article.]

Guaiacolum.—This is the principal constituent of creosote, and is obtainable as liquid or crystals. It should be treated exactly like creosote.

Hydrargyri Iodidum Viride.—Mass with half its weight of manna, which gives an excellent pill that does not oxidise.

Hydrargyri Perchloridum.—This should first be rubbed to a fine powder along with twice or three times its weight of sugar of milk, and the other ingredients, except the excipient, added little by little, so that a perfect mixture may be formed. The following form is designed to exhibit the perchloride in a dissolved state:—

Evaporate on water bath that with licorice.



The perchloride being dissolved in the glycerin, perfect distribution is effected. If the perchloride is dissolved in ether and the solution triturated with liquorice powder, the salt is obtained in a very finely divided state, and the powder masses well with glycerin of tragacanth.

Hydrargyri Subchloridum.—A very good mass is made with manna. The following also makes an excellent pill:—

Hydr. subchlor. . . . . . . . . gr. xxiv.

Pulv. tragac. . . . . . gr. ij.

Conf. rosæ canin. . . . . . q.s.

M. Ft. pil. xij.

Hydrargyrum c Cretâ must not be vigorously worked in the pill-mortar, else mercury separates. It masses well with glycerin of tragacanth. If prescribed with powders or pill-masses which can be used in powder, hyd. c cretâ should be carefully triturated with such ingredients first.

Ichthyolum.—Ordinary ichthyol makes a bad pill. When more than 2 grains is ordered in one pill the method recommended on page 416 should be adopted.

Insoluble Salts.—For substances insoluble, or nearly so, in water, and entirely devoid of adhesive property, such as subsalts of bismuth, cerium oxalate, &c., glycerin of tragacanth is the best excipient. In some cases a mixture of equal parts acacia and tragacanth with syrup gives more adhesiveness and excellent results.

Iodum.—Rarely prescribed by itself in pill, but we have met with the following:—

Iodi . . . . . . . gr. ss. Fiat pilulæ sex.

The iodine was triturated in a mortar with a few drops of rectified spirit, 3 grains of kaolin added, and a mass made with kaolin ointment. Pills so made keep better than if glycerin of tragacanth is taken to mass the iodine.

Iridinum.—This resinoid masses easily with glycerin of tragacanth or dispensing-syrup. The following gave difficulty owing to the essential oil reacting in some way with the iridin:—

Iridini				gr. xij.
Olei caryophylli				gtt. iij.
Ext. hyoscyami				gr. vj.

Misce, fiat massa et divide in pilulas sex.

Mix the oil with 6 grains of powdered soap and add the other ingredients; mass smartly.

Lithium Guaiacatum.—This so-called guaiacate of lithia makes a very satisfactory mass with dispensing-syrup. If massed with mucilage the pills crumble to pieces after a few days. If massed with spirit they may be of doubtful solubility.

Lupulin and Camphor are not readily made into a plastic mass by the usual excipients without considerably increasing the size of the pills, but ether very sparingly used yields a good mass without any other addition.

## Menthol.—This behaves like carbolic acid; thus:—

Menthol				gr. j.
Thymol				gr. j.
Ext. belladonnæ				gr. ss.
Pulv. saponis				gr. ij.

Fiat pilula. Mitte tales xxiv.

The first two ingredients liquefy, and an absorbent is required (kieselguhr) with  $\frac{1}{2}$  grain of soap to each pill.

Naphthalinum.—Triturate with its own weight of sugar of milk, and mass with glycerin of tragacanth.

Oleum Crotonis.—Powdered curd soap, with a little glycerin of tragacanth, does well for croton oil. When a dispenser gets a prescription such as the following to compound,

the best plan is to add 2 grains of wheaten flour to each minim of oil, and mass with the confection:—

```
Ol. croton. . . . . . . . . . gtt. v
Conf. rosæ . . . . . . . q.s.
```

The dispenser who got this prescription melted 5 grains of yellow wax in a mortar and added the oil; mixed and added 2 grains of confection, and massed with liquorice. It made a fair mass. But, from what has already been said about wax, such a procedure may result in a pill which will pass through the body unchanged.

**Pepsinum.**—Scale pepsin is not so suitable for pills as the partly insoluble powder. Make a rather soft mass with a mixture of equal parts of glycerin, syrup, and water, and roll quickly. Five grains of pepsin and acid. hydrochlor. dil. mj. make a very good mass. Some combinations give trouble, e.g.:—

I.		II.	
Pepsin. porci (Bullock)	gr. iij.	Pepsin gr. xxxvj	
Acid. carbolic	gr. j.	Ext. aloes gr. xviij.	
Quininæ sulphat Fiat pilula.	gr. ss.	Fiat massa et divide in pilula duodecim.	S

No. I. needs no excipient, as the quinine sulphate and carbolic acid liquefy and mass the pepsin. Mix the sulphate and pepsin in the mortar, add the carbolic acid, mass, and roll quickly. To No. II. add 3 grains of powdered tragacanth and mass with glycerin and water (equal parts).

Phosphorus.—When this is ordered in prescription the simplest method is to dissolve the phosphorus in carbon bisulphide and pour upon a suitable powder, as in the following:—

```
Phosphori . . . . . gr. ij.
Carbon. bisulph. . . . . . . . mx. vel q.s.
```

Solve et adde-

Pulv. saponis dur.			gr. xxxv.
Pulv. guaiaci resin.			gr. xxxv.
Glycerin			gtt. xij.
Pulv. rad. glycyrrh.			gr. xij. vel q.s.

Ut fiat massa gr. c. To be divided into pills of the strength required, and varnished or coated in the ordinary way.

This mass is of good consistence, easily manipulated, and readily soluble. A drop of oil of cloves added to the carbon bisulphide lessens its tendency to inflame. This method is the most expeditious for the dispensing-counter. Another good plan is to rub up some liquorice powder (\frac{1}{2} to 1 grain for each pill) with half its weight of water, pour on it the bisulphide solution, stir well and without pressure, and make into a mass with compound tragacanth powder. The water effectually prevents oxidation of the phosphorus, and the bisulphide is dissipated in massing. The method also serves for the following:—

Quininæ sulphatis...gr.  $\frac{1}{2}$ Ext. nucis vom.....gr.  $\frac{1}{4}$ Phosphori....gr.  $\frac{1}{33}$ 

If one has to make, say, 33 pills, rub the quinine and extract together with 15 grains of powdered liquorice and 5 drops of water. Now dissolve the phosphorus in 5 or 6 drops of bisulphide of carbon in a small test-tube; mix with the other ingredients, and mass quickly with glycerin of tragacanth. The British Pharmacopæia phosphorus pill-mass is fatty, because it is considered that fat preserves the phosphorus from oxidation. The mass is made by dissolving 10 grains of phosphorus in 33 minims of carbon bisulphide, adding the solution to a mixture of lard and white wax, of each 125 grains (previously melted and of the consistency of cream), and working in 115 grains of kaolin. It should be kept under water. Each grain of the mass contains  $\frac{1}{50}$  grain of phosphorus. It is now generally kept ready at the dispensing-counter for use in any combination.

Phosphorus pills should always be varnished or coated with

a solution of wax in ether (1 in 16), and finished off with French chalk.

- Pil. Coloc. Co. as now made with resin of scammony invariably flattens. This is prevented to some extent by adding from 10 to 20 drops of potash solution to the ounce of mass or by substituting soap for the sulphate of potash. The addition of a fibrous powder such as liquorice gives durability to the mass.
- Pil. Hydrargyri.—When this is prescribed with a soft extract the latter should, if possible, be dried or used in powder.
- Pil. Hydrarg. Subchlor. Co., with pill-masses having an aqueous excipient, invariably forms a crumbly combination; this is remedied by omitting the castor oil from the Plummer's pill.
- Pix Liquida.—Add a little wax (1 to 5), heat, and mass with wheaten flour or any fibrous powder.

Potassii Acetas.—This salt is rarely given in pill-form. It makes a good mass with boro-tartrate of potash—a scale compound consisting of 1 part of borax and 4 parts of cream of tartar. For example, acetate of potash 18 parts, boro-tartrate of potash 3 parts, and water 1 part, can be made into pills without much difficulty. Keep in well-corked bottles.

Potassii Iodidum.—Rub the salt in a mortar with a few drops of water into a stiff smooth paste, and mass with a little liquorice powder; in this way 6 grains may be easily got into a fair-sized pill. Tragacanth and water alone make a good mass. A pill containing this iodide and a considerable quantity of extract of colchicum was ordered, and although carefully dried extract was used, the mass proved to be too soft. As the pills were not required till next day they were placed under a bell jar (a mortar upside down), with sulphuric acid. This proved a success, and has often been found useful with an otherwise refractory pill.

Potassii Permanganas.—Some years ago the proposal to administer this highly oxidising compound in pill form for certain female complaints brought out a number of suggestions as to the manner in which the permanganate should be made into pill. Obviously no substance which is readily oxidised, such as extract of gentian or glycerin of tragacanth amongst common pill excipients, should be used. The excipient must be a substance which is practically unoxidisable, and such we have in various fats and earths. For example, resin ointment, I part, and permanganate of potash, 4 parts, make a good mass, but if kept for some time it disintegrates with great difficulty. Mr. Martindale at first used vaseline, then a mixture of vaseline and paraffin, but the mass wanted firmness; then he added kaolin, which gave it the desired firmness, and from this was evolved kaolin ointment, now a regular stock excipient. Mr. Martindale recommends the pills to be coated with sandarach varnish, but this is questionable advice, for the alcohol penetrates the pill, and is oxidised by a portion of the permanganate. It is better to give the pills a thin coating with a solution of white wax or paraffin in benzene, afterwards finishing off with French chalk.

The following prescriptions have to be treated on the principles laid down in the foregoing:—

	I.			II.
Ferri mangan.			3j.	Potass. permang gr. j.
Ferri oxid			3j.	Ext. nucis vom gr. $\frac{1}{4}$
Cinchonin. mur.			3iss.	Fiat pilula. Mitte xxiv.
Ft. pil. 48. S	ilver			

For No. I. make a mixture of paraffin and vaseline, of each  $\frac{1}{2}$  drachm, and to this add the cinchonidine previously rubbed down fine, then add the manganate and oxide of iron, both in fine powder, and stiffen with a little kaolin if necessary. In the case of No. II. rub the extract with 12 grains of fullers' earth, and the permanganate with 6 grains and the same of vaseline; mix the two, and mass with resin ointment.

Quininæ Sulphas.—The simplest excipient is glycerin of tragacanth, or 5 per cent. of tragacanth well mixed forms a very good mass with simple syrup; a little glycerin may be added if the pills are to be kept long. The use of extract of gentian or other dark-coloured excipients is objectionable, as it is now universally recognised that white substances should be formed into white pill-masses. For this reason strong sulphuric acid alone is now extensively used as an excipient, I drop being sufficient for 4 grains of quinine; mass quickly and roll in French chalk or finely sifted arrowroot.

An excellent mass is made with tartaric acid and a little glycerin and water. For a dozen 5-grain pills take 6 grains of tartaric acid and rub it up with the quinine until it becomes crumbly, then add 2 drops each of glycerin and water, and mass quickly. Some object to tartaric acid because it alters the chemical constitution of the quinine salt, sulphotartrate being formed, but this is therapeutically the same as the sulphate.

The dispenser must use his judgment as to what may be the best excipient in unusual cases. Take, for example, such a prescription as the following:—

```
Quin. sulph. . . . . . . gr. iss. Picis liquid. . . . . . gr. iij.
```

M. Ft. pil. j. sec. art. Mitte xx., j. ter die.

In this case an inert powder, such as lycopodium or liquorice, adds too greatly to the bulk of the pill. If melted with a fifth of its weight of wax, the tar becomes more tractable, and masses well with calcium phosphate.

Resinous Ingredients in Pills.—Gum resins and resins must be first rubbed to a fine powder, and, to prevent them sticking to the mortar, the latter and the pestle may be first rubbed with paper soaked in almond oil. The resinous powder is easily made into a mass with a few drops of spirit, but the pills so made do not keep their shape. To most of such substances, aloes especially, the addition of a little vegetable powder or scraped blotting-paper is advisable. Asafetida

yields pills of good consistence with a few drops of weak spirit; but such an addition with aloes produces pills which flatten. Spirit should be added very cautiously, as it is often found, especially when any soap is present, that on working the mass becomes softer than it at first appears. Mucilage of acacia is a much safer excipient than spirit.

If spirit is used the main thing to be observed is not to add too much of it. The mass, for example, should never be made so soft as those massed with ordinary excipients, but should, on the contrary, be so hard as to roll only with some degree of pressure. If this be attended to they will not fall. Where, however, the pills require to be kept for a length of time, some less drying excipient should be used. In all cases where pills are composed mainly of resins, too much friction with the rounder in finishing them should be avoided. We have had occasion frequently to observe the peculiar effect which sharp friction (probably from the heat developed) produces on various resinous substances in the way of changing their physical properties, and in many instances the cause of pills falling is due as much to the friction used in rounding them with the finisher as to the excipient used.

It is convenient to treat here a few examples of pills containing terebinthinous ingredients. The first of these is Dr. Clay's noted Chian turpentine pills, of which the formula is—

Mass in a warm mortar, and divide into thirty pills.

This goes all right, but the addition of 15 grains of lycopodium is an improvement.

	1.			II.	
Pulv. resinæ			žiij.	Cupric sulphate	gr.
Pulv. acaciæ			žj.	Cayenne pepper 1	gr.
Spt. tenuior.			ziij.	Hydrastin	
Fiat massa, A non-falling			Oil of copaiba  Venice turpentine Calcined magnesia  Make a pill. Send 144.	suffi-	

No. II. is a peculiar prescription. The best plan is to mix all the ingredients with 80 grains of calcined magnesia and 10 grains of Venice turpentine, and allow to stand for twelve hours, or even longer, when the mass becomes hard enough to mould into pills. The presence of much Venice turpentine keeps the mass soft, and the pills fall considerably.

Rhei Pulvis.—Use proof spirit or tincture of rhubarb (mj. to 3 gr.); a *soft* mass should be made and rolled quickly, otherwise it is troublesome. Only twenty-four pills should be made at once, or the mass assumes a leathery condition, and has to be thrown away.

I.	II.
Pulv. rhei gr. xxiv.  Tr. zingib. fort q.s.  Fiat massa et div. in pil. vj.  Use 6 drops of tincture and 2 drops of water.	Pulv. rhei

Rhubarb is, like many other substances, one for which each dispenser has his own excipient, as may be judged from the following recommendations by skilled pharmacists:—

(1) Simple syrup is better than either spirit or water for massing powdered rhubarb.

(2) Use a mixture of equal parts of glycerin and tincture

of rhubarb (mj. to 3 gr.).

(3) For powdered rhubarb, a mixture of glycerin 2 parts, rectified spirit 1 part, answers well.

(4) Powdered rhubarb makes a good mass with one-fifth its

weight of glycerin.

(5) Treacle is the most valuable excipient for powdered rhubarb.

(6) One of the best excipients is glycerin and rectified spirit, equal parts.

For the following pills glucose syrup gives a mass which does not crumble in rolling:—

With watery excipients there is much worry in this case.

Salol.—Masses well with glucanth, but the excipient must be adapted to the combination, e.g.:—

	I.				II.		
Salol			ъj.	Salol			gr. iiss.
Pancreatin.			Ðj.	Acid. carbol.			gr. j.
Capsicin			mxv.	Ext. nucis vom.			gr. ss.
M. Ft. pil.	XX.			Ext. opii .			gr. ss.
				Fiat pil. Mit	te xx	iv.	

No. I. masses nicely with mucilage of acacia and a little rectified spirit, the latter being required to keep down the size of the pill. For No. II. melt 20 grains of gelatin base and add the phenol and salol, pour on the extracts previously thinned with a little glycerin and water, and mix quickly; allow to stand for some time, and stiffen with liquorice and tragacanth.

Sodii Bicarbonas.—Three grains of dry bicarbonate of sodium with I grain of powdered ginger can be made into a very workable mass by the addition of I grain of tragacanth, and water or mucilage sufficient to make a mass. The pills both roll well and keep well.

Sodii Nitris.—Occasionally ordered in pill. Care should be taken not to use any acid excipient, else nitrous fumes will be liberated; even extract of gentian has done this, the pills swelling and cracking. Kaolin ointment is the best excipient.

Sodii Sulphidum.—Treat exactly like calcium sulphide, but in such a case as the following resin ointment is the best excipient:—

Sodii sulphidi				gr. xxiv.
Acidi salicylici				gr. xxiv.
Pulv. capsici				gr. xij.
Pulv. ipecacuanha	e			gr. vj.
Ext. aloes .				gr. xij.
Ext. gentianæ				q.s.

Omit the extract of gentian, as any moisture will make the salicylic acid react with the sulphide, liberating sulphuretted hydrogen; hence the use of a fatty excipient.

Sodii Taurocholas.—This substance is so deliquescent that it may be massed by simply beating in a mortar with the smallest possible quantity of proof spirit. The pills are coated with melted salol or keratin solution.

Sulphonal.—Masses well with glycerin of tragacanth, but pills are the worst possible form for administering this hypnotic.

Thymol.—May be treated like menthol.

Zinci Oxidum.—Makes a good mass with dispensingsyrup.

Zinci Phosphidum.—Triturate well with sugar of milk (½ grain for each pill) and mass with glycerin of tragacanth.

Zinci Valerianas.—Add a small quantity of acacia, and mass with spirit. This gives a mass requiring quick manipulation, but yielding excellent results. Glycerin of tragacanth also makes a good mass with the addition of a little inert vegetable powder. For behaviour of the valerianate with caffeine citrate, see page 103.

· I.			II.	
Zinci valerianatis Creosoti (Morson) Fiat pilula.		gr. iij. mj.	Zinci valerianatis .  Extracti aloes .  Ferri arsenatis .  Ext. cannabis ind.	gr. xxiv. gr. iv. gr. ij.
			Fiat pilulas xxiv.	

No. I. is softish on mixing, but gets firmer on standing, and only requires kieselguhr to mass it. No. II. makes a nice mass with proof spirit.

By intelligent application of the principles involved in the foregoing paragraphs dispensers should be able to overcome difficulties in connection with allied substances.

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# FINISHING AND COATING PILLS.

THE massing of the ingredients constitutes the more important part of pillmaking, and the rest reflects the dispenser's manipulative dexterity. The work of rolling, cutting, and rounding is not arduous, and it is unnecessary to describe these operations in detail, for deftness in respect to them can only be acquired by practice; but a few hints to students of pharmacy will not be out of place.

A pill-mass is not finished until it is perfectly uniform in appearance. The best mass is one which comes out of the

mortar leaving little on the mortar and pestle.

Weigh the mass as soon as it is ready for rolling. This is a good check, and is necessary when the mass is to be divided into more than the number of pills which the machine cuts at a time.

See that the bed of the pill-machine, the roller, and cutters are free from adhering pill-mass, which is detrimental to a good finish.

In rolling, reverse the pipe two or three times, so that the left side may not be thicker or thinner than the right side. (Few people have a left arm as powerful as the right, hence greater pressure is exerted with the latter.)

The pipe should be exactly of the length to cover the number of grooves required. The ends should not be within

the last cutting edges but slightly upon them.

Avoid French chalk alone in rolling, and use as little powder

as possible. (A pepper-caster is best for sprinkling.)

The cutters should be free from jagged edges and not blunt. The finish greatly depends upon this condition.

Try to round the pills as much as possible during the cutting process by using the cutter gently and at moderate speed.

Check the result by putting the two pills at the left end of the lot on one scale-pan, and the two from the right end on the other scale-pan. Also count the pills.

In finishing with the rounder, press gently and turn as if making the figure 8, but do not reverse the turning.

Pills containing much resinous matter should not be subjected to great friction. Pills otherwise perfect sometimes acquire their falling faculty in the rounding process, owing to friction working changes.

The lid of a  $\frac{1}{2}$ -ounce chip box furnishes a fair makeshift pill-rounder.

Use the minimum of sprinkling-powder. An excess, especially of fluffy vegetable powder, may provide the patient with a distressing insufflation as well as a pill.

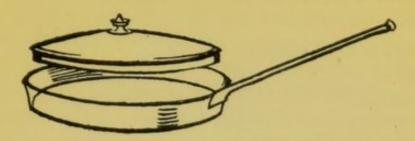
Never silver pills unless so ordered, but varnish as often as permissible and possible. Pills containing deliquescent substances should invariably be varnished.

# VARNISHING PILLS.

The pills should be thoroughly well rounded and free from powder. Ensure the latter by shaking them on a muslin sieve (page 168). Place in a covered pot a few drops of the varnish, sufficient to wet all the pills, drop the pills in, and rotate the pot so as to cover all the pills equally. The pills are then transferred to an earthenware developing-dish, so that they may be detached from each other, and occasionally turned until the coating is quite hard.

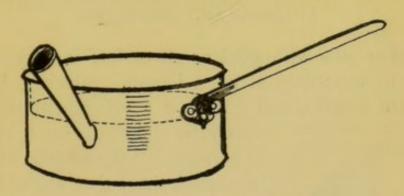
To give the varnished pills a bright polish, they may be transferred from the covered pot to a brass pill-finisher, such as the one devised by Mr. F. W. Goodess, of Leicester (*The Chemist and Druggist*, xlv. page 640). This is a tiny warmingpan 6 inches in diameter and 2 inches deep, with a spout, and fitted with hinged lid and handle. It should be made of

copper, tin-lined. Immediately on transferring the wet varnished pills to the finisher, the latter is rotated quickly over a Bunsen or spirit-lamp flame (the heat being adapted to the kind of



THE GOODESS PILL-POLISHER.

pill), and in a minute or so the pills dry with a bright polish. A good and cheap drier for pills is made by soldering a shallow porcelain evaporating-dish into a small tin pan with side tube for pouring in water and letting off steam, and provided with



WATER-BATH PILL-DRIER.

a handle. Water is put in the pan, and brought to the boil, while the mass is being rolled and made, and the varnished pills transferred to the dish and gently shaken to dispel solvent. The following are the best varnishes:—

I.	II.					
Tolu-syrup residues zj. Ether (meth.) ziij.	Balsam of tolu (old) 3ss. Gum sandarch 3v.					
Dissolve and filter or decant after standing.	Ether					

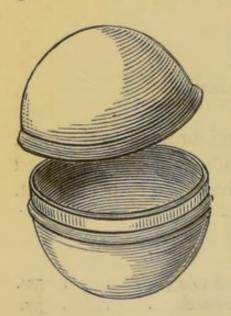
the ether to half.]

III. JOHN BELL & CO.'S FORMULA.	v.
Sandarach	Sandarach
Dissolve.	VI.
IV. SQUIRE & SONS' FORMULA.	Mastic 5 parts
Sandarach	Basalm of tolu 15 parts
Absolute alcohol 3vj.	Absolute alcohol 25 parts
Ether	Ether 80 parts
Dissolve.	All by weight. Dissolve.

The varnishes containing ether are the quickest driers. Mr. W. Martindale's varnish is like No. V., but has absolute alcohol I ounce by weight.

### GILDING AND SILVERING.

Covering pills with gold or silver leaf is a process which need not be described at great length. Silvering has largely gone out of fashion, and gilding is a refinement of pharmacy



which the chemist is rarely called upon to perform. Like all pills which are to be coated, those that are to be silvered should be of firm consistence, and all powder should be carefully removed from them after rolling and cutting.

Pills in which there is asafetida, or any ingredient containing sulphur or sulphides, should be stiff, and must be varnished before they are silvered, otherwise the metal will blacken after a few days. A covered pot may be used to silver the pills, or even a

2-ounce chip box, but the boxwood silverer represented in the above cut is generally employed. The form of silverer with a foot to it is handier. Many experienced dispensers prefer the covered-pot arrangement, and use two pots—one for silvering,

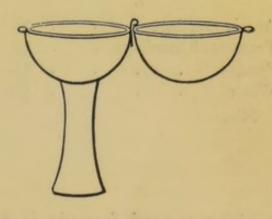
the other for polishing or for applying thin mucilage before silvering.

If the pills have been varnished with tolu or other varnish, the surface should not be allowed to dry hard before the silver is applied. In these cases use an alcoholic varnish, which dries more slowly than ether. One drop of weak mucilage is sufficient to damp a dozen 5-grain pills. Put it in a pot and spread out, drop in the pills, and rotate until all are smeared. Note that the pills should have a dull, not a glistening, appearance when they are ready for silvering. The wetter the pills are, the more silver leaf is required, and the finish is not so good. A single leaf of silver coats half-a-dozen 5-grain pills. Put a leaf in the coater, drop in six pills, another leaf, more pills, and so on. Cover and rotate briskly. To give them a bright polish transfer to the 'Goodess' finisher and rotate over a Bunsen flame. Gold leaf is used in the same way.

### PEARL-COATING.

This is the method of coating pills which is done by making the pill-powder, French chalk, adhere to form a cemented layer on the surface of the pills. Full particulars

are given in the 'Art of Pharmacy' ('The Chemists' and Druggists' Diary, 1898') in regard to coating pills on the large scale. A similar process is used at the dispensing-counter. The apparatus employed is a tinglobe copper-lined, about  $5\frac{1}{2}$  inches diameter, intersected



in the middle, the two sections being fixed with two brass pins. This arrangement permits of the apparatus being easily taken to pieces and thoroughly cleansed. In practice, two globes are generally sufficient (one is figured above)—namely, one to coat and one to burnish the pills; but if a very high finish is

required, a third is necessary to polish the pills. This is done by thinly coating the warmed globe with hard paraffin. The pills, after passing the second globe, are transferred to the waxed globe, and slowly rotated for a time in it. This gives them a brighter, more uniform, and probably, also, a more permanent coating. Many dispensers succeed in coating pills by using covered pots or tins as coaters.

The coating solutions which are recommended vary in composition, but a good one is made by mixing I drachm mucilage of acacia, I drachm simple syrup, and sufficient water to make I ounce. Of this mixture pour sufficient upon the pills to damp the surface thoroughly—the exact quantity can only be determined by experience, but a dozen 5-grain pills require not more than 2 drops—and after rotating in the coater in order to distribute the gum-mixture uniformly over the surface, transfer to the French-chalk tin, and rotate uniformly until the chalk has all been taken up or the pills are thoroughly coated. If too little chalk has been used, or too much mucilage, more chalk has to be added from time to time until the coating is uniform.

The following are other formulæ for moistening-solutions:—

	I.			II.	
Acacia mucile Tragacanth n Syrup Water	nucilage	 	3j. 3j. 3j. 3iv.	Rectified spirit 3s  Mix and add—	ss. ss. vij.
Mix.				Shake and add—	ss.

The second formula is Mr. Martindale's, who advocates the three covered-pots method. Mr. E. W. Lucas recommends a mixture of acacia mucilage and syrup, 2 ounces each, and sandarach varnish, ½ ounce.

Fine French chalk is used for coating, and it is much improved by having 3 per cent. of light carbonate of magnesia

added to it. This mixture should be well sifted through a lawn sieve several times. The carbonate of magnesia is beneficial because the gastric acid acts upon it, and thus aids in disintegrating the coating. The coating-powder may be sweetened by the addition of 1 ounce of powdered sugar or 5 grains of saccharin to each pound. Obviously the secret of a thin coating is the use of as little mucilage as possible, just as in coating with silver. After a uniform coating has been imparted, the pills are transferred to a clean coater, and rapidly rotated in order to give them a polish.

The following process has been specially recommended for use at the dispensing-counter. It turns out a finished pearl-coated pill in a few minutes. Shake the pills in a covered pot with sandarach-and-ether varnish (page 133) and throw into very fine French chalk, rotate for a minute, and separate excess of powder by sifting. Shake the pills in another pot with a mixture of equal parts of whipped white of egg (strained), syrup, and water, sufficient to thoroughly wet the pills, and throw them into excess of very fine French chalk, shake for a minute, remove the pills to a flat marble slab, and rotate very lightly under a pill-finisher, sprinkling on a very little chalk until a smooth surface is produced. If time permits they should be exposed to the air in a tray to dry thoroughly.

Various forms of mechanical apparatus are obtainable, such

as the 'Niblett.'

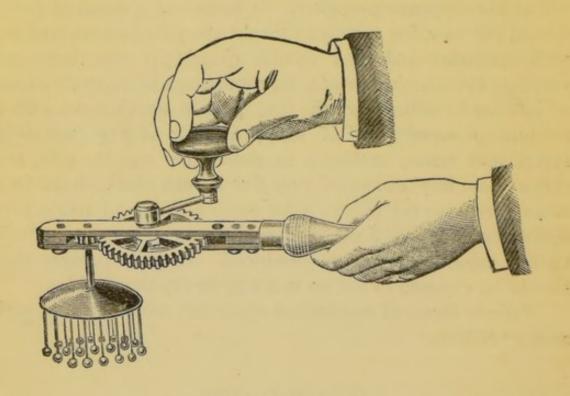
# GELATIN-COATING.

Gelatin coating is the most soluble of all, and is now easy of application on account of the simple apparatus which is obtainable for doing the job expeditiously. The gelatin coating has the advantage of being transparent, so that the colour of the pill is seen, and the coating is more quickly imparted than any other.

In the absence of better apparatus we have used the following simple coating device with good results. If, say, three dozen pills are to be coated, take three soda-water corks,

and stick into one end of each the eye-ends of a dozen needles at an angle of 45°; then place a pill on each of the needles. The pills are now ready to receive the coating. Having melted the coating-solution on a water-bath, dip the 'corkful' of pills into it, withdraw, allow the drops of superfluous gelatin to form, and remove them by allowing the pills to just touch the surface of the liquid, then twirl the cork between the forefingers for a few seconds, and set aside to harden.

A convenient and simple apparatus for dispensing-counter work is that devised by Mr. James Cocks, Plymouth, which is now only made to order. It will be seen from the figure that



this consists of a disc (fitted with needles) which is rotated by means of the cogged wheel actuated by a handle. The points to be observed in gelatin-coating are:—

(1) An expeditious arrangement for affixing and removing the pills from the needles, so as to avoid touching them with the fingers. A pill-tray with as many holes in it as there are needles, and each hole opposite a needle, is used for charging the needles. For removing the pills a plate which slides between the disc and the needle-points is the best idea, and is

provided in the 'Unique' coater (see 'The Chemists' and Druggists' Diary, 1898,' page 498).

(2) The coating-solution should be kept as limpid as possible without heating much above 150° F. This is to ensure a thin coating. Coating-solutions are either made of (1) gelatin, (2) acacia and gelatin, or (3) acacia. The second kind is that generally adopted, and the following are formulæ for it:—

	Patch's	Thompson's		Cocks's
Gelatin	žiiss.	živ.		žiiss.
Boric acid .	3ij.	5ij.		-
Acacia mucilage	ъij.	. <u>3</u> j.		ξij.
Distilled water .	ξvij.	žxl.	sat. sol. boric acid	ξvij.

Soak the gelatin in the water until soft, heat on a water-bath until dissolved, add the mucilage, and mix.

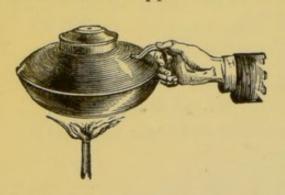
The mucilage should be made by dissolving 4 ounces of gum ('flaked' or Trieste picked grain) in 7½ ounces of water.

- (3) Allow the pills to dip completely in the solution, withdraw from the solution slowly (so that superfluous coating may be removed by capillary attraction), and when out, if drops form, touch the surface of the solution with the drops. Finally, turn upside down and allow to dry.
- (4) Most gelatin pill-coating machines provide for rotation of the pills after they are dipped. Pill-manufacturers allow the pills to remain at rest at a temperature of 80° F. The object of rotation is to dry quickly, and it is a substitute for rest at a higher than normal temperature. The pills should be removed from the needles as soon as the surface is hard, and before the inner layer of the coating hardens, so that the hole may close with the soft solution and thus exclude air.

On the manufacturing scale in the United States gelatincoating is done with machines which have tubes where are needles in the apparatus here described; these tubes terminate in a shallow box connected with a suction-machine, and the pills are thus picked up by atmospheric pressure. One half of each pill is first coated and dried, then the other half.

### SUGAR-COATING.

This kind of coating has become popular, but the operation is somewhat difficult to perform on a small scale. Dr. Symes states that with practice it may be successfully carried out by the following process: Pills well dried on the surface are placed in a tinned-copper bowl, such as is represented in the illus-



tration, with a flat bottom, or an enamelled-iron dish, the surface of which has been moistened with syrup, or syrup and gum. They are then rotated and gently heated, very finely powdered sugar being dusted on, and the motion kept up till a perfectly

dry, hard, and whitish coating is obtained, the operation being repeated if necessary. The first attempt is generally a failure, but practice is the only secret. The following methods have also been proposed:—

Albumen and Sugar.—Pills sufficiently firm and dry should be rolled between the finger and thumb with enough white of egg to give them a thin coating. They should then be placed with finely powdered white sugar in a suitable vessel and rotated. The coating looks well and has a pleasant taste.

French Chalk and Sugar.—The pills are moistened with syrup or mucilage, or a mixture of the two, by shaking in a covered pot. They are then transferred to a box containing powdered French chalk or a mixture of French chalk and sugar, and are well shaken, and again transferred to a warm pill-tray and kept rapidly rotating until dry and smooth. The operation takes but little time.

The dispenser should not, however, expect to turn out pills with a sugar coating so elegant in appearance as that which is exhibited by commercial sugar-coated pills. The coating on these is done by the art of confectionery, and on the large scale consists in giving the pills successive coatings of a starch-and-

sugar syrup, beginning with a thin one and ending with a thick. The apparatus used is a revolving spherical pan, heated by a coil of steam-pipe, which envelops the wider circumference of the pan. When the pan has reached the proper degree of heat some pills are put into it and allowed to revolve for a minute; then a syrup, consisting of 11 pound of sugar and 1 drachm of starch dissolved in 20 ounces of water, is poured into the pan dexterously, so that it may land on a part where the pills are not and yet have time to be smeared on the side before the pills land there. The pan has an eccentric motion, so that the pills are not driven round and round the pan continuously, but from one part of the pan to another, with a noise which reminds one of the intermittent 'hush' of shingle moved on a beach by the tide. A thin coating is thus imparted to the pills, and for success they should, as soon as this coating has a finished but dull-white appearance, be transferred to another pan where they get a coating of a somewhat thinner syrup, and, finally, to a third where a syrup (2 pounds of sugar to 20 ounces of water) is applied. After this they are polished in a perfectly clean and smooth pan, or in a special polisher consisting of a cylinder whose circumferential wall is made of bolting-cloth, and which is provided with means for rapid rotation.

### KERATIN-COATING.

This is intended to protect pills so that they may pass the stomach undissolved, the keratin being insoluble in the gastric juice, but soluble in the alkaline contents of the intestines. Only fatty excipients (such as kaolin ointment) should be used in massing, and the pills should be covered with a thin layer of cocoa-butter previous to applying the keratin solution. This solution is made from horn shavings, which are first macerated in ether to remove fat, then dried. Next the shavings are digested for several days in a solution of pepsin 4 parts, hydrochloric acid 1 part, and water 95 parts. All that remains undigested is washed, and dissolved in solution of ammonia or acetic acid, and evaporated until only a trace of the solvent is

left. The gum-like liquid which remains is the coating-solution, and several thin coats of this are imparted to the pills. The process is troublesome, and not a success, as the coating becomes sticky and nasty.

Salol-coating has been suggested to take the place of keratin-coating as being less troublesome and quite as effective. The coating is applied as follows: Take the 'Goodess' pillfinisher and sprinkle in it a scruple of salol for every two dozen 5-grain pills to be coated; heat carefully over the flame. moving the finisher all the time, until the bottom of the pan is wholly covered with melted salol. Now put in the pills and rotate until they are evenly coated with the melted salol. Transfer quickly to a photographic developing-dish which has had the chill taken off it, keep the pills rolling in this pan for a minute or so, when the coating becomes hard, glassylooking, and greyish-white when cold. It should be thin, but if too thick a coating happens to have been applied, clean out the 'Goodess' finisher, put the pills into it, warm, and keep the pills moving until the coating melts; then finish as before. As the coating is apt to chip off, the pills should be dispensed in boxes, the layers being separated by cotton wool. Salolcoated pills are taken one hour after food. The mass must not be of a fatty nature, as fats dissolve salol. Compare also the Phenol Table, page 97.

# CONCENTRIC-COATED PILLS.

These were proposed by the late Dr. Mortimer Granville, and the following formula will show what they are and how prepared:—

Fiat pilulæ xij.

Make the aloin into a stiff mass with as little excipient as possible; cut into pills and coat with gelatin (hard). Then roll

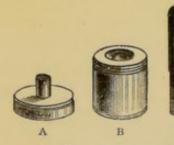
each pill in 2 grains of extract of cascara sagrada, and coat with keratin solution (two coatings); finally make the iridin into a mass, divide into twelve portions, and roll each portion round a pill; varnish or coat with gelatin. The iridin portion of the pill is supposed to dissolve in the stomach, where it is most wanted; the keratin coating dissolves only when it reaches the duodenum; and the barbaloin portion begins to dissolve in the intestines, where its action is manifested. [This method of pill-making has not caught on, but the description is worth retaining because it is an ingenious way of making incompatibles into pills, as already explained. See page 109.]

# TABLETS, LOZENGES, AND PASTILLES.

THESE articles more or less resemble each other, especially in respect to the fact that they are generally the product of the manufacturing chemist, and few physicians prescribe remedies to be compounded in any of the forms, as they usually expect them to be ready-made. Nevertheless, all competent dispensers should be able to prepare them at a moment's notice. Several forms of medication go under the name

### Tabellæ or Tablets.

For convenience they may be divided into three classes—
(1) tablets made by compression; (2) tablets made by moulding without compression, commonly called tablet-triturates; and (3) tablets made from a chocolate basis, as provided by the British Pharmacopæia. Apparatus for the production of



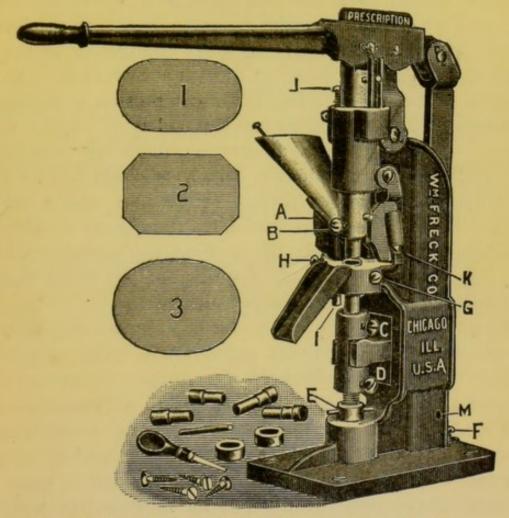
Compressed Tablets work by (1) percussion or (2) pressure. The former requires the simpler form of mould, and is here illustrated. A is the lower die, B the compressing cylinder, and c the plunger, which is put into the cylinder

and given one sharp and heavy blow with a mallet, whereby the powder previously placed in the cylinder is moulded into a tablet by percussion.

Moulds of the second type are true compressors, and are of two classes—viz., (1) long lever and (2) power. Of the

first of these, the 'Freck' is a good example It is important that the dies be sharp and smooth, for upon that the finish of the tablets largely depends.

Of the many kinds of machines which are offered for making compressed tablets, the 'Freck' is one which has been



THE 'FRECK' PRESCRIPTION TABLET-MACHINE.

A, the feeder which contains the powder and fills the dies; B, set-screw which holds the upper compressor; C, set-screw which holds the lower compressor; D, set-screw which prevents the regulator from moving; E, regulator for making various thicknesses or weights of tablets; F, adjusting-screw for stopping the lower compressor even with the surface of the die; G, set-screw which holds the die; H, set-screw for pin, I, which swings the feeder, A; K is the point which holds the feeder to the surface of machine, and brings the feeder back automatically out of the way when compressor is descending; L, screw to stop lever-handle at a certain distance, and so give uniform hardness; M is a hole into which a pin is inserted when the handle is raised to its highest point to put it out of gear.

received with considerable favour in this country. The one here illustrated makes anything from a grain tablet  $\frac{3}{16}$  inch diameter to a compressed lozenge  $\frac{3}{4}$  inch diameter, and is suitable for dispensing-work and for making stock supplies,

It occupies an area 5½ inches by 8 inches, and the lever is of such length that each pound of pressure upon it is multiplied to 12 pounds on the die. The apparatus is worked thus: The powder to be made into tablets is put into the feeder, the feeder moved over the die, which is filled automatically, the feeder is moved back, the lever brought down with a steady firm pull, whereby the powder is compressed, then the lever is raised and at the same time the lower compressor in the die is raised, bringing the tablet to the surface, whence it is discharged by the feeder. The lower compressor is adjustable, by means of the screw E, for making tablets of various thicknesses. The figures on the illustration sufficiently indicate the dies and compressor-cylinders which are supplied so as to make tablets of various shapes. Nos. 1, 2, and 3 are the lozenge-shapes. These are useful, for there is no simpler way of making lozenges than by this method, the ingredients being first granulated and dried (as described below) and a weighed portion being put into the feeder as indicated.

Chemical salts which are to be compressed should be in the granular form; ordinary powders are quite unsuitable. English chemical-manufacturers now supply the proper form of material. The same remark applies to all powders—they must be granular. On the dispensing scale a considerable amount of 'faking' is necessary in making tablets of pure substances. Thus, an excipient must be added to make the powders adhere, and the dry powder must be sprayed with heavy petroleum oil or a solution of vaseline in ether (gr. x. to \(\frac{z}{3}\)j.) immediately before compression. The latter treatment prevents the formation of a clear solution of the tablets in distilled water. The subjoined formulæ by Edel show the requisite treatment:—

### FOR DOSES OF A FEW GRAINS.

Example.

Phenacetin .				500 gr.
Powdered sugar			70.5	50 gr.

Reduce the phenacetin to fine powder, and mix. Moisten with a few drops of syrup and a sufficiency of water. Pass through a No. 20

sieve, dry, and again sift. Spray the powder with 20 to 30 drops of vaseline solution, and make 100 tablets.

In the same manner the following are made:-

Acetanilide Antipyrin Bismuth salts Choralamide Salicin Salol Sulphonal

SMALL TABLETS OF FRACTIONAL GRAIN DOSES.

### Example.

Mix thoroughly, add 4 or 5 drops of simple syrup, then moisten with water, and pass through a No. 20 sieve. Dry. Lubricate the granular powder by spraying 10 drops of vaseline solution over it, and make into 100 tablets.

In the same manner may be made tablets of the undermentioned remedies, adjusting the weight of sugar of milk taken to the dose of the medicine. Thus, if aloin tablets gr. j. are to be made, only 50 gr. of sugar of milk is required for the 100 tablets.

Aloin
Arsenious acid
Caffeine
Codeine
Digitalin
Ext. of nux vomica

Mercurous chloride Mercurous iodide Morphine hydrochloride Podophyllin Strychnine

These are simple forms. Many substances require no addition, this being especially true of the granular salts; but even in these cases the addition of 2 to 5 grains of finely-powdered French chalk to the powder for 100 tablets is an advantage, the mixture being well sifted. Disintegrating tablets are obtained by adding 2 to 4 grains of powdered arrowroot to each ounce of material. On the other hand, tablets required to dissolve slowly should have 5 per cent. of powdered acacia mixed with the powdered substance before damping and granulating.

Hypodermic tablets are made with a basis of granulated sodium sulphate or sugar of milk, the former being the

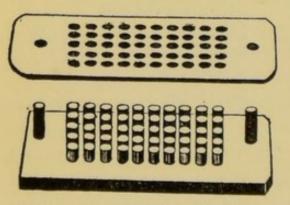
better. Sodium acetate is used for diluting morphine acetate. The powder for each tablet should be weighed.

A mixture of cocoa powder and sugar of milk has been suggested by Mr. Stewart Hardwick as a tablet-vehicle. He gives this general formula:—

Medicament.				as	ordered
Cocoa powder				1	gr.
Sugar of milk			te	0 2	gr.

This is for one tablet. The cocoa powder prevents the tablet sticking to the mould. One or two minim doses of tinctures should be added to the sugar of milk, evaporated over a water-bath, stirring all the time; when dry, add the cocoa powder, rub lightly in a mortar, and compress.

Tablet-triturates, or moulded tablets, are made with sugar of milk by means of an apparatus consisting of a flat plate of vulcanite having holes bored into it, which fits upon another vulcanite plate upon which are as many pro-



TABLET-TRITURATE MOULD.

jections as holes, and these projections push out the tablets from the holes. Each tablet generally weighs a fraction over a grain, but the weight of the tablets formed by the mould is determined by making powdered sugar of milk into a paste with proof spirit. The paste should have such a consistency

that it will just spread with a spatula. The mould is filled with the paste, the tablets pressed out, dried, and their weight taken. From this the weight of sugar of milk required for the desired number of tablets is calculated, a portion, equal to the bulk of the medicament to be added, being deducted. The medicament is triturated thoroughly with the sugar of milk, made into a stiff paste with proof spirit, and moulded as above directed.

Official Tabellæ.—Trinitrin tablets are the only official example of this form of medication, and they are described as 'tablets of chocolate each weighing five grains (0.324 gramme) and containing one-hundredth of a grain (0.00065 gramme) of the trinitroglycerin of commerce' (see page 150).

The 'Physicians' Pharmacopæia' method of preparing chocolate tabellæ is as follows:-The cocoa and other ingredients, including the medicine to be administered, are rubbed together in a mortar, massed, in the same way as a pill-mass, with the liquid excipient, and cut into pills on a pill-machine. Each pill is then taken, dusted with a powder of equal parts powdered sugar and arrowroot to prevent sticking, and placed in a tube of brass or wood standing vertically on a tile, an accurately-fitting piston of wood giving a round form to the lozenge on being forced down the tube on the top of the pill. The tablets may also be turned out without the mould, by simply placing the mass on the cutter of the pill-machine after piping, and pressing down the upper cutter upon it, oblong or square tablets resulting, according to the amount of mass used.

For most medicines this process answers admirably, but there are some which could be administered in lozenge form were it not for their nauseous taste, which requires an amount of cocoa and sugar to disguise it scarcely compatible with the dimensions of an ordinary lozenge. In such cases Mr. Harold Wyatt, jun., recommends glycyrrhizin (the sweet principle of liquorice-root) and saccharin as substitutes for the sugar. He finds, for example, that 5 grains of antipyrin is rendered almost tasteless by 1 grain of glycyrrhizin, and that the intense bitterness of strophanthus is covered by the addition of \( \frac{1}{6} \) grain of saccharin to every 5 minims of tincture in the tablet.

A warm mortar should be used for compounding the powders, when the cocoa becomes pasty, and the ingredients mix easily. The strengths of tabellæ are as follows:-

Tabella Acidi Arseniosi, each | Tabella Aconiti, each containing containing 1 grain of arsenious acid.

21 minims of tincture of aconite.

Tabellæ Antipyrini, each containing 5 grains of antipyrin.

Tabellæ Belladonnæ, each containing 5 minims of tincture of belladonna.

Tabellæ Caffeinæ, each containing I grain of caffeine.

Tabellæ Cerii et Bismuthi, each containing 2 grains of cerium oxalate and 2 grains of bismuth ammonio-citrate.

Tabellæ Gelsemii, each containing

2½ minims of liquid extract of gelsemium.

Tabellæ Hamamelidis, each containing 5 minims of liquid extract of hamamelis.

Tabellæ Nitroglycerini, each containing  $\frac{1}{100}$  grain of nitroglycerin.

Tabellæ Strophanthi, each containing 2½ minims of tincture of strophanthus.

The following formula of Mr. Wyatt's will serve as an example of how the foregoing are made:—

#### Tabellæ Acidi Arseniosi.

Trituration of arse	nic	(I in	100)		48 grains
Cocoa powder					70 grains
Tragacanth powde	er				24 grains
Saccharin .					I grain
Alcohol .					30 minims
Essence of vanilla					24 minims
Distilled water					30 minims

Place the cocoa powder in a warm mortar; when melted add the powders, previously well rubbed together, and, after the mass has set, powder it with the aid of the alcohol and essence of vanilla; mass with the water, and divide into forty-eight tablets.

The British Pharmacopœia gives no formula for tabellæ trinitrini. The following is Mr. Lucas's method of making them:—

Alcoholic solution	of n	itrogly	cerin	(10 p	er ce	nt.)	100	parts
Powdered chocolate	9						1,450	parts
Powdered sugar							2,500	parts
Mucilage of acacia							390	parts
Powdered acacia							360	parts
Distilled water							200	parts

All by weight.

Mix the powders, add the solution of nitroglycerin, and stir with a light hand until evenly mixed. Add the mucilage and water, and work up

to a soft mass; roll into a cake, and divide into lozenges weighing exactly 5 grains.

The following is from 'Pharmaceutical Formulas':-

Fry's cocoa powde	r (w	ithout	oil)		3	oz.
Powdered sugar					6	oz.
Oil of theobroma					41/2	oz.
Nitroglycerin .					24	gr.

Mix the cocoa powder with the sugar, pass through a fine sieve. Liquefy the oil of theobroma on a water-bath, and dissolve the nitroglycerin in it. Then add the powders, stirring the whole well together, and when mixed cut into 2½-grain tablets by Mr. Wyatt's method.

The advantage of Mr. Lucas's formula is that the commercial solution of nitroglycerin is employed in making the tabellæ. The second formula is a manufacturer's.

Lozenges are rarely required to be made extemporaneously, which is a good reason for saying something here about how they are made. The British Pharmacopæia apparently contemplates that special combinations may be prescribed, for it gives formulæ for four bases with which medicaments are compounded. The simple basis is the one most generally useful, and may be quoted here, the following being the proportions for 500 lozenges:—

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Refined sugar in fine powder . . . 17½ oz. or 496 grammes

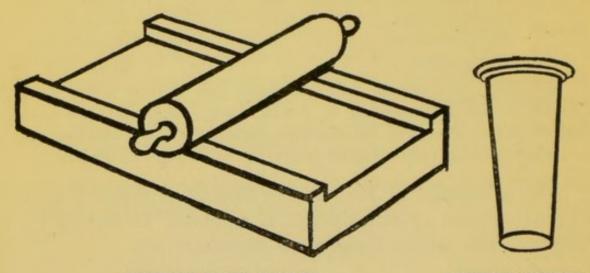
Gum acacia, in powder . . . 300 gr. or 19.5 grammes
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To these is added the medicament, the whole being intimately mixed and thereafter made into a paste with—

Divide the mass into 500 equal lozenges. Dry them in a hot-air chamber at a moderate temperature.

From this it will be seen that for each lozenge there are required  $25\frac{1}{3}$  grains of powdered sugar,  $\frac{3}{5}$  grain of powdered acacia, and  $1\frac{1}{5}$  minim of mucilage of acacia. A mortar may be used for massing the lozenge-ingredients. The lozenge-machine resembles a pill-machine, but the sides do not slope,

and are generally made to adjust to the required thickness of lozenge. A cylindrical roller is used for spreading out the mass, a mixture of starch and sugar being employed to keep it from sticking. For dispensing-purposes it will suffice to divide



LOZENGE-PASTE ROLLER.

LOZENGE-CUTTER.

the mass into equal weighed portions, and form into a lozenge by squeezing into the lid of a pill-box, or any suitable mould. Otherwise the mass should be rolled and cut with a lozengecutter or into rectangular lozenges with a knife.

Pastilles are soft, jelly-like jujubes, variously medicated, made from a gelatin and glycerin base, called in the Throat Hospital Pharmacopæia 'Glyco-gelatin,' which is best made according to the following form:—

French gelati	n.				I	oz.	
Glycerin .					21/2	oz. (by	weight)
Tolu-water					21/2	oz.	,,
Ammoniacal	solution	of	carmine		24	min.	

Cut the gelatin into shreds and soak in the tolu-water for two hours; then transfer to a water-bath and heat with the glycerin until the gelatin is dissolved. Colour with the carmine solution, and pour into an oiled tray to cool.

· The solution of carmine is made as follows :-

Carmine					30 gr.
Solution	of ar	mmonia			a sufficiency

Dissolve the carmine in 6 drachms of the ammonia solution, filter, and wash the filter with more ammonia until I fluid ounce has been collected.

The tolu-water is the liquor made by boiling 11/4 ounce of balsam of tolu in 20 ounces of water (contained in a covered vessel) for half an hour and straining off 16 ounces.

The medication of the pastilles is accomplished by melting the glyco-gelatin on a water-bath, adding the medicine (previously rubbed to a thick syrup with glycerin, if a powder), stirring until nearly cool, and pouring into an oiled mould.

Flavours for the pastilles other than tolu-water are the fruitjuices, orange-flower water, and glycyrrhizin. Rose or cinnamon water may also be used. Two drachms of cherry-laurel
water with 2½ ounces of distilled water imparts a pleasant almond
flavour. Raspberry-juice may be used in the same proportion
as orange-flower water, lime-juice in the proportion of half juice
and half distilled water. Glycyrrhizin, 24 grains, dissolved in
the water used to soak the gelatin, imparts an excellent
liquorice flavour, which is useful to hide the taste of ammonium
chloride.

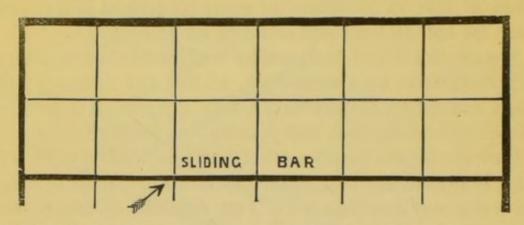
The following examples from 'Pharmaceutical Formulas' show the nature of the combinations:—

Ammonium chloride . 3iij. gr. xij.
Ammonia glycyrrhizinate gr. xxiv.
Glyco-gelatin (without carmine) . 3viij.
To make 96 pastilles.

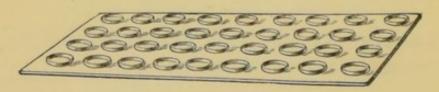
# Cocaine hydrochloride . gr. xij. Citric acid . . . gr. xxxij. Oil of lemon . . mxxiv. Glyco-gelatin . . zviij. To make 96 pastilles.

Formerly these pastilles were usually made by casting in a suitable tray and afterwards cutting with scissors. On the next page is a diagrammatic sketch of a mould made from a square piece of plate-glass with narrow slips of plate-glass cemented on its three sides as shown in the figure. The square is divided into smaller squares by means of grooved lines, and a piece of glass is provided to slip up to any row required, there to be secured by means of a piece of cork, thus serving

to give the requisite surface. The diagram shows part of the plate arranged for a dozen pastilles. The plate having previously been slightly oiled, the pastille-mass is poured into it, and when it sets the glyco-gelatin sheet is removed, when it is found that



on the under-surface are ridges corresponding to the grooves in the plate. All that remains to be done is to cut through these ridges with a pair of scissors, and the pastilles are finished. Now, however, circular discs with bevel-edges are preferred. These are made with Mr. F. Bilson's mould (made by Toogood),



which is simply a series of small circular tin saucers secured to a metal base. This mould is exceedingly convenient, and the finished pastilles have the best appearance.

These glyco-gelatin pastilles are now much prescribed, and are the most convenient form of lozenge for extemporaneous preparation. The following are the doses of medicaments usually required in each:—

Acid, benzoic I gr.	Borax 2 gr.
Acid, boric, T.H 2 gr.	Caffeine ½ gr.
Acid, carbolic, T.H . $\frac{1}{2}$ gr.	Ditto with menthol 1 gr.
Acid, lactic 2 min.	Bismuth carbonate, T.H. 3 gr.
Aconite tincture I min.	[Also with morphine acetate $\frac{1}{30}$ gr.
Ammonium bromide . 3 gr.	or potassium chlorate 2 gr.]
*Ammonium chloride, T.H. 2 gr.	*Cascara sagrada extract. 2 gr.
Apomorphine hydrochloride $\frac{1}{30}$ gr.	*Coca extract 2 gr.
	- p.,

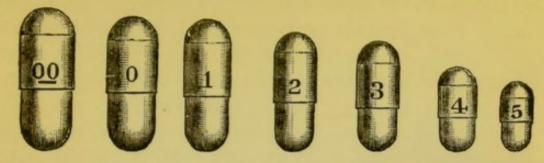
Cocaine hydrochloride . ½ gr.	Menthol, T.H	1 gr.
Codeine, T.H $\frac{1}{10}$ gr.	Morphine acetate .	$\frac{1}{30}$ gr.
Eucaine $\frac{1}{10}$ gr.	Pine oil (pumilio) .	I min.
Guaiacum 2 gr.	Potassium chlorate.	2 gr.
Eucalyptus oil . ½ to 2 min.	Salol	2½ gr.
Iodoform, T.H. 1 gr. (more or less)	Terebene	2 min.
Ipecacuanha, liquid extract 1/4 min.	Thymol	$\frac{1}{32}$ gr.

The glycyrrhizinated glyco-gelatin should be used for those marked \*, and the carmine-coloured one for the others. The glyco-gelatin basis is not suitable for astringent medicaments such as red gum, rhatany, or any other tannic substances.

# CAPSULES.

THERE was nothing about capsules in the earlier forms of the 'Art of Dispensing,' and the chapter introduced into the 1888 edition began with the remark that 'a growing disposition on the part of medical men to prescribe nauseous medicines in capsules makes it necessary for the dispenser to be acquainted with the details of the operations of capsule-making.' At that time one could count the capsule-makers in Great Britain on the fingers of one hand, and the chapter referred to was the first treatment of the subject in an English text-book. The gelatin capsule was invented by Mothes in 1833, and the French Academy of Medicine declared his invention to be an immense service to science and to humanity. (See The Chemist and Druggist, xxxv. 214.) The original capsule was hard, as gelatin, gum arabic, and refined sugar were its constituents: glycerin, then being unknown, was not an ingredient. There was a demand for capsules in this country from the first; Mr. John Warrick, of London, being agent for Mothes, and Messrs. Morgan Brothers later taking up the agency for Denoual, of Paris. The manufacture was commenced in this country in the forties by Mr. Bateman and Mr. Turner, of London, but it was not until the eighties that prescribers began to order capsules as they do pills, and articles in The Chemist and Druggist urged the need for dispensers acquainting themselves with the methods of manufacture. Now there are many makers of capsules in the wholesale way, and leading dispensing establishments have capsule-equipments so that they may compound any capsule-prescription which is presented to them.

A form of capsule which is generally considered to be American in origin and comparatively new, is the empty

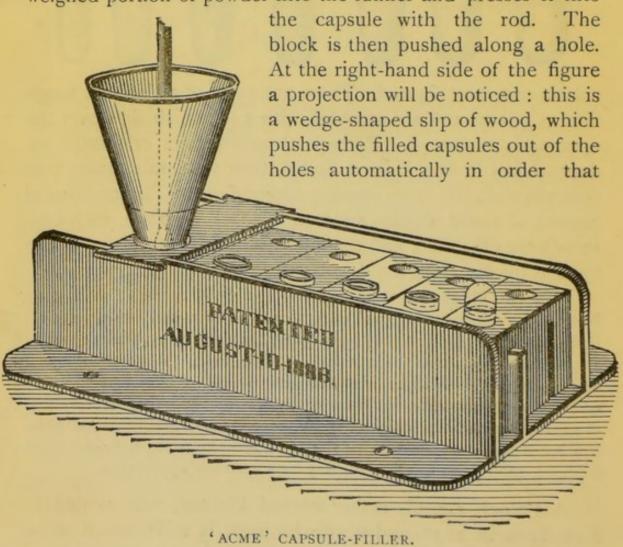


gelatin one, here figured. These are made of a thin and tough film of gelatin, and are provided with a lid which slips over the open end to close it. Perhaps these capsules originated independently in the United States (their wholesale production certainly did), but at an evening meeting of the Pharmaceutical Society of Great Britain, held on October 12, 1842, such capsules were exhibited, and the following paragraph in respect to them is quoted from the *Pharmaceutical Journal*, ii. 343:—

Some Gelatine Capsules, contrived by Mr. Chaston, of Walton, in Norfolk, for administering fluid medicines to Horses and Dogs, were exhibited to the meeting. They were open at one extremity, which required a covering of skin, after the introduction of the fluid. It is scarcely necessary to add that, if water be introduced, they should be administered in the course of a few minutes; but they are chiefly adapted for the administration of spirit of turpentine, or any other substance in which gelatine is insoluble. The horse-capsules are about the size of an ordinary horse-ball, and when wrapped up in paper in the usual way have a similar appearance.

A French capsule-maker named Planten, who settled in New York in 1836, and whose business is still carried on by his successors, is said to have brought this idea into the market in the early years of his residence there, but it was not until 1860 to 1863 that empty capsules began to be appreciated in the United States, when they were re-introduced. In his interesting history of this subject (*Proceedings of the American Pharmaceutical Association*, 1896) Dr. Alpers does not mention Chaston's early effort.

The empty capsules now obtainable are chiefly used for dispensing powders and pill-masses, although globular and oval capsules for liquids are also obtainable. The capsules are filled by means of such an apparatus as the 'Acme,' which consists of a nickelled metal case into which slides a block of wood with holes for twelve capsules. The funnel for filling is placed as shown, and the perforated block is inserted under it, so that it travels from left to right. The dispenser puts the weighed portion of powder into the funnel and presses it into



the lids may be put on. The margin of the capsule is generally wetted before the lid is put on. When the medicine is massed like a pill, the mass is divided on the pill-machine by pressing the pipe on the cutter to form cylinders, and each of these is inserted into a capsule of suitable size. Empty capsules are also made with a pointed lid for use as suppositories.

For Extemporaneous Production of capsules the first requisite is the gelatin mass. As already stated, capsules are either hard or soft. The former were the first introduced,

but the latter are now deservedly the more popular, for they are more easily swallowed. The mass for hard capsules is made according to the following formula:—

Gelatin .					6	oz
Gum acacia .					I	oz.
Powdered sug	gar				I	oz.
Water					5	oz.

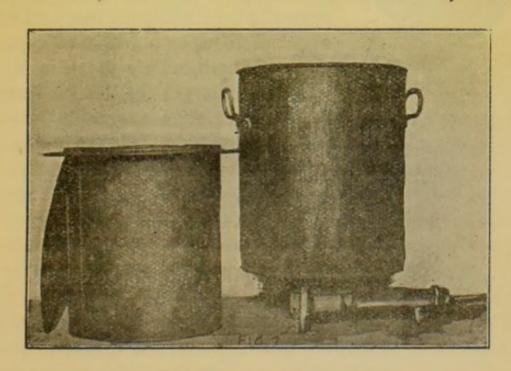
Steep the gelatin in the water, when soft add the gum and sugar, and heat until dissolved, removing any scum which rises to the surface.

Various forms have been proposed for the soft capsules, and the following has been found to give a good flexible mass which provides a capsule practically unalterable in most atmospheric conditions:—

Gelatin					30 oz.
Glycerin					15 oz.
Mucilage o	of aca	icia			$7\frac{1}{2}$ oz.
Water.					50 oz.

Steep the gelatin in the water, when soft add the mucilage and glycerin, dissolve by the heat of a water-bath, and mix thoroughly by stirring.

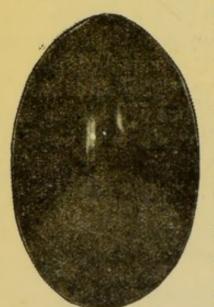
For some purposes (as when the capsules are to hold a ferrous mass) the latter formula is amended by omitting



CAPSULE-MASS WATER-BATH ON GAS-STOVE.

3 ounces of glycerin and adding 2 ounces of sugar. The

water-bath should be of a special form, so as to admit the mould-holder easily. That figured on page 159 consists of an outer water-pan 14 inches deep and 12 inches in diameter. It is made of tinned copper, and is provided with handles. The inner pan for making and melting the gelatin mass is 3 inches shorter and an inch less in diameter. It is provided with a rim to suspend it in the outer pan, and with a flat lid which lies on the top, and is reversed each time it is taken off when the pan is in use so that the condense-water which gathers



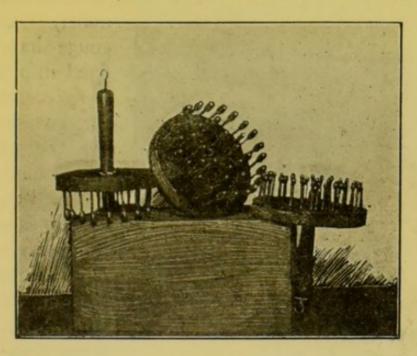
SHAPE OF A BRASS MOULD (ENLARGED).

on it may evaporate rather than drop back into the gelatin composition.

These are made of brass and fixed to rods which screw into a disc of wood provided with a handle securely fixed into the centre of the reverse side. The moulds are made in sizes according to the capacity of the capsules, and one dipper carries fifteen to sixty moulds according to size. The gelatin mass is generally kept ready for use, and when one has to make a batch of capsules the water-bath, with 2 to  $2\frac{1}{2}$  inches of water in it, is put on the gas-furnace,

the inner pan inserted, and some of the mass put in it. The moulds are now prepared by wiping them with an oily cloth. As soon as the mass is properly melted, the lid of the pan is removed and the dipper lowered into the pan, so that the moulds are immersed about an inch below the surface of the gelatin mixture. Care should be taken to remove skin or froth from the surface to the side before the dipper is put in. Once in, the dipper is rotated gently to ensure a uniform coat, and then it is slowly withdrawn; the object of slow removal being to form a thin capsule, the excess of gelatin mixture being drawn off by the bulk through capillary attraction. If this is done well, no objectionable drop forms at the base of the capsule. When the dipper is clear of the pan it is

quickly turned upside down, so that the semi-fluid coating, which is now tending to form a drop at the base of the capsule, may spread uniformly over the mould. In a few seconds

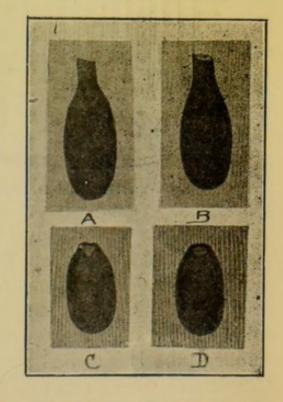


SET OF BRASS MOULDS MOUNTED ON DIPPERS.

the capsule 'sets,' and in a few minutes is easily removed

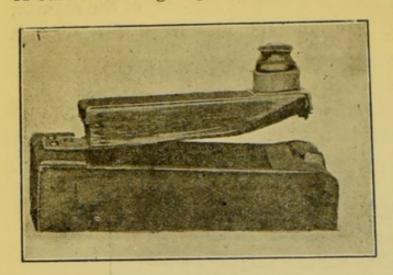
with the fingers; it then looks like A or B in the annexed engraving.

The ordinary narrow-mouthed capsule is either ovate (B) with the narrow end somewhat elongated, or oval (A), with a more or less distinct shoulder. In the former case it is difficult to know where the capsule ends and the neck begins; and as the part to be removed is practically cylindrical it may be cut off with scissors. The oval capsule, however, cannot be trimmed successfully with a straight edged cutter; if it be



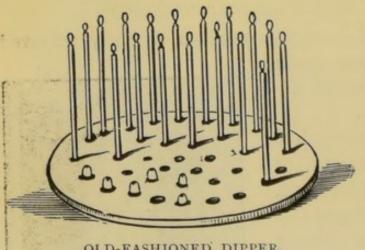
cut through between shoulder and neck with a knife or scissors, the resulting 'mouth' is not round, but lipped (c). Such a

capsule is difficult to fill, and the lips do not seal up neatly. A curved cutting edge is better, and we have this in the cutter



CAPSULING CUTTER AND BOX.

were used for this (see below), but it is better to have holders for the purpose made of wood, cardboard, or metal.



OLD-FASHIONED DIPPER.

figured, which has a flat surface immediately under gouge-shaped knife fixed into the spring top-piece of the cutting-box, into which the 'cut-offs' drop. After the 'tails' are removed the capsules are placed on suitable trays with holes. The old-fashioned dippers

Some dispensers use a suppository-mould. Holders are included in the illustrations given on the following page.

For filling capsules many methods are in use. The French employ for liquids any convenient reservoir with

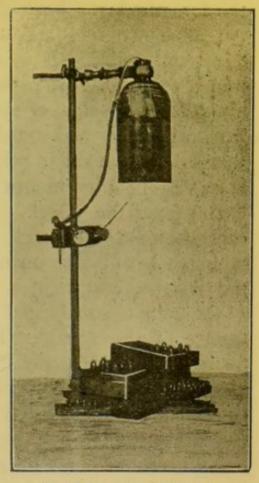
a tap, heating the substance if it is too thick, as in the case of castor oil and copaiba. This is inadmissible. For limpid liquids such an arrangement as the gravitation filler is as good as any. The liquid is put into any convenient vessel (a funnel with narrow stem or a separating-funnel is suitable), an indiarubber tube is attached to the stem and fitted with a glass nozzle and spring clip to control the flow of the liquid. For filling a few capsules ordered by prescription, an ordinary glass

syringe answers perfectly; the nozzle being drawn out to the

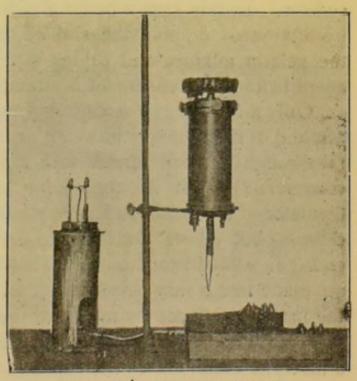
required calibre in a Bunsen or blowpipe flame, and the end cut off so as to leave a point of suitable size; the cut edge is then carefully fused by holding it for a second or two in the extreme edge of a small Bunsen flame. A more elaborate arrangement is that devised by Mr. J. A. Forret, of Edinburgh, which is excellent for viscous liquids, such as castor oil and cascara sagrada extract. This is a brass syringe with screwed piston-rod, which enables the operator to put strong pressure on the contents of the syringe. In filling, care has to be taken that the liquid does not overflow-in fact, a fraction of a minim of space should be left in

the capsule, otherwise the closing operation may be difficult.

Closing is done by a brush or glass rod dipped in the melted gelatin mass, or by a small metal bolt applied hot to the neck of the capsule, or by a bolt dipped into the gelatin mass. The method brush does not make a secure joint; with the hot, dry bolt one requires



GRAVITATION FILLER.



FORRET'S SYRINGE FIELER.

about 1 inch of neck to be left on the capsule, while in the third method we have the analogue of the soldering-bolt. An appliance for the last method is shown to the left of the syringe filler. It is a small brass vessel, similar to the tinned copper for the capsule-mass, suspended in a cylindrical tin. On one side of the tin is a hole to admit a small Bunsen burner, and round the top is a series of holes for ventilation; the tin is soldered to a heavy metal foot. The brass vessel carries an arm of stout wire with two loops projecting over the vessel. The bolt is made by soldering a capsule-mould into each end of a short length of brass tubing. A sufficient quantity of gelatin mass is melted by the Bunsen, and kept a trifle below boiling. The support of the bolts is so adjusted that the moulds are just under the surface of the gelatin. The bolt thus acquires a sufficient temperature to fuse the mouth of the capsule on which it is allowed to press for a second or two, and carries with it sufficient material to close and give a rounded finish to the capsule (see page 160). The second bolt is heating while the first is being used. When a dozen or two capsules are being made by prescription the glass-rod or brush method of closing suffices. In this case a better finish is given to the capsules by afterwards dipping the end of the capsule halfway up in the gelatin mixture and drying rapidly, but one must be an adept before this refinement is attempted.

Only a few drugs are capsuled as dry powder. The usual method of doing this is to weigh or divide as for powders, and fill through a small funnel with a suitable nozzle, fixed at a convenient height in the clamp of a retort-stand. The diameter of the nozzle is a trifle greater than the mouth of the capsule, but allows the latter to be readily slipped over the end. In some instances—e.g., Blaud's pill-mass—the powders are made into a thin paste with a suitable liquid medium and the paste introduced by means of the pressure-syringe.

Capsules and perles are also made on the large scale with a machine which makes the capsules from two sheets of gelatin or gum material, simultaneously filling the formed capsule.

# POWDERS.

THERE is a right and a wrong way in compounding powders, but fewer difficulties occur in this class of medicines than in any other, most likely on account of the fact that chemical solids do not interact readily until they are brought into solution. A list of solids which liquefy when mixed with each other is given on page 97, and dispensers should make themselves familiar with it.

In Mixing, the rule is to take the smallest or most potent ingredient first and triturate it in the powder-mortar with some other ingredient which will assist in comminuting it well, as in the following instance:—

Morphinæ hydrochloridi			gr. 1/2
Bismuthi subnitratis			gr. v.
Pepsin			gr. ij.

Fiat pulvis. Mitte tales duodecim.

Here we weigh the bismuth subnitrate and put a few grains of it in the mortar, then put on it the morphine hydrochloride, triturate lightly, add a little more bismuth subnitrate, triturate, and so on until half the bismuth subnitrate is used; then add half the pepsin, triturate, the rest of the bismuth subnitrate and pepsin, again triturate, and finally sift or mix well on paper with a bone spatula.

Never rub so hard that the powder cakes; that is bad pharmacy. A glass mortar is used for the very reason that it suggests gentle trituration. Also note that friction induces electricity in many instances—so much so that when the spatula is put into the powder the metal gets a coating of the electrified powder, which is somewhat difficult to remove. Indiscriminate use of mortar and pestle is bad. Here, for example, is a prescription of Sir Morell Mackenzie's, which was in the first instance dispensed by a well-known West-end pharmacist, and gave satisfaction:—

Bismuthi subnit. . . . . . . . . gr.  $\frac{1}{8}$ Pulv. catechu . . . . . . . gr.  $\frac{1}{12}$ Morphinæ hydrochlor. . . . . gr.  $\frac{1}{16}$ Fiat pulvis. Mitte tales lxij.

The powders were used for insufflation in a case of chronic sore-throat. The second pharmacist who dispensed the prescription was an ardent advocate of the mortar-and-pestle method, and he lost a customer by the practice of his principle. The third with his spatula mixed the powders on a powder-paper, and the patient no longer sent to London in order to get the prescription dispensed. The complaint made of the powders sent out by the second pharmacist was that they had a lumpy feeling in the throat, and did not adhere so kindly as those supplied by the first and third dispensers. No doubt the heat of friction had caused aggregation of the catechu with the other ingredients.

It has been shown by Mr. Boa, of Edinburgh, that the method of mixing materially affects the miscibility of powders. The general conclusion arrived at from Mr. Boa's experiments is that powders mixed on paper and sifted are more readily miscible in water than those which have been rubbed up in a mortar and sifted. For example we quote two instances in which this effect may be readily observed:—

Pulv. rhei .				gr. x.
Pulv. cinnamom.				gr. vj.
Magnes. levis.			2 .	gr. xx.

<sup>&</sup>lt;sup>1</sup> If the spatula is dipped in powdered French chalk beforehand, the adhesion is reduced.

If these ingredients are rubbed up in a mortar the powder diffuses in water with exceeding difficulty, whereas when mixed on paper it diffuses quickly.

Pepsin				gr. ij.
Bismuth. alb				gr. v.
Magnes. carb.				gr. iij.
Pulv. aromat.				gr. j.

When these are rubbed up in a mortar, and sifted, the powder can be mixed in water only with considerable difficulty, but when mixed on paper the difficulty is not experienced.

The following powder is a distinct exception to the foregoing:—

```
Sulphur. præcip. . . . . . . . . gr. xv. Guaiac. resin. . . . . . . . gr. x. Magnesiæ . . . . . . . . . gr. xx.
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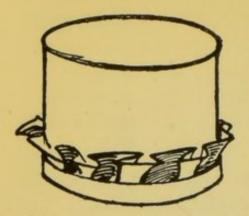
The most readily miscible powder is here obtained by rubbing the guaiacum and magnesia well together before adding the sulphur. If the powders are mixed on paper they will scarcely mix with water.

It is quite evident that there is an art in powder-making, as there is in pill-making, the only difference being that in the former case dissatisfaction is experienced by the customer, in the latter by the dispenser—a sufficient reason, therefore, to call forth the care and ingenuity of the dispenser in mixing powders.

In the great majority of cases, where limited quantities are ordered, say under 2 drachms—such, for example, as one or two dozen of powders—no better or quicker method of mixing the powders can be adopted than the spatula and a sheet of white paper. The ingredients ordered in smallest quantity should be first thoroughly incorporated, and the larger quantities added gradually.

It is customary to condemn this method as being bad pharmacy, but it is quite the contrary, and experiment has proved that mixture done in this way is effectual. It is the only admissible plan in some cases, the paper-and-spatula

mixing being followed by sifting through an extemporised sieve

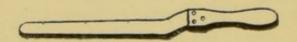


SIEVE EXTEMPORISED FROM MUSLIN AND CHIP BOX,

made by removing the bottom from a chip box, and securing a piece of muslin to it with the band of the lid as shown in the illustration. This is the method by which most powders containing potassium chlorate should be mixed, e.g.:—

Pulv. pota	assii chlo	oratis		ъij.
Acidi tanı	nici .			ъj.
Misce.	Pro ga	rgaris	mâ.	

A dispenser triturated these in a mortar. There was a violent explosion, which does not happen when the chlorate is



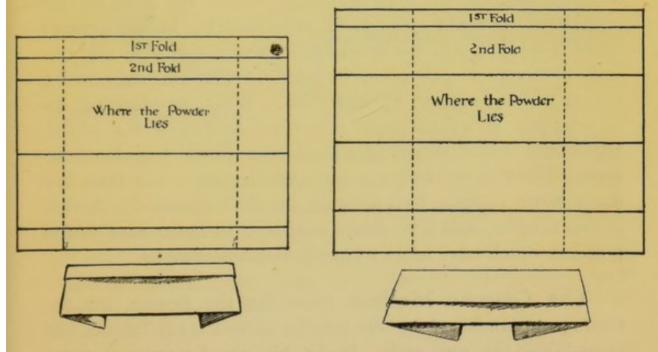
HORN SPATULA FOR MIXING POWDERS,

smoothed down on paper with a bone spatula and the tannin then added and mixed.

Division of Powders.—The only method of division which is tolerated by examiners is weighing each powder. No guesswork is allowed. While we endorse this view we cannot overlook the fact that experienced dispensers divide, say, a drachm of compound jalap powder into twelve powders so well 'by guess' that there is not I per cent. of difference between any two of the powders. It is all a matter of practice, and if the dispenser begins by learning to divide by means of the scales and weights, he becomes as expert in dividing as the man who divides by guess. There are various mechanical contrivances for dividing, but they have never come into favour in this country, and the tendency is entirely towards division by weight.

Folding.—A convenient size of paper for powders is 5 inches by 4 inches, but the size should be proportionate to the

powder. The paper should be good calendered demy, rather to the thin side. In placing the papers on the dispensing-counter it is customary—say, in the case of a dozen powders—to arrange them in fours, leaving about 2 inches square of the first two rows exposed to receive the portions of powder. This is the arrangement for dividing by eye; but it has become the custom also in the more accurate method of division. After all the papers have received their portions of powder, the dispenser begins to fold them. This operation is simple enough. The powder is tilted to the centre of the paper, the side of the paper nearer 1 the dispenser is raised



DIAGRAMS SHOWING HOW POWDERS ARE FOLDED, WITH SKETCHES OF THE FINISHED POWDERS.

and placed about a quarter of an inch from the edge of the other side, and, keeping a thumb on each end of the upper half, the forefingers lift the lower half, bring it over, and meeting at the centre are swiftly drawn to the edges, thus making the fold. A double fold is next made exactly in the same manner. The aim in folding is to make the whole of a set of powders exactly the same width in fold, as well as the same

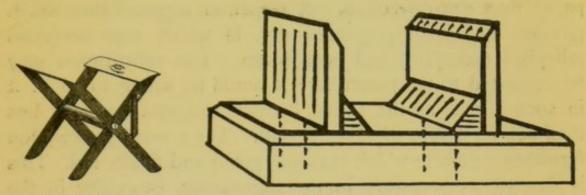
We have seen a few dispensers who have worked in the opposite way dexterously. Left-handed men doubtless.

length. The latter is easily fixed by a powder-folder, but the width of fold is a matter of practice and eye-judgment. The sketches on page 169 show how it is done. The smaller sketch represents a piece of paper 41 inches long and 31 inches wide. The first fold was 3 inch deep, and the second was the same; then 7 inch at each end was turned over by means of the folder. The finished powder is shown at the bottom of the sketch, 23 inches long, by 11 inch wide. This method may be called edge-folding. The second example represents a powder-paper  $5\frac{7}{8}$  inches long, and  $4\frac{3}{8}$  inches wide. The first fold was 3 inch deep, as in the former case, the second (arranged so that the fold should lie nearer the edge of the powder, as it is not so pleasing when exactly in the centre) was I inch deep, and the cross-foldings were made so that the ends overlapped each other by 1/8 inch. The finished powder was  $2\frac{3}{4}$  inches long and  $1\frac{1}{4}$  inch wide. When powders are to be wrapped in waxed paper it saves a folding if the waxed paper and white demy paper are put down together, the waxed paper being about 1 inch smaller each way than the outer white paper. Deliquescent powders should be folded in this manner, and it is always advisable to cover with tinfoil powders which have to go to damp and hot climates.

The German Method resembles the former, but the German apotheker buys his powder-papers ready folded, and cross-folded at one end. If he has to dispense a dozen powders, he weighs or divides (generally the latter) the required quantities of powder, putting each portion upon a horn scoop, next takes a dozen folded papers between the thumb and fingers of the left hand, and one after the other opens them, placing the contents of a scoop into each, and dexterously cross-folds each paper with the forefinger and second finger of the right hand.

The Powder-folder is an indispensable adjunct to most dispensers. It is well to learn powder-folding with it rather than without, for powders of unequal length are as irritating to

the equanimity of a practised pharmacist as pills of unequal size. The length of the folded powder should be about  $\frac{1}{8}$  inch less than the length of the powder-box, or  $\frac{1}{4}$  inch less than the powder-envelope. A block of wood somewhat longer than it is wide, and wider than it is deep, is the simplest folder. Next comes the kind made of two plates of brass with a pillar between, then the adjusting folder here illustrated.



MAW'S POWDER-FOLDER.

POWDER-FOLDER MADE OF WOOD.

The second figure is a home-made folder—viz., a suitable box with two movable uprights in it which can be secured through the sides of the box by means of pegs. Punctilious dispensers record in the prescription-book the length of powders dispensed in particular cases. It is important to observe in folding that none of the powder gets in the turned-over parts of the paper.

## SPECIAL MEMORANDA.

Ammonium Carbonate.—Rarely prescribed in powders, but if so wrap in waxed paper.

Antipyrin (Phenazone).—This substance is eminently a remedy which should be prescribed by itself, as its physiological action has been definitely determined and its limitations fixed. But prescribers go more upon their personal experience than physiological experiments, and combine things with it which sometimes trouble the dispenser, as in the following instances:—

I.				II.						
Antipyrin			gr.	x.	Phenazoni				gr.	v.
Sodii salicylatis			gr.	xx.	Caffeinæ citrat	is			gr.	v.
Fiat pulvis.	Mitte x	ij.			Sodii nitritis				gr.	iss.
Sig.: One		-	hours		Fiat pulvis.	1	Mitte	tales	vj.	

Antipyrin and sodium salicylate liquefy when mixed together, salicylate of antipyrin being formed. This is not at all dependent upon external moisture, therefore wrapping in waxed paper does not obviate it. A dispenser reported that No. I. powders had been dispensed dry, in which case antipyrin salicylate (salipyrin) had been given. The substitution may be suggested to the prescriber: it would be wrong to adopt it in such a case as the above, because salipyrin contains less than half its weight of salicylic acid. The second prescription furnishes a powder which becomes green and finally red. This is due to the moisture in the ingredients, especially in the sodium nitrite, liberating citric acid from the caffeine citrate (an unstable salt). The acid, reacting with the nitrite, liberates nitrous acid, which then, acting upon the phenazone, forms an isonitroso compound of a green colour. With an equivalent of the alkaloid caffeine (21 grains) this change does not take place, but a dispenser who used parchment-paper for wrapping the powders made with the alkaloid found that they did become green. This was found to be owing to the parchment-paper being acid in reaction (it is made by steeping ordinary paper in sulphuric acid and water).

Crystals should be reduced to powder before they are dispensed as powders. In the case of quinine sulphate this is, unfortunately, not generally done; but every dispenser who gets a prescription for quinine powders fresh from the prescriber should take care to mark it 'Tere bene i.m.' for the benefit of subsequent dispensers.

Exalgin.—It was noticed that when the following were triturated in a mortar a valerianic-acid odour was developed:—

```
Exalgin. . . . . . . . . gr. ij.
Phenacetin. . . . . . . . gr. iij.
Fiat pulvis. Mitte xij.
```

There is nothing in either of these substances to give rise to valerianic acid ( $C_4H_9$ .COOH), as neither exalgin (methylacetanilide ( $C_6H_5$ N.CH<sub>3</sub>.CH<sub>3</sub>CO) nor phenacetin (oxyethylacetanilide [ $C_6H_4$ .OC<sub>2</sub>H<sub>5</sub>.NH(CH<sub>3</sub>CO)] contains the requisite  $C_4H_9$  group. It was therefore concluded that the materials had been crystallised from an amylic solvent. It may be useful to keep this fact in mind respecting other synthetic remedies.

Hydronaphthol.—The following dusting-powder exemplifies one of the many precautions which an intelligent dispenser (in this case Mr. H. Wyatt, jun.) has to observe:—

Hydronaphthol.				gr. xij.
Pulveris iridis				3j.
Zinci oxidi.				3j.
Cimoliti .				ъij.
Pulveris amyli a	d			<b>3</b> j.

Fiat pulvis aspersorius.

Hydronaphthol in crystals is exceedingly irritating to raw surfaces, and it is difficult to reduce it by mortar and pestle to a sufficiently fine powder. So the 12 grains was dissolved in a drachm of ether, and the solution poured upon the mixed powders contained in a warm mortar. The ether was quickly dissipated on stirring, and the powder proved satisfactory.

Hygroscopic Substances, such as acetate, carbonate, and citrate of potassium and iodide of sodium, ought not to be prescribed as powders, but if so each dose should be folded up in waxed paper, that again being covered with ordinary powder-paper. Do not attempt the reverse way.

Iron Succinate.—This deliquescent salt has been ordered in cachets. The precaution to take is not to wet the catchetedges, but to use the smallest possible amount of mucilage to make them adhere.

Liquids.—It rarely happens that liquids are prescribed in powders, but it may be well to note that a grain of white kieselguhr will absorb at least I minim of a liquid without

becoming wet, and still be fit to dispense in waxed paper. The following peculiar prescription looks very like a slip on the part of the doctor:—

Misce bene. Divide in pulveres xxiv.

With compound tragacanth powder and the plaingum a powder was obtained which would scarcely mix with water. So the dispenser tried the mucilage, mixing it with the powders, drying and reducing to powder, then adding the bimeconate, and was surprised to find that this powder mixed nicely with water. This may have been intended by the prescriber; if so, he was clever and has originated a wrinkle which is worth remembering.

Mercurous Chloride.—A dispenser who had a prescription for 1-grain calomel powders was so struck with the minuteness of the portion that he added 2 grains of sugar of milk to make bulk. This is not considered justifiable, but it is open to consideration whether fractions of a grain of dense substances should not be made up as is the case with pills, and were such prescriptions more frequent than they are, the question would have been discussed and settled before now. Homeopathic powders are dispensed on this plan. A doctor prescribes the following with excellent results in infantile diarrhoea:—

Hydrargyri cum cretâ . . . . gr.  $\frac{1}{24}$ Sodii bicarbonatis . . . gr.  $\frac{1}{8}$ 

Fiat pulvis. Mitte xxiv.

Sig.: One every hour.

There is nothing for it but to guess when dividing the powder, but it would be a boon to the dispenser and nurse alike if the bulk were made up to 24 or 30 grains before division. This is a case which recalls the old Scotchwoman's remark, 'Dinna be sae sparin' wi' it: it's for a mitherless bairn.'

Salts which are likely to mutually decompose each other must be mixed in a perfectly dry condition, and should be stirred together lightly in the mortar. Instances are tartrate of potassium with sulphate of sodium, tartrate of potassium with chloride of ammonium, nitrate of potassium with salicylate of sodium. Effervescing lemonade-powder should be mixed by first rubbing together the tartaric acid with the sugar in a previously warmed mortar and then stirring in the bicarbonate of sodium very lightly. The powders should not be dried at a temperature above 30° C., or they are more liable to absorb moisture afterwards.

Squill and Ammoniacum in Powder keep perfectly in a bottle with an accurately fitting stopper, which should be wiped each time it is used, so that no particles are left between the stopper and neck. If the stoppering is not quite perfect, a little vaseline will make it airtight.

Powders for Lotions or other external purpose should be sent out in a different coloured paper from that used in other cases. A coloured paper is useful to distinguish at once between an internal and an external remedy. The powder should in all cases, however, be wrapped in waxed paper first, as the colouring of the paper may be altered by the powder. This would certainly be the case with the following:—

When mixed, deliquescence takes place, owing to the water of crystallisation and consequent interaction of the salts. Therefore the salts must be separately dried before mixing, and wrapped in waxed paper, when the powders keep well.

Administering Powders.—It is the practice of many parents to give powders mixed with jam to children; there is no objection to this, provided the ingredients are compatible with the jam; but it should be borne in mind that many children's powders contain magnesia or bicarbonate of sodium, and the acid present in all jams would combine with and alter

the action of a portion of these ingredients. The simplest way to give a powder is to make a small draught of it with sugar and water. Treacle is sometimes recommended, but is objectionable in some cases owing to its alkalinity. These old remarks in regard to administration bring us to a topic which it was vain to write about fifteen years ago, viz:—

#### CACHETS.

The late Mr. Henry Groves, of Florence, writing to The Chemist and Druggist, July 27, 1888, remarked:—

We have coated our pills and we are now thinking of starch shirts for our powders, in the wafers used for that purpose for so many years on the Continent. Until a few years ago people were content to wrap up the powder themselves, depositing it in the centre of a damped wafer and folding over the edges so as to form a sort of oyster, which, floated in a spoon with a little water, was as easily swallowed as the bivalve itself. Now, however, under the auspices of elegant pharmacy, the shirt is often put on by the pharmacist himself in the form of a 'cachet,' . . . the result being an elegant morsel which, moistened with water, is taken as in the old system.

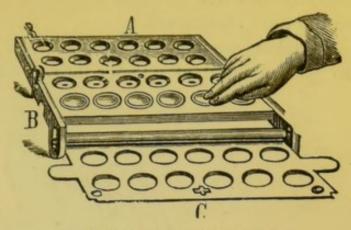
Cachets were invented by Limousin, of Paris, in the early seventies, and many attempts were made to introduce them into this country up to the time Mr. Groves wrote; but it was not until 1891, when the 'Morstadt' cachet-closing apparatus was offered, that the advantages of cachets began to be appreciated, and since then they have so grown in favour that no dispensing-counter is complete without a cachet-apparatus.



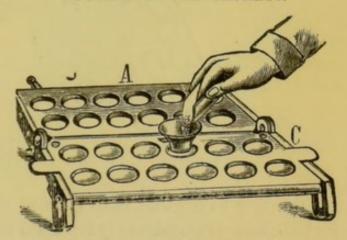
The one illustrated on page 177 is the 'Morstadt.' A cachet is made of two plate-shaped forms of rice-paper and when filled looks as shown in the first of the above figures. 'Keseal'

is the name given to a cachet with a raised rim, the advantage of which is that the edges do not get such a superfluity

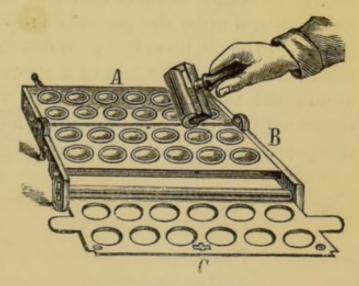
of moisture as to curl. The first step in filling cachets is to place the halves in the holes of the apparatus. This is being done in the first of the annexed figures. B being the bedplate which holds those that are to receive the powder, A for those which will make the cover, and c covering-plate which is placed over B while the cachets are being filled with powder, in the manner shown in the second of the figures. This prevents the powder getting on the edge of the cachets. c is then lifted up as shown in the next figure and the lids moistened with damp roller. considerable nicety is required in damping much cachets: too makes the moisture edges curl, and if the moisture is insufficient the two halves will not adhere. A good plan is



PUTTING IN THE CACHETS.



FILLING WITH POWDER.

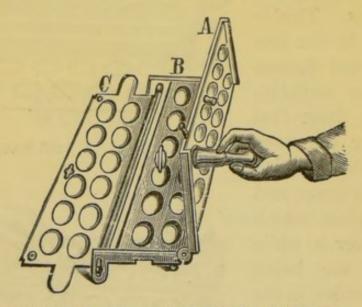


MOISTENING THE LIDS.

to dip a piece of paper in water, drain it, shake off superfluous moisture two or three times vigorously, lay it upon the upper

halves of the cachets, press once with the roller, remove the paper, and quickly turn over the top of the machine and press steadily for a few seconds. Then remove the cachets as shown in the next illustration.

Cachets are made of various sizes. It is the dispenser's duty to get a prescribed powder into as small a cachet as possible,



PUSHING OUT THE FINISHED CACHETS.

and the way to do that is to rub the substance well in a mortar, the bulk being considerably reduced thereby. Some prescribers appear to regard cachets much in the same way as they do capsules, and order deliquescent substances—e.g., glycerophosphates—to be put up in them. When that happens the dispenser must simply make the best of it; fortunately the cachets have a polished surface which excludes air well, and if they are dispensed in a layer of cotton-wool, a small number containing deliquescent substances keep fairly well for a few days.

# SUPPOSITORIES, BOUGIES, AND PESSARIES.

Dioscorides (A.D. 79), Galen (A.D. 131–200), and Avicenna (A.D. 980–1037) prescribed suppositories, and their prescriptions were still in vogue in the sixteenth century. Dioscorides also prescribed pessaries, which were more of the nature of tampons than soluble medicated pessaries. (See *The Chemist and Druggist*, lix. 385.) Suppositories and pessaries in those early days were made with such vehicles or excipients as (1) oils and fats, (2) gums and resins, and (3) honey. Suppositories frequently encased a piece of soft, old linen, which enabled the undissolved mass to be withdrawn. These now have their equivalent in the linted suppository and the Watson-Cheyne bougie. All these forms of medication dropped out of use, at least in good practice, during the eighteenth century. Pereira mentions suppositories (1849) in the following terms:—

When the substances applied to the rectum are solid, we name them suppositories (suppositoria, from suppono, to put under). Formerly suppositories were conical, or cylindrical, like a candle, and of variable size—sometimes one or two inches long. They are now usually made globular and of small size. They are employed to evacuate the bowels; to irrigate the rectum... but more commonly to act as local agents in affections of the rectum, bladder, uterus, prostate gland, urethra, &c.

This is interesting in view of the fact that the decade 1840-50 saw the renascence of the suppository, and that Pereira includes the bougie and pessary in the title. It was in 1840 that Dr. Osborne, a leading English practitioner, wrote about the value of suppositories in the London Medical

Gazette. A few years later Sir James Y. Simpson began to prescribe pessaries, using a wax-and-lard basis; he published particulars in 1848. In 1850 Mr. A. B. Taylor, of Philadelphia, suggested cocoa-butter (oleum theobromatis) as a basis, and this has now become the most commonly employed fat for suppositories and pessaries. The various editions of the British Pharmacopæia fairly reflect the progress of ideas in regard to the bases in use at the respective dates, but it is right to add that the earlier pharmacopæial formulæ were considered to be behind date.

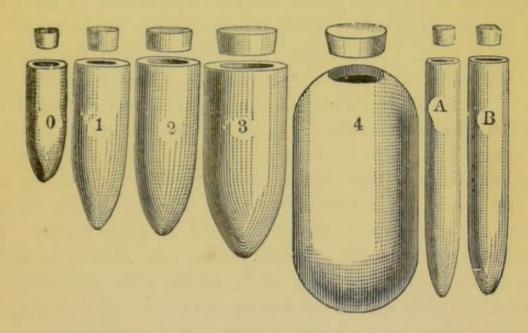
SUPPOSITORIA MORPHIÆ 1864.					SUPPOSITORIA ACIDI TANNICI 1864.					
Hydro	chlorat	e of 1	norph	nia	3 gr.	Tannic acid				24 gr.
Sugar					30 gr.	Glycerine				20 min.
White	wax				30 gr.	White wax				40 gr.
Lard					30 gr.	Lard .				80 gr.

Each of these was for twelve suppositories, and the mass was divided, solidified, and formed into cones each of which was dipped in a melted mixture of white wax 3 parts and lard 8 parts. This coating was abolished in the 1867 edition, and the mass made of benzoated lard 64 grains, white wax 20 grains, and oil of theobroma 90 grains for morphine suppositories. This was very good indeed as a basis, because one melted the wax and cocoa-butter together, mixed the medicament with the lard, and added the mixture to the melted portion, when a mass just fit for pouring was obtained. However, cocoa-butter alone was preferred generally, and the 1867 form was omitted in 1885. The Addendum to the 1867 B.P. recognised an old-fashioned formula, which was continued in the 1885, but was dropped in the 1898, edition. It was as follows, in the case of tannin:—

	1874.	1885.
Tannic acid	36 gr	36 gr.
Glycerine of starch	50 gr	30 gr.
Curd soap	100 gr	100 gr.
Starch	a sufficiency	a sufficiency
For twelve suppositories,		

This was an unsuccessful attempt to prepare suppositories in the cold way. A gelatin basis was introduced into the 1898 Pharmacopæia as a vehicle for glycerin, and the principle of adjusting the melting-point by the addition of white wax to cocoa-butter was recognised in the case of phenol suppositories. The United States Pharmacopæia basis is cocoa-butter; no formulæ are given, but it is recommended that suppositories should be made to weigh I gramme, pessaries 3 grammes, and urethral bougies I gramme.

The Shapes of suppositories, pessaries, and bougies conform more or less to that of a rifle-bullet. They are represented in the subjoined illustrations of hollow suppositories.



No. o is for children, and can also be used for the ear or nose. Nos. 1, 2, and 3 are for the rectum, the last being the size generally adopted for nutrient suppositories and for most pessaries (3j.); No. 4 is a pessary (3ij.); and A and B are the shapes and sizes for nasal bougies. Bougies vary in diameter from  $\frac{1}{12}$  to  $\frac{1}{6}$  inch, and are from  $2\frac{1}{2}$  to  $6\frac{1}{2}$  inches in length—a bougie 21 inches long and 1 inch in diameter weighs about 15 grains. The common size for urethral bougies is 4 inches long and 1 inch in diameter. Suppositories seldom exceed 15 grains in weight-that is, they fill the same space as 15 grains of water-and are 1 inch long and inch in diameter. Pessaries are now made oval as well as cylindrical and rarely more than I drachm in weight. An



improved shape for bougies and suppositories, consisting of a long and short cone, was suggested by Dr. Samuel G. Dixon, of Philadelphia, in 1888. Mr. Henry S. Wellcome, in a

WELLCOME SHAPE.

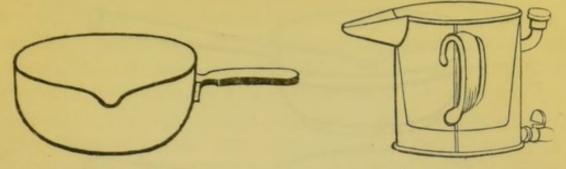
communication to the American Pharmaceutical Association in 1893, suggested a form as here indicated, now known as the 'Wellcome' shape. The object of the bulb is to enable the sphincter ani to grip the suppository and so prevent its return.

The Size of the official suppository was at one time vague, as the British Pharmacopœia weight was in each case 15 grains, independent of the specific gravity of the mass. In January, 1896, The Chemist and Druggist asked the opinions of several representative pharmacists (Messrs. Peter Boa, A. W. Gerrard, W. Martindale, C. Symes, and Walter Hills) on the question, Should the bulk of a suppository be made up to that of 15 grains of water? They unanimously replied in the affirmative. The 1898 Pharmacopœia prescribes the bulk to be made up accordingly. The capacity of the moulds varies about a grain on either side of a 15-grain mould. It is advisable to check the capacity of any new mould by wiping the interior with an oiled cloth, filling with melted cocoabutter, and after the fat has hardened by cooling, trimming the cops and weighing each suppository. If the discrepancy is not more than a grain either way the mould may safely be used, as approximate accuracy is all that is expected in dispensing. Should the mould hold more than 15 grains of cocoa-butter, an additional quantity of the basis will be required in dispensing. The capacity of the mould for other bases-e.g., gelatin-should also be determined.

# METHODS OF PREPARATION.

Suppositories are made either by pouring the liquefied mass into a suitable mould or by pressing a powdered mixture of the ingredients into the mould (cold method). In the

former way it is not advisable to melt the basis by the direct heat of a spirit-lamp or Bunsen burner, the temperature of a

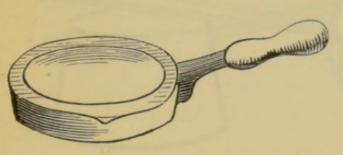


EARTHENWARE CASSEROLE.

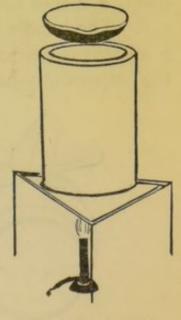
LEAROYD'S SUPPOSITORY-PAN.

water-bath sufficing and being safer. An earthenware casserole is the simplest dish to use for melting the basis; this may be heated over a flame if asbestos mill-board is placed between the two, but better over a simple water-bath, such as the one figured below, which is made of copper, the outside

diameter being 4 inches, the depth  $1\frac{1}{2}$  inch, and the rim  $\frac{1}{2}$  inch wide. Learoyd's suppository-pan is a waterbath, but is more adapted for the manufacturing scale than for the dispensing-counter. The extemporised arrangement figured here consists of a 1-lb. vaseline tin, supported by a tripod. An ordinary



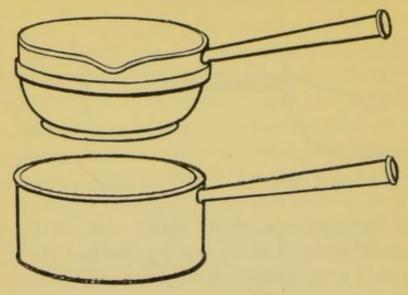
COPPER WATER-BATH.



EXTEMPORISED WATER-BATH.

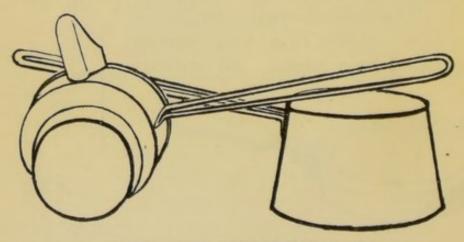
porcelain evaporating-dish is used for melting the fat, but a casserole may also be used. Another method of using the casserole is shown in the next figure. This consists of a casserole (or evaporating-dish to which a handle is secured) with a tin rim to support the dish when it is put into the

tin pan containing the water. An improvement upon this is the Martindale suppository-pan, made entirely of tinplate.



CASSEROLE WATER-BATH

The pan on the right is the water-bath, which is  $1\frac{1}{2}$  inch deep, 2 inches diameter at the bottom, and  $1\frac{13}{16}$  inch at the top. The handle is  $3\frac{1}{2}$  inches long. Half an ounce of water is all that is needed for this pan. The lipped pan for holding the suppository-basis is  $1\frac{1}{2}$  inch deep, 2 inches diameter at



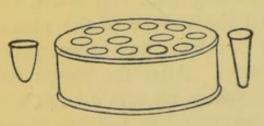
MARTINDALE SUPPOSITORY-PAN.

the top, and  $1\frac{1}{2}$  inch at the bottom. The spout of the pan is  $\frac{3}{4}$  inch wide where it joins the pan,  $\frac{1}{4}$  inch deep, and it narrows to  $\frac{1}{4}$  inch, so that it is easy to fill the mould—in fact, this is a perfect suppository-pan for the dispensing-counter. (See *The Chemist and Druggist*, xli. 273.)

The Mould is the next requisite in suppository-making. Metal moulds are the best, but it is a good pharmaceutical accomplishment to be able to make a mould of any size when wanted. The French do that by twisting paper into cones (as in making a paper bag), and sticking each cone into a box of linseed meal. Another way is to make some suppositories of white wax; then take a box of suitable size, about 1 inch deep, and nearly fill it with plaster of Paris, made very thin with water. Next place the wax suppositories at equal distances apart along one side of the box, leaving them half above the plaster; allow to set hard, and oil the surface of the plaster well. Now raise the sides of the box by rolling brown paper round it, then pour in more plaster. After the plaster has properly set separate the parts, trim them up with a knife, and boil for at least half an hour in linseed oil to toughen them. In trimming the edges of the mould two notches should be made on each side so as to fix them properly when the mould is required. After casting and cooling the suppositories the top half is lifted off first, and the suppositories pushed out from the bottom. Another plan, as in making bougie-moulds, is to carefully wrap tinfoil round an elastic bougie, and place the foil with its mould in a box of chalk. As the elastic bougie is of the same thickness nearly all its length, there is considerable difficulty in drawing off the mould from the model, and the sides of the mould are drawn together. This trouble may be obviated by using a piece of glass tubing same size as a No. 8 bougie. First draw out the end to a point and cut it off about 1/8 inch from where the narrowing begins, then fuse again until the end is rounded off as the bougie is to



be, taking care not to allow the aperture to close. This tube now forms the model upon which to shape the tinfoil moulds. The tinfoil slips more easily from the glass than from elastic gum, and the little hole at the apex allows air to enter as the tube is withdrawn. This plan serves well, and as tubing is generally available the plan may be adopted when smaller or larger sizes of suppositories than the usual are required. The late Mr. H. Bowman Brady, LL.D., F.R.S., was the first to describe the gunmetal mould, and we believe he was the originator of it (Maw made one for him in 1865). Such a mould is shown on page 189. It is made in two pieces, which are hinged together at the base. This is the form now generally in use. An American style consists of a



PARRISH'S MOULD.

circular metal box pierced with holes into which thimbles fit (see illustration). The box can be filled with iced water or a freezing-mixture. The thimbles are filled with the suppositorymixture, dropped into the box,

and owing to the chill the contents of the mould contract, and are easily tapped out when solid. We consider it a clumsy way of working. There is nothing better than the Brady mould. An excellent idea was once put forward in *The Chemist and Druggist* for modifying this mould—viz., to keep it the same diameter as for a 15-grain suppository, but to double its length. The mould thus becomes a nasal-bougie mould, but can be used for any smaller size of suppository.

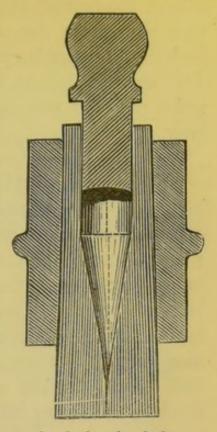
To get the proper quantity of mass into the mould when it was to be partly filled, the originator of the idea got small sewing-thimbles of the requisite capacity, soldered a bit of wire to them as a handle, and with the thimble as a ladle poured into each mould the requisite amount of melted mass. A glance at fig. A, page 181, and fig. o will show the reader that o can be made in the same mould as A.

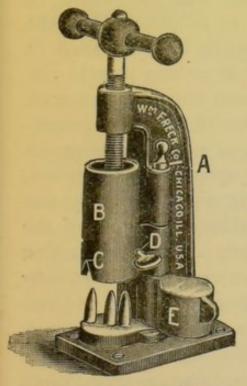
The Cold Method of suppository-moulding has only come into vogue in England during the past few years, but it has been described in this book from the beginning as the only possible method for moulding suppositories of certain compositions, and the first figure, page 187, is a section of a mould re-

commended for the purpose. The mould proper is formed, it

will be seen, of two hollowed-out pieces of metal or hard wood, wedge-shaped externally, so as to fit into the stout ring. The weighed quantity of material is pressed well into the mould by means of the stopper, as shown.

Much more elaborate apparatus is now obtainable for cold moulding. In this case the medicament is powdered and mixed well in a mortar with shredded or granulated cocoa-butter (which can be bought in the granulated state). The mass is placed in the cylinder of the machine, B, to the bottom of which a circular mould is attached; by screwing the lever the mass is pressed into the holes of the





'FRECK' SUPPOSITORY MOULDER.

mould. By removal of the bedplate E and giving the screw a turn, the finished suppositories are pressed out of the mould. The apparatus illustrated is one of several on the market. Bougies are made in these machines by attaching a plate to the base of the cylinder in which there is a circular orifice about & inch diameter. On turning the lever the mass comes out through this orifice as a pipe, and is cut into the requisite lengths. If the dispenser cannot get such special apparatus, suppositories can be made by cold compression thus: insert a brass screwnail (with head of less diameter than an ordinary metal suppository-mould) in an awl-handle; also take two pieces

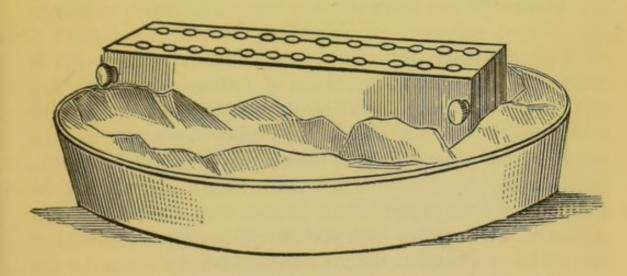
of card the length of the suppository-mould, and bend back at

the level of the mould to an angle of 45°; put a piece each side of the mould, and protect the ends similarly. Tie round with string, put the powdered mass into this trough, and fill each of the holes by pressing with the screw-nail compressor. The ordinary mould-lubricants should be used. Instances in which the cold method is superior to the hot one are given later.

The Cocoa-butter Basis is used when none is specially indicated on the prescription. The following is the *modus* operandi for the hot method:—Weigh the basis (using at least I grain more than theory requires), and melt as already indicated; then, if the prescribed medicament allow, it should be finely powdered, and rubbed down with a little of the melted basis to a creamy consistence on a pill-tile which has been made nearly as warm as the hand; transfer this mixture while still creamy to the suppository-pan, stir until it begins to thicken, then pour into the mould.

In case an aqueous extract (which does not admit of powdering) is an ingredient, proceed as follows:-Melt the cocoa-butter, and keep on the water-bath until required (it must be kept at a temperature just over its melting-point); rub the aqueous extract and other medicament with a little water on a cold pill-tile to creamy consistence, transfer to an ointmentslab (which has been warmed in water to the body temperature), pour a little of the melted basis upon the medicament, and stir until it begins to thicken; manipulate rapidly and vigorously as an ointment, gradually adding the whole of the melted basis, so as to produce a perfectly uniform preparation before it becomes harder than a soft ointment; quickly transfer the whole to the dish, and warm cautiously, stirring continuously, until it is just fluid enough to pour into the mould. Tannic acid, or any other incompatible, must not be mixed with the aqueous extract: it should be separately rubbed down with a little of the melted basis on a slightly-warmed slab, and added just before pouring into the mould. Some dispensers use a quinine-bottle for melting the basis by putting it in a pan of hot water. This receptacle has the advantage of being easily shaken so that the contents can be well mixed.

A well-made suppository will slip readily from the mould, it has a perfectly uniform appearance throughout, and a fine polished surface. To secure this result, careful attention must be paid to the lubrication of the mould and to the method of pouring. If the mould be cold, and its surface highly polished and quite free from grease, no lubricant is needed, or perhaps the inner surface may be breathed upon just before filling; in either case, the mould should not be opened until plenty of



MOULD COOLING ON ICE.

time has been allowed for the suppositories to become thoroughly hard. When this involves too much delay, the mould should be wiped with a piece of lint dipped in olive oil, or it may be coated with a mixture of soap liniment (1 part) and glycerin (3 parts). The coating must be thin, and evenly distributed with a little cotton-wool or lint. Too much soap in the lubricant emulsifies the surface of the suppository, and gives it a whitened and uneven appearance; too little prevents the glycerin from remaining thinly distributed—then the suppositories adhere to the mould, and may break in extracting. The melted suppository-mixture should be poured into the mould just as it is beginning to solidify; if too hot, any medicament not in solution may subside and accumulate at the apex of the

suppository. In very hot weather it will be found necessary to put the filled mould on the floor of a cold cellar for half an hour to cool; but it is usual when suppositories are urgently required, to place the mould on a plate and surround it with lumps of ice, as shown on page 189. Never put the mould under water until after the suppositories have set.

If expeditiously and properly done, the suppositories, when cool, should slip from the mould without the least trouble, having a beautiful polished finish, and, what is more important still, having a uniform composition and structure, and not with the active medicinal agent all concentrated at the apex, as is always the case when the heat applied has been excessive.

The Melting-point of cocoa-butter (about 93° F.) is lower than the normal temperature of the human body (98° F.), and the fat is in consequence considered to be an ideal basis for suppositories, but it is customary during the summer months and in warm countries to add from 1 to 3 grains of white wax to each 15-grain suppository in order to keep the mass firm; the addition does not imperil the therapeutic efficacy of the suppositories. Dispensers should, however, keep the fact in mind that some medicaments raise the melting-point of cocoa-butter, either by chemical action upon it or by retarding fusion. This matter was investigated by Mr. T. Maltby Clague (The Chemist and Druggist, xxxviii. 800), and his results are well worth quoting. In 1890 a correspondent submitted suppositories prepared according to the following prescription, with the complaint that they remained solid in the rectum:—

Misce et divide in suppositoria sex.

We found the melting-point of the suppositories to be 113° F., so that it had increased by at least 18° F. Mr. Clague, taking the matter up, compounded several suppository-masses, kept them under observation, and noted that with the

ingredients mentioned below the melting-points were raised as stated:—

```
Ferric nitrate (10 per cent.) . . raised the melting-point 18° F.
     ,, mixed cold and allowed to stand six
Nitric acid (10 per cent.) . . .
                                                 28° F.
Silver nitrate (0.3 per cent.), after two years
                                                 17° F.
Bismuth oxide, after two years . . .
                                                 17° F.
Lead acetate (5 per cent.) . . .
                                                 10° F.
Lead carbonate (20 per cent.)
                                                 12° F.
Tannic acid (20 per cent.) .
                                                 13° F.
                        . .
Zinc oxide (25 per cent.) .
                                                 14° F.
```

There seems no doubt that the rise in melting-point is due in these cases to interaction between the substances and the fat, metallic salts of the fatty acid being formed in some cases. Mr. Clague proved this with the bismuth, lead, and zinc suppositories, while the ferric salts doubtless raised the melting-point through the influence of their acid radicles. One may tell quickly whether a suppository will melt or not by placing a small piece of it in the mouth; should it remain hard a little oil or lard must be added to the mass.

### OTHER FATTY MEDIA.

Mr. Martindale has spoken highly of a mixture of equal parts of stearic and oleic acids as a substitute for cocoa-butter; the advantages which he claims for it are that—(1) the mixture has a very low fusing-point, and readily melts at the temperature of the body; (2) the suppositories leave the mould without difficulty; (3) it has the advantage, besides being a solvent of such alkaloids as pure morphine, atropine, cocaine, &c., of being, at least as far as the oleic acid is concerned, readily absorbed by the skin and mucous membrane; (4) on account of the partial crystallisation of some of the stearic acid, the suppositories are firm, and can be placed in their position without difficulty, not being elastic, brittle, or yielding in any way; and

(5) the proportions of stearic and oleic acids can be varied to suit the temperature of summer or winter, and also the other ingredients prescribed with them. These opinions were expressed many years ago, but cocoa butter has maintained its pre-eminence. Cocoanut stearin is better than ordinary stearin or than Mr. Martindale's mixture. It was long ago recommended by Dr. Bowman Brady, and Squire speaks well of it. Mr. C. J. S. Thompson finds a mixture of 4 ounces of the stearin and 340 grains of white wax suitable. The stearin itself melts at 84° F., and is just right for cold climates without the wax.

The Gelatin Basis.—Although sometimes employed in making pessaries, this basis is generally considered to be not nice for these, as the gelatin mats the pubic hairs, and the only advantage which the basis possesses over cocoa-butter is the contained glycerin—frequently a valuable therapeutic agent in uterine troubles. The basis is much used for nasal bougies. The following are recommended formulæ:—

THR	OAT	HOSP	ITAL.		
Gelatin .					5 oz.
Glycerin					6 oz.
Water .					6 oz.
All by	weigh	nt.			
			16	100	

Soak the gelatin in the water for twelve hours, add the glycerin, dissolve on a water-bath, and evaporate until the mass weighs 15 oz.

S	0	п	T	R	H.	S.
2.0	1	~	*	-	**	-

Gelatin		I	oz.
Water		I	oz.
Glycerin		31/2	fl. oz.

Soak the gelatin in the water until absorbed, add the glycerin, and dissolve by the heat of a waterbath.

The British Pharmacopæia formula is substantially Squire's, but the B.P. directions are not so good as Squire's. The finest French gelatin, in thin, almost colourless sheets, should be used. It is right to observe that one mass is not universally applicable, because various medicaments act upon it in diverse ways, rendering the suppositories too hard or too soft, as the case may be. Ochse gives the following hints as to the use of the gelatin basis:—

Where gelatin suppositories are frequently dispensed it is best to have a definite mass in stock. This is made in large

quantities or small, according to the requirements of the pharmacist. After removing the scum from the solution the latter is poured into bottles, and when thoroughly cooled covered with alcohol to prevent it from becoming mouldy. When wanted for use the alcohol is drained off, the bottle placed in a water-bath, and the required quantity poured off. The mass is made as follows: The accurately weighed gelatin is allowed to macerate overnight in distilled water, and drained on a sieve. The gelatin adhering to the sieve is col-- lected, the whole placed in a tared porcelain dish, and sufficient water added to make the weight four or five times as much as the original quantity of gelatin used. The dish is placed on the upper ring of a retort-stand and heated over wire gauze with a gas or spirit-lamp flame, care being taken not to burn the gelatin. The glycerin is added (in all the subjoined formulæ the parts are to be by weight) and the whole evaporated to the consistency required, viz. :-

I. Gelatin 20 parts, water 80 parts, glycerin 40 parts; evaporated to 60 parts. Intended for preparations kept in stock and for those which are to retain their transparency.

II. Gelatin 10 parts, water 40 parts, glycerin 15 parts; evaporated to 25 parts. For hygroscopic drugs, for bougies of perchloride of iron (made by dissolving 1 part of ferric chloride in 9 parts of water, and adding to 19 parts of the mass), for tannin suppositories (0.2 per cent.—but this recommendation is opposed to theory), and for vaginal pessaries containing iodide or bromide of potassium, bromide, chloride, or salicylate of sodium, and ergotin. Chloral-hydrate suppositories are made with this mass, the hydrate being dissolved in as little water as possible.

III. Gelatin 10 parts, water 40 parts, glycerin 20 parts; evaporated to 50 parts. For suppositories generally, also in special cases, as for carbolic acid (and similar medicaments soluble in a small quantity of alcohol), which are made by adding 3 parts of carbolic acid, previously dissolved in alcohol to 7 parts of glycerin and 50 parts of this mass. To make alum bougies, liquefy 25 parts of the mass and 10 parts of

distilled water on a water-bath. To this add a hot solution of 7 parts alum, 10 parts glycerin, and 5 parts distilled water. The whole is then evaporated with gentle stirring to 35 parts. The mixture becomes thick and turbid on adding the solution of alum, but, on heating over a water-bath and stirring carefully, it soon becomes clear and transparent.

IV. Gelatin 10 parts, water 40 parts, glycerin 30 parts; evaporated to 60 parts. This mass is used for certain vaginal pessaries, and for urethral bougies, especially those containing sulphate of zinc, sulphate of copper, nitrate of silver, extract of opium, hydrochloride of morphine, and bichloride of mercury. One part of any of them is dissolved in a little water, and then added to 99 parts of mass and poured into moulds. If it is desired to make a large quantity of sulphate of copper bougies, it is best to mix not more than the mould will hold at a time, because by frequently heating the mass the bougies acquire a yellowish-green instead of a blue-green colour.

V. Gelatin 30 parts, water 120 parts, glycerin 15 parts; evaporated to 104 parts. Used for bougies containing a large percentage of powdered drugs insoluble in water or alcohol. Thus 50 per cent. bougies of iodoform are made by adding 27 parts of powdered iodoform to 54 parts of mass. When taken from the mould the bougies are placed in a drying closet until they weigh about two-thirds of their original weight.

The quantities of medicaments indicated may, of course, be modified. Those given serve to show how the active ingredients are added.

In making suppositories with the gelatin basis, the mould should be cold, clean, and quite dry; then thinly coated inside with almond oil. When turned out the suppositories should be wiped with a dry cloth in order to remove the oil, or placed for this purpose on a sheet of filtering-paper. A mortar or slab is not convenient to use with this basis; it is simply melted in a dish, and the medicament stirred in until thoroughly dissolved or diffused. The gelatin basis is well adapted for the exhibition of alkaloids and aqueous extracts,

but not for tannin, carbolic acid, or bromide and iodide of potassium.

## HINTS FOR SPECIAL CASES.

The following paragraphs deal with substances which either do not 'go' according to rule, or which illustrate principles that may be adopted with similar substances.

Anusol, or bismuth iodo-resorcin sulphonate, is a remedy solely used as suppositories, the following being the prescription:—

Anusol				Dv. gr. xij.
Zinci oxidi				3iss.
Balsami peruvi	iani			mxx.
Olei throbroma	atis			3v.
Unguenti resin	næ			Đij.

Misce et divide in suppositorios xij.

It will be seen that each suppository weighs almost 50 grains—an excessive size; but the prescription is German, and is quoted partly as an instance of German methods.

Aristol (see page 405) is sometimes prescribed in bougies for nasal affections and for urethral discharges. It decomposes readily on the application of heat. A prescription ordering 10 grains in a bougie, when compounded with 12 grains of cocoa-butter, gave a tough indiarubber-like mass by the hot method, a better one with 10 grains of cocoa-butter and 3 grains of spermaceti ointment; but the bougie is best made by the cold method, using cocoa-butter alone.

Balsam of Peru is now getting into greater favour as an antiseptic. The following is a typical prescription for it:—

```
Balsami peruviani . . . . . gr. x. Iodoformi . . . . gr. v. Olei throbromatis . . . ad 3j.
```

Fiat pessus. Mitte tales duodecim.

The balsam makes the mass much too soft if cocoa-butter alone is used. It mixes easily with the fat, and that may tempt the dispenser to add it to the dish, which should not be done. The best plan of compounding is: Take 540 grains of cocoabutter and 60 grains of white wax, shred and melt on the water-bath. Mix the iodoform (subtilissimum) on a slab with the balsam, then add about a third of the melted basis, mix well, add a little more basis, again mix, and transfer to the dish, stirring all the time, then pour into the mould.

Boric Acid makes the cocoa-butter basis crumbly, and when compounded by the hot method the mould should be well lubricated with soft-soap lubricant (1 in 10 of water). The best suppository of boric acid is made with glycerinum acidi borici B.P. and gelatin on Squire's plan (page 192).

Bougies are sometimes made on the Continent in the following manner: Glass tubing of suitable calibre is cut into convenient lengths, and the melted mass drawn into it by attaching a piece of indiarubber tubing to one end, and sucking the mass up. The mass solidifies in a few minutes, and is then pushed out with a piece of iron wire of sufficient thickness to go into the tube like a piston. Care should be taken that bougies are not made too hard. It is inadvisable to add wax to cocoa-butter in this case, but a mixture of cocoa-butter 2 parts, lanoline 1 part, and white wax 1 part, gives a tough mass which melts at the body-temperature, and is better than cocoa-butter alone.

Chloral Hydrate behaves with cocoa-butter much in the same way as it does with camphor, especially when heated. A mass containing 60 per cent. of chloral hydrate may be made as follows: Into a small wide-mouth bottle put I drachm of shredded white wax, and melt on a water-bath; then add 3 drachms of powdered chloral hydrate, shake well, and add I drachm of cocoa-butter previously melted. Continue to shake until creamy, then mould. Cocoa-butter alone may be used by the cold method along with powdered chloral hydrate.

## The following illustrate other methods:-

I.		
Chloral, hydrat.		gr. v.
Ext. cannab. ind.		gr. j.
Ol. theobrom		q.s.
Fiat suppositor	ium.	

Melt the cocoa-butter and pour into a well-lubricated and iced mould. Allow to stand for a minute so that the outer layer of fat becomes quite hard, and the inner remains liquid, then invert the mould to allow the liquid fat to flow out. Trim the hollow suppositories and put into each the doses of chloral hydrate and extract previously mixed, then fill up with melted cocoa-butter.

Chloral hydra	te		2	parts
Oleic acid			1	part
Stearin .			3	parts

II.

Melt the stearin on a water-bath and add the oleic acid, mix; next add the powdered chloral hydrate, stir until dissolved, and just before the mass begins to set pour it into an iced mould previously well lubricated with spirituous solution of curd soap.

No. I. method is an ingenious way, suggested by Mr. A. H. Morgan, of getting over the difficulty which frequently arises of mixing certain things with the basis. It is really an extemporaneous method of making hollow suppositories.

Cocaine.—If the pure alkaloid is prescribed alone in suppositories it should be dissolved in the melted cocoa-butter (solubility I in 12). Medical men sometimes forget to add 'hydrochlor.' or 'mur.' in prescribing cocaine suppositories and pessaries (the latter are much used for vaginitis), and many dispensers hold in this case that the pure alkaloid should be used and dissolved as stated. It is probable, however, that the finely-powdered hydrochloride would give a more efficacious suppository, as it would be absorbed directly it touched the mucous membrane, while it is doubtful if a moist surface could extract the alkaloid from fatty solution. This suggestion is supported by the statement, on high medical authority, that 'carbolic oil is worthless as a disinfectant; it does not liberate the carbolic acid to moist surfaces.' The hydrochloride and other substances easily soluble in water may be dissolved

on the slab with an equal quantity of water, and then thoroughly mixed with the suppository-basis; but when other medicaments are prescribed along with the salt, which may involve chemical decomposition, it is better not to use water. Powder the ingredients finely, and rub separately with a little of the melted fat before finally mixing together.

Ergotin presents little difficulty when the dose is 3 grains or under, but 5-grain suppositories are not uncommon, and we have seen as much as 8 grains prescribed. With cocoa-butter the procedure is the same as with extracts, a little wax being added to the cocoa-butter, and care being taken to incorporate the ergotin with half of the melted fat. An excellent suppository is made with the gelatin basis, the ergotin being thinned, if necessary, with a little water and added to the melted basis.

Extract of Belladonna.—The alcoholic extract is prescribed by the British Pharmacopæia for suppositoria belladonnæ. The liquid extract (from which the solid extract is made) may be used in the proportion of 4 minims for 3 grains of dry extract.

Extracts.—It suffices in the case of most extracts to rub the prescribed quantity to thinness on a slab with a little liquid appropriate to the extract (water or proof spirit); then add as much of the melted basis, mix, and so on until half the basis is used, return to the dish, mix well, and pour into the mould.

We have never had any difficulty with even large quantities of green extracts by taking care to soften the extracts with water, and to mix them intimately with the melted, but not too hot, fat, as in the following case:—

Fiat suppos. Mitte vj.

Powder the bromide as finely as possible, and place it on a slab; rub down the extract on the slab with 3 to 5 drops of

water. Melt 50 grains of cocoa-butter and 5 grains of white wax over a water-bath, and rub up more than one-half of it with the medicaments on the slab. Then transfer to the dish containing the rest of the basis, mix expertly, slightly heating if necessary, and pour into the mould.

The following prescription would be a simple one to compound were it not for the presence of the tannin, so that it is inadvisable to melt the basis:—

Ext. bellad. virid. . . . . . . . . . gr. iij. Plumb. acet. . . . . . . . . . . . . gr. iij. Ac. tannic. . . . . . . . . . . . . . . . . . gr. iv. Ol. theobrom. q.s. ut ft. suppos. gr. xv.

Mitte vj.

The simplest method of dispensing these is to take 54 grains of cocoa-butter for the six suppositories and shave it into shreds; soften the extract in a warm mortar with a few drops of water, mix the butter intimately with this, add the tannin and the lead acetate, each in fine powder, and work up like a pill-mass; weigh out each suppository and press into the mould.

We quote the following on account of the large dose of extract of opium, rather than for any inherent difficulty which it presents:—

Ext. opii . . . . . . . . gr. iij.
Ext. belladonnæ . . . . . gr. j.
Ol. theobromatis . . . . . . . gr. xx.

Fiat suppos.

It is advisable in this case to use 18 grains of cocoa-butter and 2 grains of white wax (which in all these cases is beneficial). Rub down the extracts in a mortar with sufficient water to make a smooth soft paste; add half of the fatty matter to this gradually, so that a perfect mixture may be obtained. Then transfer it to the dish, and dissolve in the remainder of the fat, aiding the process by the heat of a waterbath if necessary. In making masses for above two dozen suppositories a 1-ounce quinine-bottle is excellent for melting

the basis and mixing, a pan of hot water being used as the water-bath.

Galls.—The powder of galls, like tannin, cakes easily in melted cocoa-butter, especially if the latter exceeds 130° F. in temperature. Dispensers should learn to melt the fat so that it is not much above 100° when all is melted, which is easily done by shredding the butter fine or using the powdered article. In the following case it is impossible to use water with the extract, as it helps to cake the powdered galls:—

Pulveris gallæ . . . . . . . . . . . gr. xx

Extracti belladonnæ . . . . . gr. iij.

Olei theobromatis . . . . . q.s.

Ut fiat suppositoria sex.

The best plan with this is to beat all the ingredients together in a warm mortar until a uniform mass is produced, and mould in the cold way; or warm gently to 110° F., stirring all the time, and pour into the moulds.

Glycerin.—For rectal purposes the British Pharmacopœia gelatin mass is as good as anything, but for pessaries either of the following is better:—

Stearin soap . . . I part
Glycerin . . . 19 parts
Dissolve the soap in the glycerin
by the aid of heat and pour into
moulds. (Glycerin by weight.)

***	
Stearic acid	75 gr.
Sodium carbonate	45 gr.
Glycerin (by weight)	15 dr.

Dissolve the carbonate in the glycerin on a water-bath, add the acid, stir until effervescence ceases, and pour into moulds.

The second is the United States Pharmacopæia formula. Both are substantially the same in result, and the finished suppositories or pessaries have to be wrapped in tinfoil. Agar-agar (Japanese isinglass) has been recommended in place of gelatin. A good mass is made by soaking 1 part of agar-agar in 5 parts of water, adding 25 parts of glycerin, and dissolving.

Hamamelis Suppositories.—These may be made with the liquid extract of the leaves—5 minims in each suppository, evaporated to one-half its bulk, with a cocoa-butter basis. The following is a rare prescription which illustrates the power of fats to take up liquids by gentle coaxing:—

Misce. Fiat suppositoria xij.

Cocoa-butter was intended as the basis. The way to compound is: Melt on the water-bath 100 grains of cocoa-butter and 5 grains of white wax. Put the solid active ingredients on a slab and rub well down with hazeline, then pour some of the melted basis on it and mix, more hazeline and basis, mix, and so on until the whole is thoroughly compounded. Transfer to the dish, stir, and in about a minute the mass should be ready for pouring. The official powdered extract of belladonna gives the best results. Those who are not good slab-workers should use a warm mortar.

Iodine.—Use the gelatin basis. With cocoa-butter there is a certain amount of absorption, and the melting-point is raised. Dissolve the iodine with potassium iodide and the minimum of water before adding to the gelatin basis (see page 203).

Iodoform.—The slightest overheating of iodoform in cocoa-butter makes it cake into intractable masses. See the example on page 195. When possible make the suppositories in the cold way, but if due care is observed in the hot method the iodoform will not cake. Observe these points: (1) Melt the basis (well shredded) on a water-bath, not over a flame. (2) Stir all the time, and as soon as almost all the basis is melted remove the heat from the water-pan. (3) Take half the melted basis to mix with the iodoform on the slab. Do this

quickly. (4) Return the mixture to the basis-dish, stir until well mixed, heating slightly if need be, and pour into the mould.

Ichthyol.—The gelatin basis should on no account be used, as the ichthyol makes it insoluble. Use cocoa-butter alone without wax.

Linted Suppositories have already been referred to. They are used in surgical operations of the rectum, and are made by taking a tuft of lint about 3 inches long, dipping the tip into melted cocoa-butter until of the right size, and then moulding by rolling on a slab with a palette-knife. The cocoa-butter may be medicated. Watson-Cheyne's bougies are made similarly. In this case soft cotton, such as is used to make spirit-lamp wick, is coated to the extent of 4 inches with the medicated cocoa-butter.

Nutritive Suppositories.—These are 60-grain suppositories made with cocoa-butter or gelatin basis and dry or paste peptone. Six drachms of Mosquera beef meal and I ounce of cocoa-butter make a good mass either by the cold or hot method.

Oils (Essential).—Mixtures of cocoa-butter and essential oils are lower in melting-point than the cocoa-butter itself, hence it is necessary, in many cases, to use as much white wax as the essential oil prescribed. This, however, is not always admissible, as the following examples show:—

1					II.		55	
Pulv. iodoli .			gr. j.	Plumbi iodidi				gr. ij.
Ol. eucalypti .			mij.	Tannin				gr. ij.
Ol. theobromatis			q.s.					gr. j.
Fiat cereolus.	Mitte	vj.		Ol. eucalypti				mv.
				Ol. theobrom.				q.s.
				Fiat supposi	itori	um.	Mit	te xij.

In the first case 2 grains of white wax is added to each bougie. In the second, although more essential oil is

present, the tannin and other dry ingredients elevate the melting-point (compare page 191), and a satisfactory mass is obtained by using 13 grains of cocoa-butter alone for each suppository. Reduce the bulk of the tannin by trituration in a mortar, transfer to the slab, and mix with the other powders and the eucalyptus oil, using a bone spatula; then add some of the melted cocoa-butter, transfer to the basin, mix well, and pour into the mould.

Salts in Suppositories.—The settling of the active in gredient of some suppositories at the apex has already been referred to. We have seen bromide-of-potassium suppositories sent out with all the bromide at the point, forming a hard and gritty mass, which must have been disagreeable to the patient. This is inexcusable, and need never occur if care be taken to have the substance first thoroughly impalpable, and then incorporated with a part of the cocoa-butter previous to adding to the melted portion at a temperature a little over the meltingpoint. There is, moreover, another evil attending the overheating of the mixture, where powders of a ponderous nature, such as bromide and iodide of potassium, or acetate and iodide of lead, are ordered-namely, the impossibility of an equal division of the substance. The powder falls to the bottom of the dish, owing to the fluidity of the cocoa-butter, and no amount of stirring or dexterity of manipulation will ensure its equal distribution. The cold method is especially suitable in such cases.

It is in this class of suppositories that the gelatin basis has the advantage—for instance, in the case of iodine, which should have a little potassium iodide added to render it soluble—

Iodi				gr. ij.
Potassii iodidi				gr. iss.
Gelat. glycer.				3iss.

Finely powder the iodine and iodide, stir with a *little* of the melted basis until entirely dissolved, then add the rest of the basis.

Tannin.—The observations made in several of the preceding paragraphs sufficiently indicate the points which should be observed in compounding tannic acid—or, indeed, any astringent substance—into suppositories. Compare especially the paragraphs on Galls and Iodoform.

Tincture of Benzoin (Compound).—A pessary containing 10 minims of this and 50 grains of cocoa-butter could not be made by heat, but the ingredients blended well in a mortar by pounding, and each pessary was moulded by cold compression.

#### STRENGTHS OF BOUGIES.

The following are the average doses of medicines for adults given in this form:—

NASAL		
*Acid. carbolic.		gr. ss.
*Bismuth. subnitrat.		gr. v.
Cocainæ hydrochlor	r	gr. 1/6
*Cupri sulphat.		gr. 1/16
*Iodoformi .		gr. ss.
*Morphinæ acet.		gr. $\frac{1}{10}$
*Ol. pini sylvest.		mss.
*Plumbi acet		gr. ss.
*Thymol		gr. 1/10
*Zinci sulphat.		gr. 1/10

\* These are Throat Hospital preparations, and are to be made with 40 grains of gelatin basis.

#### URETHRAL.

Acid. gallic. . gr. j.

8	2. 1.
Acid. tannic	gr. j.
Argenti nitrat	gr. $\frac{1}{4}$ to gr. j.
Bismuthi oxidi .	gr. v. to gr. x.
Bism. oxychlor	gr. v. to gr. x.
Bism. subnit	gr. v. to gr. x.
Cocainæ (& salts)	gr. ss.
Cupri sulphat	gr. j.
Ext. bellad. alc	gr. 1/4 to gr. j.
Ext. opii	gr. ij.
Ferri perchloridi.	gr. ss. to gr. j.
Iodoform	gr. v.
,, c ol. eucalypt.	mv. to mx.
Morph. hydroch.	gr. j.
Ol. eucalypti .	mv. to mx.
Plumbi acet	gr. ss. to gr. j.
Salol	gr. x.
Thallin. sulph	gr. iij. to gr. v.
F41 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	gr. \(\frac{1}{4}\) to gr. \(\frac{1}{2}\)
Zinci sulph. exsic.	gr. ss. to gr. j.

### STRENGTHS OF PESSARIES.

The following are the average doses for adults of medicines given in this form:—

Acid. boric gr. x.	Ferri perchlorid gr. v.
Acid. carbolic gr. ij.	Ferri sulphat. exsic gr. x.
Acid. gallic gr. x.	Hydrarg, oxid. rub gr. ij.
Acid. tannic gr. x.	Iodoform gr. v.
Aconitin gr. $\frac{1}{36}$	Maticæ gr. x.
Alum gr. x.	Morphinæ hydrochlor gr. ss.
Alum and catechu of each. gr. x.	Ol. eucalypti 3ss.
Argenti nitrat gr. j.	Opii pulv gr. ij.
Atropinæ gr. $\frac{1}{20}$	Plumbi acetat gr. viiss.
Atropinæ sulphat gr. $\frac{1}{40}$ )	Plum. acet. c opio . gr. ij.
Morphin. acet gr. ss.	Plumbi iodid gr. v.
Bismuthi oxidi gr. x.	Plum. iod. $\bar{c}$ atrop. sulph. gr. $\frac{1}{20}$
Bismuthi subnit gr. xv.	Potassii bromid gr. x.
Boracis gr. xv.	Potassii iodid gr. x.
Chloral. hydrat gr. x.	Quininæ hydrochlor gr. xv.
Cocainæ gr. ss.	Sodii carbonat gr. xv.
Coniinæ mss.	Ung. hydrarg gr. xgr. xxx.
Ext. belladon. virid. , gr. iij.	Zinci oxidi gr. xv.
Ext. belladon. alc. gr. ssgr. j.	Zinci sulphat gr. x.
Ext. conii gr. v.	Zinci sulphocarbol gr. x.
-	

# STRENGTHS OF SUPPOSITORIES.

The following are the average doses for adults of medicines given in this form :—

Acid. boric			gr. v.	Cambogiæ gr. iij.
*Acid. carbolic.			gr. j.	Chloral. hydrat gr. v.
Acid. gallic			gr. iij.	Cocainæ gr. ss.
*Acid. tannic			gr. iij.	Cocainæ hydrochlor. gr. 1-gr. j.
Aloin			gr. j.	Coniinæ hydrobromat. gr. 1-gr. ss.
Argenti nitrat.			gr. j.	Cupri acetat gr. ij.
Atropinæ .			gr. $\frac{1}{20}$	Cupri sulphat gr ij.
Bismuthi oxidi			gr. x.	Elaterii gr. ss.
Bismuthi oxychlo	ridi		gr. x.	*Ext. belladonn. alc. gr. iss.
Bismuthi subnit.	. gr	. v	gr. x.	Ext. belladonn. vir. gr. ssgr. ij.
Boracis			gr. v.	Ext. hamamelid gr. ss.

Ext. krameriæ gr. viij. c	Iodoform. gr. iij. ē ol.
morph. hydrochlor gr. 1/10	eucalypti mv.
Ferri perchlorid gr. ij.	Morphinæ hydrochlor. *gr. \frac{1}{4}-gr. ss.
Gallæ pulv. gr. v. and opii	Opii pulv gr. j.
pulv gr. j.	*Plumbi acet. gr. iij. c opio gr. j.
Gummi rubri gr. v.	Plumbi iodid gr ij.
Gum. rub. cext. nuc. vom. gr. j.	Podophylli res gr. j.
Hamamelin gr. jgr. ij.	Santonin gr. iijgr. vj.
Hamamelin. c̄ opio . gr. ½	Zinci oleat gr. v.
Ichthyol gr. ij.	Zinci oxidi gr. v.
*Iodoform gr. iij.	Zinci sulphat gr.ij.

Those marked with an asterisk are the British Pharmacopœia strengths.

In Dispensing Bougies a layer of cotton-wool should be placed at the bottom of the box and a piece of waxed paper over it, then the bougie should be put in flat, and if there is more than sufficient for one layer cover the first with waxed paper, a piece of cotton-wool and waxed paper again. Pessaries and suppositories may be dispensed similarly, but partitioned boxes are more suitable for these. It is sometimes advisable to wrap each bougie, pessary, or suppository in tinfoil or waxed paper, especially if the compound is hygroscopic (e.g., glycerin) or volatile (e.g., eucalyptus oil).

# OINTMENTS.

OINTMENTS are fatty compounds, of the consistence of butter, for external application. It is supposed that they should soften or liquefy when applied to the skin, so as to permit the medicament contained in them to exert its influence upon the cuticle or even be absorbed, but a class of ointments, known as cerates, maintain their firm consistence when so applied, these being intended more as protectives than as medicinal agents. An ointment of the former class, such as zinc ointment, when applied to the skin upon lint, melts completely and soaks into the lint; while one of the second class, such as boric ointment, remains soft and like a plaster even when removed after a day. These considerations scarcely come within the compounder's province, except in so far as he should see that all ointments which he dispenses are capable of being spread easily upon lint. This is partly a matter of melting-point, but not entirely so, seeing that cocoa-butter, a substance as hard as wax, has a lower melting-point than lard; but it is generally recognised that ointments should melt at about 100° F., and cerates at about 120° F.

The most commonly employed bases or vehicles for ointments are (1) lard, (2) mixtures of oil and wax, (3) soft paraffin or vaseline, and (4) wool-fat or lanoline. Of these the least changeable through atmospheric influence or the action of chemicals is soft paraffin, next to it comes wool-fat, then lard and oil-and-wax mixtures, which are extremely liable to become rancid. Bases also differ in properties. First in respect to absorptive power they are notably distinct. Physiological experiments by several observers place the bases in the following order, as regards rapidity of absorption of

chemicals from them: first, wool-fat; second, lard and combinations like simple ointment; and a bad third, vaseline. It has been found that chemicals compounded with lanoline applied to the skin show themselves in the urine before corresponding compounds with other bases. Again, a strychnine ointment made with lard (1 in 4) applied to the shaved scalp of a 12-lb. dog killed it in twenty minutes, but a similar ointment made with vaseline produced no effect. On the other hand, Dr. A. P. Luff experimented with ointments of potassium iodide, by an exosmosis process—the ointment was put in a bladder, the bladder in water, and the test-reagent added to the water. It was found that the vaseline ointment gave the iodide reaction in one hour, the lard one in nine hours, and the lanoline none at all at the end of twenty-four hours. We mention these results, but must add that the experience of others is entirely opposed to Dr. Luff's conclusions.

Another characteristic which distinguishes the ointment-bases is their relative miscibility with water. A good deal of work has been done on this subject, but the following results by Scoville and Loftus are the latest and fullest. They represent parts by weight of the respective fluids absorbed by 100 parts of the bases after diligent mixing:—

Basis Used.	Water.	Sat. Sol. Zn Sulph.	Liq. Plumbi Subacet.	Pot. Iod. Sol 1-2.	Sat. Sol. Sod.Chlor.
Lard	$ \begin{array}{c} 12-16 \\ 20 \\ 20 \\ 12-23 \\ 7\frac{1}{2}-11 \\ 216 \end{array} $	34 37 28 23 140	90 75 22 15 212½	30 40 25 22 <sup>1</sup> / <sub>2</sub> 185	20 30 27 23 120

In comparing these figures the fact should not be overlooked that the volumes do not differ so greatly, owing to the greater densities of the salt solutions compared with water.

# GENERAL INSTRUCTIONS

For compounding ointments a slab of marble or porcelain and a steel or horn spatula are generally employed, but if the ointment contains an insoluble powder the mortar and pestle must be used. The slab is all right for experienced operators, but even they cannot be sure that they get the powder equally uniform by this means. The better plan is to put the powder in a mortar, which in cold weather should be warmed with boiling water; if the basis be not too hard or too bulky, the heat of the mortar suffices to liquefy it sufficiently for thorough mixture. The powder is rubbed with a little more than its own weight of the basis until a perfectly smooth mixture is obtained, no appearance of grit being evident to the eye, or to the finger and thumb when a little is rubbed between them. The rest of the basis is then added in portions until the whole is thoroughly incorporated.

Extracts, balsams, or any fluid or semi-fluid should be added in such a state as is best fitted to produce a perfectly homogeneous mixture. In the case of powders a small proportion of the basis is, in the majority of cases, sufficient to reduce them to a fine enough state of division; but in some cases, and often with extracts, a preliminary treatment with some medium, such as oil, water, or spirit, is necessary. Whatever medium is chosen, it should not in any way interfere with or affect the medicinal properties of the ointment. Watery extracts should be rubbed down smooth with a little water before being combined with the fatty basis, and spirituous extracts with a little diluted spirit. Soluble salts, such as perchloride of mercury, sulphate of zinc, and nitrate of silver, which are likely to crystallise, are best rubbed smooth with a little oil or dissolved. Very soluble or deliquescent salts, such as carbonate of potash, iodide of potassium, and chloride of zinc, are best rubbed down with a little water, if this will not favour interaction with other ingredients. Tartarated antimony should be mixed dry with the ointment-basis.

Ointments are prescribed occasionally whose ingredient must be melted. In such cases the hardest ingredient—e.g., wax or hard paraffin—should first be melted by the heat of a water-bath or well-regulated gas-flame, the other fats or oils next added, the mixture stirred until clear, and then strained

through cheese-cloth or fine muslin into the pot. If the mixture has not been overheated, the contents of the pot may be allowed to cool without stirring, as it has been shown that ointments so prepared solidify uniformly and without becoming lumpy; but if the ointment contains any ingredient which may separate on cooling, it is advisable to pour the strained mixture into a warm mortar and triturate constantly until the mass becomes pasty. Liquids are frequently added to ointments in order to impart a cooling property to them, as in the case of cold-cream. In the preparation of these ointments a quasi-emulsion has to be made, and circular stirring towards the dispenser is important. The action must always be slow, and larger quantities of a liquid can be incorporated thus than the inexperienced would deem possible. A striking instance is shown in incorporating liquor plumbi subacetatis with lard. Not less remarkable is the effect on colour : otherwise dark ointments can be rendered nearly white, and with very faint indication of the original colouring ingredient. This is the case with various shades of brown, yellow, or greenish vegetable colours, the exception being with regard to the partial decoloration of certain chemical salts, such as red oxide of mercury.

Order of Mixing is sometimes as important in the case of ointments as in mixtures, e.g.:—

Liq. antim. terchlor.	· .			m v.
Hydrarg. ammon. chlor.				gr. xx.
Hydrarg. nit. ox				gr. xv.
Potassæ subcarb				3j.
Adipis				.3j.

This ointment retains its pink colour if the carbonate of potash be rubbed down with a little lard, but if dissolved in a few drops of water, the final addition of the liq. antim. terchlor. produces a brown colour, due to the formation of ferric hydrate, iron always occurring in commercial samples of 'butter of antimony.' In a fatty medium the incompatibles are slow to react. This is further instanced by the fact that tannin

ointments may with impunity be made with a steel spatula, as no blackening occurs unless an aqueous ingredient is present.

#### SPECIAL MEMORANDA.

Acidum Carbolicum.—Although the solubility of phenol in fats and oils is greater than 1 in 10, it has been found that paraffin ointments prepared by heat, although containing less than that proportion, show separate crystals of the acid on cooling. This peculiarity indicates that the hot mixture is not a true solution, or that the force of crystallisation is stronger than that of solution. It is advisable to prepare such ointments in the cold, by mixing the liquefied acid with the basis.

Acidum Hydrocyanicum Dilutum.—This is to be mixed on the slab with the cold basis, using a horn or bone spatula, and mixing as quickly as possible. Proctor gives the following good example:—

nnæ.					3iss.
ci, Sch.					3ss.
					ъj.
	ci, Sch				

M. Fiat ung.

A thoughtless dispenser might thin the extract (B.P. 1885) with the acid; this should be done with a little water, the lard then mixed with it, and the acid added in drops, mixing expertly on a slab.

Acidum Salicylicum.—Always use horn or bone spatulas for this acid, which sometimes gives rise to unexpected results. For example, the following became quite lumpy on keeping:—

Zinci oxidi .				žss.
Amyli pulv				3ss.
Acidi salicylici .				gr. x.
Adipis lanæ hydro	os			3ss.
Paraffini mollis.				žss.
Olei lavandulæ.			,	mvj.

Fiat unguentum,

The lumpiness was due to formation of zinc salicylate, the water of the lanoline sufficing to bring the acid and zinc oxide together. As the lumpiness arose on keeping, it was avoided by completing the reaction before dispensing the ointment. One drachm of zinc oxide and 10 grains of the acid were triturated in a mortar with 80 minims of water. Separately the rest of the ingredients (170 grains of anhydrous wool-fat) were made into an ointment and added to the mortar-contents and well mixed. It is generally, advisable when a chemical change takes place in an ointment slowly, to bring it about quickly before compounding with the fatty basis.

Acidum Tannicum.—This acid should be compounded with fats in the cold, if possible. First triturate the acid lightly in a mortar, then add its own weight of the basis, and continue trituration for three minutes before adding the rest. This is the plan to adopt with most crystalline substances.

Alkaloids.—It is commonly said that alkaloids ordered in ointments should be combined as oleates, so that they may be certain of absorption. The remarks made on this subject in dealing with suppositories apply equally to ointments. It is not advisable to add oleic acid unless the ointment is to be used by friction. On the other hand, alkaloidal salts, which are readily soluble in water, may be dissolved in the smallest possible quantity of that solvent before being added to the basis, provided the weight of the ointment is not materially increased by the addition.

I.	II.
Atropinæ gr. j. Vaselin. flav	Atropinæ gr. j. Cocainæ gr. j.
M. Fiat unguent. pro oculis.	Vaselini albi
	Acidi borici gr. viiss.

No. I. is the prescription of a well-known London oculist. It is peculiar in prescribing yellow vaseline, because the oculist finds from experience that white vaseline irritates the eye—a fact probably due to the circumstance that the white vaseline is purified with chemicals, which may produce a change in the paraffin. At all events, this is a point from experience against the rule 'white vaseline for colourless ointments, yellow for any other.' The ointment was made by triturating the alkaloid with a few grains of the basis and adding the rest. It acted promptly and perfectly. The prescriber objected to the use of oleic acid because (1) it is not necessary, and (2) it sometimes irritates. Nor did he approve of the 1885 British Pharmacopæia use of rectified spirit for the second reason. From the ointment No. II. atropine crystallised out on cooling. This alkaloid was therefore mixed with the boric acid, the cocaine dissolved in the vaseline, and the two then incorporated.

Camphor.—Rarely prescribed *per se* along with fats, but when that happens the only course is to dissolve the camphor in the melted basis, as in the case of the following prescription:—

Camphoræ					ъj.
Zinci oxidi					zij.
Vaselini					Ziss.

Here put a drachm of flowers of camphor in the vaseline melted in a 1-ounce quinine-bottle placed in a pan of hot water; shake until dissolved (which takes only a few seconds). Put the zinc oxide in a mortar and triturate with a few drachms of the camphorated vaseline until smooth, then add the rest.

Chloral Hydras.—To look at, the following prescription would seem to provide a very hard ointment:—

Chloral .					I	part
Menthol .					1	part
Cocoa-butter					4	parts
Spermaceti.				d.	2	parts

Melt the cocoa-butter and spermaceti, and when getting creamy add the chloral and menthol, previously powdered, and stir until cold. The chloral prevents the basis from becoming quite solid. Compare remarks on page 196.

Chrysarobin ('Chrysophanic acid').—This should be dispensed dissolved, if possible, in the fatty basis of the ointment, but if there is not sufficient fat to form a perfect solution, it is preferable to rub the chrysarobin to fine powder, and gradually incorporate the solid basis with it. In making the official ointment it will be noticed that the chrysarobin dissolves perfectly in the melted basis, but on cooling a part of it crystallises out, and the crystals cause some irritation when applied to the skin. Chrysarobin is more soluble in castor oil than in lard, and, taking advantage of this fact, Mr. J. R. Hill proposed the following formula:—

Melt the wax in the castor oil by the aid of heat, add the tincture of benzoin and the chrysarobin, and continue the heat until the latter is dissolved. Place the lard in a mortar, pour in the other ingredients while hot, mix thoroughly, and continue the rubbing until cold.

In the case of very strong ointments of chrysarobin, the substance and the basis are heated together for ten to thirty minutes, allowed to cool, then well beaten up in a mortar.

Cocaine.—This alkaloid is frequently prescribed to be dissolved in melted vaseline or lard. Ointments containing I of cocaine in 20 when prepared in this way, exhibit microscopic crystals on cooling. It is better to follow the British Pharmacopæia plan (dissolving the alkaloid in four times its weight of oleic acid), or when the ointment is for the eyes simply triturating the alkaloid with the cold basis. The salts should be dissolved in water before mixing with the fat prescribed.

Extracts should always be thinned and the fatty matter added in portions. This is the plan which should be followed in the case of

### Unguentum Hyoscyami (Middlesex Hospital).

Ext. hyos	cya	mi.				3ss.
Adipis						3ss.
Glycerini						3j.

Mix the extract with the glycerin, then add the lard.

Glycerin is most easily incorporated by using a mortar which has been first thoroughly warmed with hot water.

Hydrargyri Perchloridum.—Small particles of mercuric chloride irritate the skin intensely, so that in compounding into ointment it is advisable to triturate with glycerin (2 minims to each grain) before adding the basis. When prescribed along with potassium iodide in ointment, rub together in a mortar until perfectly smooth, then mix with the basis. In this case it is apparently the intention to have mercuric iodide formed before the basis is added.

Ichthyol.—The ammonium ichthyol is generally used, as in the following:—

Ichthyol.					3v.
Aquæ .					3j.
Adipis lanæ					3x.
Paraffini mol	lis				Ziiss.

Fiat unguentum.

This is rather hard to compound, but it can be done satisfactorily by mixing the ichthyol with the water, adding gradually to the wool-fat, then adding the vaseline.

**Iodine** is first rubbed down by itself, then with about its own weight of the fatty excipient. At this point a few drops of rectified spirit should be added, and the rest of the basis then worked in. If any haloid salt, such as iodide of potassium, is to be combined in the ointment, triturate with the salt and sufficient water to dissolve, then work in the basis.

Iodoform in ointments should be reduced to fine powder, and mixed with the cold basis. Heat should not be used. See remarks under Suppositories.

Mercurial Ointments.—A series of experiments published in *The Chemist and Druggist* twenty years ago proved that mercurial ointments may be made with steel knives with impunity, unless an acid or aqueous ingredient be present.

Oleates.—For the preparation of oleates see 'Pharmaceutical Formulas,' page 562, and C. & D., March 30, 1901, page 524. It is important for dispensers to remember that oleates should not be melted in metallic dishes, but in porcelain basins, glass rods or bone spatulas being used to stir or mix them. If the oleates are prescribed for their local effects, and are to be diluted, vaseline is the best diluent; on the other hand, if absorption is not to be retarded, oleic acid should by preference be used, or lard, lanoline, or fixed oil. The oleates of the alkaloids are generally employed without dilution. Most of the metallic oleates are obtainable in the powder form for use as dusting-powder or for making ointments. The following are the accepted strengths of the more common oleates or oleate-ointments:—

Aconitine, 1 grain; oleic acid, 49 grains.

Aluminium.—Oleate, 1 or 2 drachms, to 1 ounce lard.

Arsenic.—Oleate, 20 grains; lard, 1 ounce.

Atropine, 1 grain; oleic acid, 49 grains.

Bismuth Oleate is made into ointments of strengths varying from 5 to 20 per cent. with yellow vaseline as the diluent.

Cocaine, 6 grains; oleic acid, 94 grains.

Copper.—Ten and 20 per cent. ointments are generally used, the diluent being soft paraffin with a fifth of its weight of hard paraffin added to it. Lard is preferred by some physicians. Melt the oleate with the basis and stir until cold.

Iron.—Oleate and lard, equal parts.

Lead.—Hebra's ointment is a favourite remedy in skindiseases. It is generally made by melting lead plaster in its own weight of olive oil, but equal parts of the plaster and vaseline make a much better preparation. Melt the plaster first, then add the vaseline or oil, and perfume with oil of lavender.

Mercury.—Oleatum hydrargyri was official in the 1885 B.P., and contained 10 per cent. of mercuric oxide. It is still much used, also 5 and 20 per cent. Precipitated mercuric oleate is now official. Oleates of mercury and morphine contain 1 grain of the alkaloid in each drachm, irrespective of the mercurial strength.

Nickel.—Oleate, 1 part; lard, 7 parts.

Quinine.—One part of the alkaloid dissolved in 3 parts of oleic acid.

Silver.—One part of the oleate to 9 parts of lard.

Strychnine.—One grain in 49 grains of oleic acid.

Tin.—Oleate, 1 part; lard or vaseline, 7 parts.

Veratrine.—One grain dissolved in 49 grains of oleic acid.

Zinc.—The official 'oleatum' is an ointment. The powdered oleate is preferred in 25 per cent. ointment, with lard or vaseline as the diluent. The powder is largely used for dusting.

Oleates in combination are liable to curious changes in colour—for example, mercuric oleate with ung. potassii iodidi is blue on mixing, but becomes brown quickly, and in a few days it is yellowish white, owing to a series of chemical changes which finally fix the oleic acid as potassium oleate (soft soap). The following are also interesting:—

I.	II.						
Quininæ sulphat. Ung. bismuthi oleat. Ung. hydrarg. oleat.		 3ss. 3ss. 3ss.	Cupri oleatis.  Lanolini ĉ oleo  Fiat unguentur	n.			3j. 3j.
Fiat unguentum.			st bligging my			adr.	

No. I. when dispensed with white soft paraffin as the basis for the oleate ointments became green in colour, but did not change with the unbleached paraffin. This supports the suggestion on page 213. Copper cleate is easily reduced on heating with certain substances. This was found to be the case with No. II. when the cleate was warmed with 2 drachms of lancline, but not so when it was melted with clive oil on a water-bath, and the lancline added when nearly cold.

Percentage questions in respect to the oleates sometimes give rise to divergence of opinion. Thus in a prescription (1897) 'oleat. zinci (5 per cent.) \( \frac{7}{3}\) ss.' occurred, and the dispensers in the pharmacy suggested that (1) 12 grains of zinci oleat. pulv. should be used or (2) 2 drachms of zinci oleat. B.P. and the same of oleic acid. At that time the oleate of the British Pharmacopæia contained 10 per cent. of zinc oxide, and there should have been little hesitation in concluding that the prescriber meant a similar preparation containing 5 per cent. of oxide. This oxide basis of calculation no longer obtains since the pharmacopæial preparations are made by interaction of hard soap and soluble metallic salts. Normal oleate of mercury (to which the B.P. oleate now approximates) contains the equivalent of 28.4 per cent. of mercuric oxide, and normal zinc oleate the equivalent of 12.9 per cent. of zinc oxide.

Paraffin Ointments.—Ointments made with hard and soft paraffins are apt to be granular unless they are very carefully made. Melt the paraffins, pour into a mortar previously well warmed with boiling water, and stir constantly until cold or not at all. If the ointment contain any powder, rub this up with a little of the soft paraffin before adding the melted mixture. Although it lays down no specific rule for the guidance of dispensers, the British Pharmacopæia in its formulæ directs white soft paraffin to be used for colourless ointments, and yellow for others. From what has been stated on page 213, dispensers must exercise some judgment in deciding whether white soft paraffin is always suitable for use. Sulphuric acid is used in bleaching it, and it appears to leave something irritating behind.

**Resorcin.**—Few articles give dispensers so many surprises as resorcin, the dihydric phenol ( $C_6H_4.2OH$ ) which is so largely used in producing artificial dyes. It is a powerful reducing body, and greedily absorbs oxygen from its environment, becoming changed from its colourless state to rose or dark brown; the following illustrate what may happen in ointments:—

I.		
Resorcin		3ss.
Hydrarg. ammon.		gr. xxv.
Vaselin. alb		ъij.
-		-

Fiat unguent.

The resorcin was dissolved in spirit and added to the other ingredients previously mixed; the product became blue owing to reduction of ammoniated mercury. The resorcin should not be dissolved in spirit. Rub it to powder and mix with half the vaseline, do the same with the ammoniated mercury, and mix the two.

		II.		
Resorcin.				Ðj.
Sulphur. 1	præci	p.		Ðj.
Pulv. amy	li			ъij.
Boracis				3ss.
Vaselini			ad	зj.

Fiat unguentum.

The powders were triturated together and mixed with vaseline. The ointment was of a pea-green colour in ten days. It does not become so if the resorcin is triturated with a drachm of vaseline before adding to the rest.

Sometimes the No. I. combination has liq. carbonis deterg. along with it, in which case a blue colour is inevitable.

Sapo Durus.—A prescription which turns up periodically, and which hails from Buxton, is—

Potassii iodid	i				ziij.
Saponis					ъij.

Fiat unguentum.

This is really a cipher prescription: what the prescriber wishes the patient to get is lin. potass. iodidi ā sapone B.P. 3ij.

Thymol should only be combined in a state of solution. A good way of compounding is to add about its own weight of camphor and rub them together. These form an uncrystallisable fluid. Crystals of thymol are exceedingly irritating.

Tinctures and other spirituous substances are not easily combined with fat. Ordinary soft lard will take up one-fifth, hard lard will take up one-sixth, of its weight of tincture. To mix them, the lard or other fatty substance should be spread evenly on the bottom and sides of the mortar, and the tincture added gradually. A little soap-powder, if permissible, greatly facilitates the combination. The following ointment is rather difficult to prepare:—

M. Fiat unguentum.

The best method, without alteration of the formula, is to place the ointment in a mortar, add the liniment drop by drop, and stir constantly. The ammonia in the liniment combines with the fat of the ointment to form a soap, thus greatly assisting the compounding. This method requires considerable care in order to produce a creamy preparation which does not separate, and, if you fail, begin afresh, using a little soap to assist combination.

Sending out Ointments.—If the patient can afford it, always send out ointments in covered pots. If not, use chip boxes, preferably flat shape, previously dipped in melted hard paraffin. It is customary to cover with 'waxed paper.' Preference should be given to paraffined paper: wax or stearin paper is often rancid, and affects the ointment. When ointments are of a semi-fluid character, or if very volatile ingredients are present, a wide-mouth stoppered bottle should be used. Very poisonous ointments should be labelled 'Poison' on the pot as well as on the lid.

## SALVE-MULLS.

This is the common name for steatins, or spread cerates—preparations intermediate between ointments and plasters, proposed by Mielcke, of Hamburg (Unna's late pharmaceutical associate), for dermatological practice. Mutton-suet is the

principal fat in them, and the finished steatins are spread upon muslin in the proportion of 100 grammes (3xxv.) to 1 metre by 20 cm. (39 inches by 9 inches). The following are typical formulæ:—

#### STEATINUM ACIDI BORICI.

Powdered boric acid .	7.0	žj.
Benzoated lard		зij.
Mutton-suet (rendered)		ξvij.

Melt the fats, triturate the acid in a warm mortar with some of the melted fats, transfer to the rest, and stir occasionally until cold.

Resorcin and zinc-oxide steatins are made in exactly the same proportions.

#### STEATIN. DIACHYLON.

Lead plaster	. 1		žv.
Mutton-suet			žiij.
Benzoated lard			ξij.

Melt together and stir occasionally until cold.

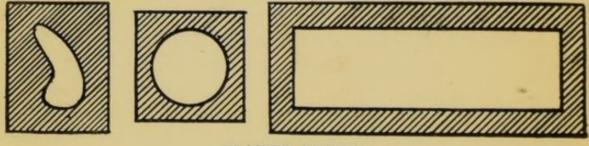
#### STEATIN. ICHTHYOL.

Ammonium ich	thy	olate		ğj.
Benzoated lard			7.	<b>3</b> j.
Mutton-suet				žviij.

Prepare in the same way as steat. ac. boric.

# PLASTERS.

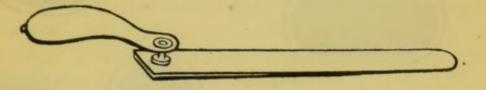
It is seldom nowadays that the dispenser is called upon to spread other than a cantharides plaster, and, consequently, few of the rising generation can handle the plaster-spatula with dexterity. It is customary to use paper shapes in spreading plasters, for if not used the edges are uneven. There should be no hesitation about the way to melt the plaster. Sufficient for the surface required (average 15 grains per square inch) is shaved off the roll and melted in a porcelain dish over a gentle gas-flame or water-bath. This is the surest plan. While the plaster is melting the leather may be cut and prepared; allow an inch all round for a margin. The shape of the plaster is



PLASTER SHAPES.

cut from white wrapping-paper, which should be wetted on the label-damper and placed on the margin. Zinc shapes are kept for stock plasters. By the time the paper shape is adjusted the plaster will have melted. The plaster must not be so hot as to frizzle the leather, and the spatula, warmed in a gas-flame, should not make the leather curl, but be just hot enough to smooth it. Place the leather on a thick pad of paper, and smooth it before putting on the shape. Having obtained the proper temperature (as low as will permit of easy spreading), the melted plaster is poured on the leather near the margin,

the operator applies his spatula at a slight angle, the point of the blade somewhat overlapping the paper shape. The plaster is pushed with a gently firm pressure in such a manner that the iron may not be raised from the leather until it has gone all round it (the leather being turned to suit the position of the operator, but the spreading must not be stopped while this is being done). Evenness of spreading is attained by regularity of pressure; but no one can spread a plaster properly who does not do it in a few rapid strokes. The plaster-iron generally used is a thick belt of iron  $3\frac{1}{2}$  inches long, by  $\frac{3}{4}$  inch



PLASTER-SPATULA.

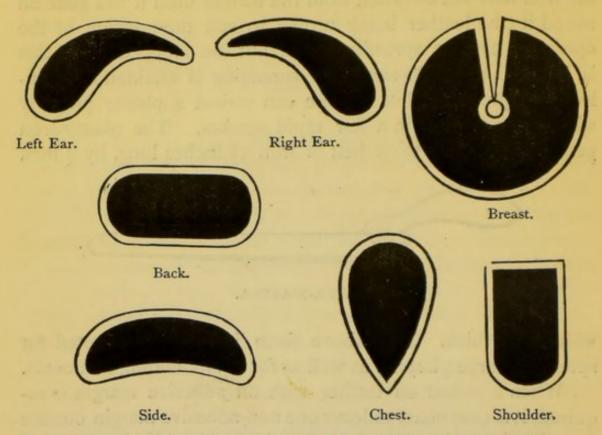
wide and thick. The above form is specially adapted for spreading large plasters, as well as for compounding ointments.

When a plaster on leather with an adhesive margin is required, it is customary to leave one non-adhesive margin outside the adhesive one. The first step is to place in the centre of the leather a piece of paper the size of the plaster, and outside this a shape that will leave \frac{1}{2} inch or so between the centrepiece and the non-adhesive margin. Spread with soap plaster, when cold remove the central piece of paper and put on a shape (well soaped) which will cover the adhesive part, and spread with the plaster.

Plasters for bed-sores (soap cerate usually) are spread without margin on split-skin or chamois leather.

Paper Plaster-shapes may generally be attached to leather by merely damping the paper, and pressing down with a dry cloth. If the shape is to be laid on a previously spread plaster, it should be well brushed with thin soft soap; after its removal, any soap adhering to the plaster must be taken off with a wet cloth or sponge.

Breast-plasters should be about 7 inches in diameter, exclusive of 1 inch margin, with a hole near the middle 1 inch in diameter, and with a piece cut out, beginning from



SHAPES OF PLASTERS FOR DIFFERENT PARTS OF THE BODY.

the hole and gradually widening towards the circumference to about 1 inch, so as to allow the plaster to be adapted to the curved surface of the breast.

Blisters (emp. cantharidis extens.) are spread on adhesive plaster (calico). Cut a paper shape of the size desired, and place it on the plaster, leaving  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inch margin. Now soften the cantharides plaster by working it in the hand for a minute or two, and then spread over the calico with the thumb, usually, although some prefer a slightly warmed spatula. The objections to the thumb method are that it is not elegant and the plaster is spread unevenly, as may be judged by holding it between the eyes and the light. The plaster should be of such thickness that the yellow colour of the adhesive plaster should be obliterated when it is held up to

the light. When spread remove the shape, trim the edges of the calico, and cover the blister with waxed paper. Powdered cantharides should on no account be rubbed over the surface, because it sticks to the skin after the blister has done its work, and is like so many pin-pricks to the poor patient. Simply use a warm spatula to smooth the surface of the plaster. Some dispensers brush the surface with liquor epispasticus. This also is not admissible.

If a plaster is wanted soon after it is spread, place it on a cold metal surface, where it soon hardens. Waxed paper (or paper rubbed on one side with a piece of hard soap) should be used for covering it. Send out in a box if possible.

It is not permissible in the United Kingdom to dispense rubber-combination plasters unless specially prescribed.

Plaster-mulls are preparations like salve-mulls, with a plaster basis, prescribed by Unna.

# PASTES AND JELLIES.

Modern dermatological methods are responsible for the introduction of various forms of applications which are neither ointments nor lotions, and which may or may not be fatty. Specialists find that a vehicle for a remedy which has not itself any action upon the epidermis is hard to find. Dr. Unna is one of the most fertile innovators in this line. It was he who introduced the now universally known jellies, composed essentially of glycerinated water solidified with gelatin and mixed with a medicament suitable for the diagnosed disorder. The best known is zinc-jelly or zinkleim (i.e., zinc glue), for which the formulæ are—

			Common.			Hard.	
Oxide of z	inc				ξiij.		ξiij.
Gelatin					ğііј.		živ.
Glycerin					žv.		žv.
Water.					žix.		žix.

All by weight. Soak the gelatin in the water overnight, and afterwards dissolve by the heat of a water-bath. Triturate the oxide of zinc with the glycerin, and mix intimately with the warm gelatin solution. Add water, if necessary, to make the weight 20 to 21 oz.

These gelatin pastes are applied while hot to the skin with a brush; they are supposed to exert a highly cooling effect upon the skin, are as protective as fatty compounds, and do not interfere with the perspiration. While the gelatin is still warm upon the skin a muslin bandage is wound round, and the jelly penetrating into the meshes of the muslin—of which several layers are applied—gives to the disordered part quite a firm, slightly compressing case.

The following are other prescriptions of Unna's which it is

useful for dispensers to know. All the ingredients are to be taken by weight:—

GELATUM ACI	DI	ACETI	CI.
Gelatin		. 1	ъj.
Distilled water			ziiiss.
Glycerin			₹v.
Glacial acetic acid			zss.
M.S.A.			

#### GELATUM ACIDI SALICYLICI.

	5 p.c.	10 p.c.	20 p.c.
Gelatin .	žj.	ъj.	ъj.
Glycerin .	živ.	živss.	žv.
Water	živss.	živ.	žij.
Salicylic acid	žss.	<b>5</b> j.	ъij.
M.S.A.			

#### GELATUM CHRYSAROBINI.

Gelatin			3ss.
Water			₹v.
Glycerin			žix.

Proceed in the usual way, and evaporate to  $9\frac{1}{2}$  oz., then add—
Chrysarobin, in fine powder  $\frac{1}{3}$ ss.

Mix well.

#### GELATUM ICHTHYOL.

Gelatin		žj.
Distilled water		žiiss.
Glycerin		ξvj.
Ichthyol		<b>3</b> j.

Proceed as for gel. chrysarobin.

#### GELATUM IODOFORMI.

		5 p.c.	10 р.с.
Gelatin		3ss.	3ss.
Water		žvij.	žviss
Glycerin		ğij.	ъij.
Iodoform		3ss.	ъj.

Proceed as for gel. chrysarobin.

#### GELATUM NAPHTHOL-BETA.

As 10 per cent. gelat. iodoformi, but with beta-naphthol. 3v.

#### GELATA ZINCI VARIA.

To the quantities for the hard jelly may be added I oz. of tar or of extract of cannabis or of resorcin; to the common, I oz. precipitated sulphur or  $\frac{1}{2}$  oz. to I oz. of ichthyol.

The firmer jelly is also prescribed in combination with a fat. This is a somewhat difficult mixture to compound if the dispenser has no previous experience of it, but the following typical prescription will serve as a guide:—

			Part	s by weigh	it
Gelatin				150	
Zinc oxide				100	
Glycerin				$65\frac{1}{2}$	
Lard .				100	

Mix the gelatin with the glycerin and its own weight of water, place in a porcelain dish, and heat on a water-bath until a perfectly homogeneous mixture results, replacing from time to time any water which is lost by evaporation. Now add the zinc oxide made into a smooth cream with water, and continue the heat and stirring until the mixture is brought down

to the weight of the gelatin, glycerin, and zinc oxide. Next add the lard, and stir until it is mixed, which is not a difficult matter. Pour into moulds, or directly into a gallipot, and allow to cool.

The mass so prepared has a uniform and fine white shining appearance and elastic consistence. For use the gallipot is simply placed in hot water, and, when the contents become thin, it is applied to the affected parts with a brush.

These jellies were at one time alternately called 'pastes,' but Dr. Unna has, since their introduction about 1886, prescribed other preparations more correctly termed 'pastes.' These more closely resemble glycerin of starch, the ointment-basis substitute introduced by the late Mr. G. F. Schacht and officialised by the British Pharmacopæia. Others are based upon Lister's original carbolic paste (prepared chalk made into a paste with carbolic oil). The following formulæ, which are reprinted from 'Pharmaceutical Formulas,' are the more commonly required preparations:—

# PASTA ICHTHYOL. (Unna).

Ammonium ichthyolate Dij. to zij.
Powdered dextrin . . zj.
Distilled water . . zj.
Glycerin . . . zvj.

Dissolve the ichthyol in the water and the glycerin, mix with the dextrin, and heat on a water-bath until uniform.

#### IHLE'S PASTE.

Amyl .		žij.
Zinci oxidi		ъij.
Lanolin		žj.
Vaselin		žiij.
M.		

This is the basis, and it is medicated with various substances, such as resorcin.

### PASTA NAPHTHOL.

(Lassar).

Beta-naphthol	V.	žj.
Precipitated sulph	nur	ξv.
Yellow vaseline		ξij.
Soft soap .		žij.

Mix the powders, add the vaseline and soap, and mix thoroughly.

# PASTA PLUMBI (Unna).

Litharge		5vj.
Vinegar .		3ij. 3ij.

Boil together until the solution is syrupy, then add—

Starch			3v.
Water			žij.

Again boil, and add —

Mix, and heat if necessary until the paste weighs 5 oz.

# PASTA RESORCIN. (Lassar).

		Fortior.	Mitior.
Resorcin		žij.	<b>ž</b> j.
Zinc oxide		ъij.	žiiss.
Starch.		žij.	žiiss.
Vaseline oil		živ.	živ.

Rub all the powders together until they are impalpable, then make into a paste with the oil.

#### PASTA ZINCI SULPHURATA

(1	Unna).	2
Zinc oxide .		žiss.
Precipitated sul	phur	<b>3</b> j.
Kaolin		žss.
Benzoated lard		žvij.

Levigate the powders together, and mix with the lard.

# PASTA ZINCI.

F 2	POIN	LEINC	4.0	
I	Jnna	's Stif	f.	
Zinc oxide				žiiss.
Kaolin .				3ss.
Benzoated las	rd			₹vij.
Mix inti	mate	ly.		
U	nna	's Soft		
Prepared cha	lk			ъj.
Zinc oxide				ъj.
Linseed oil				100
Lime-water				ъj.
Mix.				
	Las	sar's.		
Zinc oxide				žiij.
Starch .				***
Salicylic acid				зij.
Vaseline.				ξvj.

Levigate the powders together, and make into a paste with the vaseline.

For other medicinal and surgical pastes consult 'Pharmaceutical Formulas.'

Mollin, or salve-soap (sapo unguinosus), is another basis prescribed by Dr. Unna. This is made by saponifying 40 parts of lard with potash (50 parts of a solution of sp. gr. 1'130 evaporated to 40 parts) and 4 parts of rectified spirit in the cold, then adding 15 parts of glycerin to the soft soap formed. Both liquids and solids to be taken by weight. The product contains 12 per cent. of free fat. The following are the more common combinations, the figures representing the quantities of the medicaments in 100 parts:—

The state of the s											
Ammonium	sulp	hydra	te.		5	Oil of cade 2	10, a	nd ic	hthy	ol .	10
Camphor					5	Oleum rusci					10
Creolin .					10	Peruvian bal	sam				10
Creosote					10	Potassium io	dide			5 and	10
Ichthyol (an	mmoi	nia)		5 to	50	(disso	lved	in as	muc	h wat	ter)
Iodoform					10	Precipitated	sulph	nur			10
Iodol .					10	Thymol					10
Lanoline					20	Zinc oxide					
Naphthol					I						

Dr. Unna's latest jelly application is called Gelanthum. It is really a tragacanth paste, and is made by steeping tragacanth 3iiss, and gelatin 3ij. in water 10 ounces for twenty-four hours (keeping in a steam-bath). The paste formed is pressed through muslin, glycerin fl. 3vj. added, the whole heated on a water-bath for an hour, and made up to 12 ounces by weight with water in which \(\frac{1}{4}\) grain of thymol is dissolved. Gelanthum is employed as a basis for medicaments.

Jellies for internal use are rarely prescribed for extemporaneous compounding, but it may be useful to state that for every 100 grammes of jelly are requisite 4 grammes of isinglass, 5 grammes of dry gelatin, 10 grammes of Irish moss, 15 grammes of Iceland moss, 10 grammes of starch, 3 grammes of salep, or 5 grammes of tragacanth. After boiling, skimming, and straining, jellies should stand for three hours in a cold place. Medicinal additions should be made to the strained or skimmed jellies while hot.

Copaiba, cod-liver oil, and castor-oil jellies are sometimes prepared by melting 5 or 6 parts of the oil or balsam with 1 part of spermaceti, and leaving to cool. A cod-liver-oil jelly can be prepared from gelatin by the following process:—

					G	rammes
Gelatini						20
Solve in—						
Aquæ fervidæ .						150
Syrupi simplicis.						100
Tum adde—						
Olei jecoris aselli						250
(C	lei a	nisi ste	ellati g	tt. 5)		

Et agita in mortario lapideo, donec massam æquabilem præbeant, quæ semirefrigerata in vitrum infundatur ut loco frigido congelet.

The above is allowed to remain in this chapter as an exercise for the student rather than as an example of elegant pharmacy.

# MIXTURES.

THE compounding of mixtures brings all the dispenser's wits into full play. It is here that medicines have the opportunity of combining with each other, because mixtures are in the large majority of cases aqueous solutions of inorganic or organic substances, hence the conditions are the best for interaction, water being the great promoter of chemical change.

In dispensing a mixture—as, indeed, in every other phase of the art of dispensing—the primary consideration should be to form a correct appreciation of the intention of the prescriber. This object should be kept in view, particularly when dealing with a supposed error on the part of the prescriber, or with the necessity or otherwise of making any alteration in the prescription. Long experience, both in dispensing and of the habits of prescribers generally, alone confers the ability to decide a question of this kind; and no alteration should be made which will in any way change the therapeutic character of the medicine without first consulting the writer of the prescription. If this is impossible, the dispenser must be guided by his experience, following the line he would adopt if he purposed taking the medicine himself.

Having decided that the prescription is free from error, the next consideration is whether any chemical decomposition is likely to occur, and, if so, is it the prescriber's intention that such should be favoured or retarded? This point being settled, the prescription should then be dispensed in such a manner that the dosage from first to last will be practically uniform. The general rule to adopt is that chemical action among the ingredients of a prescription should be prevented

or retarded as far as possible, unless the reverse is clearly ordered or intended by the prescriber.

In a great many instances the ingredients of a prescription require to be mixed in some special order so as to produce the best result, and it is desirable in such cases to record the modus operandi in the copy, so that, when repeated, the same method shall be followed. In the absence of any particular indication of this kind it is best to commence by putting half the vehicle into the bottle, then to weigh in the soluble solids, triturate insoluble solids in a mortar with a little of the vehicle and transfer to the bottle, put in the fluids, fill up, cork the bottle, and shake thoroughly. Always see if the bottle used is of correct capacity.

A typical mixture is like a quadruped—it has four legs to stand on. According to Pereira, these are the basis, the auxiliary (adjuvans), the corrective (corrigens), and the vehicle (excipiens); but the tendency is now towards simplicity, so that either the auxiliary or the corrective, and, what is of more importance to the pocket of the pharmacist, the vehicle, are frequently omitted.

The difficulties in this department may be illustrated by examples of

# TYPICAL MIXTURES.

When the quantity of solid ordered is within the limit of its solubility in the prescribed vehicle, it should be completely dissolved before sending out. Many salts—e.g., silver nitrate and sodium sulphocarbolate—although very soluble, dissolve but slowly in the crystalline form; if convenient, a small quantity may be kept ready in fine powder, otherwise, if the solution is wanted quickly, the crystals must be crushed in a glass mortar. Less soluble salts—e.g., potassium chlorate, sodium sulphate and phosphate, &c.—should be dissolved in water slightly warmed:—

Salicin				· 3ij.
Tr. aurant.				· 3iss.
Glycerini				, ziv.
Aquæ .				ad zviij.

Salicin is soluble in 28 parts of water, and glycerin increases the solubility; therefore dissolve the salicin in 7 ounces of water slightly warmed, and add the glycerin and tincture when nearly cold.

In the following prescription gallic acid is present in excess of what the amount of water is capable of dissolving at the ordinary temperature:—

Acid. gallic.				. 3v.
Acid. sulph.	dil.			· 3j.
Aquæ .				ad zviij.

Rub the gallic acid to a fine powder in a mortar, add the water and the sulphuric acid, and dispense with a 'shake the bottle' label. In this case the gallic acid dissolves with readiness in hot water, and some dispensers are apt to use such water, but the acid crystallises out on cooling.

Potassæ chlor	at.			. 3ij.
Tr. pyrethri				· 3j.
Aquæ dest.				ad zvj.

Although the water alone would retain the chlorate in solution, the large amount of spirit present would cause it to crystallise out; the chlorate should therefore be finely powdered, and the bottle sent out with a 'shake' label.

There are other substances with which a similar plan must be followed if sufficient solvent is not prescribed with them—viz., rub to fine powder and mix with the vehicle. It has been observed that potassium chlorate, when present in mixtures in excess, slowly becomes crystalline, due to changes in temperature: when the temperature goes up a little more chlorate is dissolved, and when it goes down that little crystallises out again.

Sodii phosph	at.				3v.
Sodii salicyla	it.				3iss.
Tr. chiratæ					m 40
Glycerini					3ij.
Aq. chlorof.				ad	ъvj.

Chloroform lessens the solubility of the salts, for, although the phosphate dissolves in 6 parts of water, it crystallises out of this mixture if the temperature falls below 60° F.; it should, therefore, be finely powdered, and no heat used to complete solution.

It is always convenient, if there are no chemical reasons to prevent it, to take the ingredients of a formula, especially where these are numerous, in the order in which they are written, and use, weigh, or measure them out in this order. It is less tax on the memory to know, when you have got so far among them, that you have used all the items previous to the one being weighed or measured; and the prescriber who has any knowledge of dispensing generally writes them in this order. The following is a good example of the value of this rule:—

Ol. santali flav.				3ij.
Ol. copaibæ .				3ss.
Tinct. cubebæ				3j.
Ol. menth. pip.				m xij.
Spt. vini rect				q.s. ut solv.
Tinct. buchu .				3j.
Dec. pareiræ .				3v.
Inf. uvæ ursi .				ξv.

To compound in the order written is the best way possible in such a case as this. Dissolve the first two oils in the tincture of cubebs, then the ol. menth. pip. in 2 drachms of rectified spirit; add this to the first solution, then the tincture of buchu, and gradually and with smart shaking the decoction and infusion. If the last two are recently prepared, the mixture is much more presentable than when it is compounded with concentrated infusions.

To take another example, a prescription for a bronchitismixture which seems to present no difficulty:—

Ammon. carb.				gr. 60
Syrupi tolutani				3vj.
Tinct. tolutanæ				ziij.
Vin. ipecac				3ij.
Spt. chloroform.				3iij.
Inf. senegæ .				Zxij.
Solve et misce.				

Here the carbonate of ammonium must first be dissolved in the infusion, and for that purpose a mortar will be required, as the salt does not dissolve readily enough in aqueous menstrua to enable us to make the solution in a measure-glass with the aid of a glass rod, as might be done with bicarbonate of potassium, and in this case also shaking causes undesirable frothing. Having got the solution of carbonate of ammonium in clear condition—say, about a couple of ounces of it—in the bottle, syrup of tolu comes second on the formula. But this should not be added now, because it would adhere to the glass, and we should not be able to measure the other ingredients accurately after it in the same graduate. The ipecacuanha wine should be added at this stage, but, before doing so, the solution should be diluted in the bottle with about 7 ounces more of the infusion. Now mix the spirit of chloroform and tincture of tolu, and pour them into the bottle, being careful to let the liquid fall into the middle of the solution, and not touch the neck or side; agitate by a little sudden jerking. In this way the tolu and chloroform will be equally diffused through the mixture. On adding the spirit of chloroform by itself to such a mixture, without shaking, the chloroform would separate and descend, and on pouring in the tincture of tolu by itself, without shaking, the resin would separate and float on the top. By having the resin of tolu held in solution by the additional quantity of alcohol of the spirit of chloroform, less separation takes place on addition to the mixture. In other words, a better emulsion will be made of the tolu than if the tincture had been poured in by itself. The syrup of tolu should now be added quickly, and the measure rinsed with more infusion -sufficient to make the required quantity of mixture. The bottle should then be gently shaken-not too much, or it will have a tendency to make the resin separate on the sides of the bottle.

A word of caution about infusions. When freshly prepared they should be allowed to become quite cold before being used for dispensing. It is a common fault with dispensers not to do so, but if used warm in this instance the heat partly volatilises

the ammonia, chloroform, and some of the spirit, and causes the resin of tolu to deposit on the sides of the bottle.

The rule in preparing such mixtures should therefore be: Make a solution of the salts first, using the vehicle, which is generally aqueous, as a menstruum; strain into the bottle, dilute with more vehicle passed through the strainer, add the tinctures, or spirits, measuring small quantities first, shaking after each addition; then add the syrup or any mixed preparation ordered; lastly fill up with the vehicle, and shake again. Sometimes syrup of squill is ordered in such a mixture as the foregoing. In this case, the dispenser should mix the carbonate solution with the syrup of squill before adding any other ingredient. If spirit of nitrous ether is also ordered, it should be mixed with the carbonate solution before tinctures and the like are added.

In the following another course has to be adopted:—

Ammon. carl	).				gr. vj.
Vin. ipecac.					3ij.
Vin. antim.					5ij.
Syr. scillæ					3iij.
Syr. mori					3iv.
Aquæ .				ad	3iss.

There is so little aqueous menstruum here that, if the former course is adopted, effervescence is most persistent, and it may be an hour before the froth subsides. Powder the carbonate and, in place of adding the syrup of squill, take a proportionate quantity of acetum scillæ—viz., 78 minims—and put it over the carbonate in the mortar. When the effervescence has ceased, which is almost immediately, transfer the solution to the bottle, add the vin. ipec., vin. antim., and syr. mori, and make up to  $1\frac{1}{2}$  ounce with simple syrup.

Another example is a mixture containing insoluble salts with tragacanth to suspend them. The great object in this is to give the patient in each dose of the mixture an equal quantity of each ingredient, having the solids suspended in it with the aid of the mucilage formed.

Bismuth. sul	onit.					3ij.
Magnes. car	b.					3j.
Acid. hydrod	cyan.	(Sch	eele)			m vj.
Tr. capsici						ηx.
Tr. opii.						3iss.
Pulv. tragac	. co.					3iss.
Aq. menth.	pip.				ad	ξvj.

Misce.

Rub the three powders together in a mortar, then pour on 3 ounces of peppermint-water, gradually stir to form a uniform mixture, which should be transferred to the bottle, and the liquids added (the acid last) in the bottle, not the mortar, else loss of hydrocyanic acid will take place. The mortar is finally rinsed with a little more of the water, this poured into the bottle, and the quantity required to fill the bottle added. N.B.—It is requisite in all cases that the dispenser should make up the measure exactly, not according to the bottle but by actual measure.

Not infrequently dispensers put powders, such as bismuth and magnesia, into a bottle, and pour mucilage directly upon them, the result being that the powders are diffused in a lumpy condition. Powders ought always to be mixed with water in a mortar before adding mucilage. We remember a candidate at the Minor examination, who had a mixture containing powdered rhubarb and bicarbonate of sodium to dispense, giving in the mixture with the rhubarb floating on the surface in little balls! Had he carefully mixed the powders with water before pouring into the bottle, this would not have happened.

When fluids are to be mixed which decompose each other, or which may form combinations, the order of mixing may have a considerable influence on the condition and appearance of the mixture. Example:—

Liquor. ferri perc	hlor.			. 5ij.
Mucil. acaciæ				· 3j.
Aquæ destillatæ				ad zviij.

If the mucilage be added to the iron solution the two form a gelatinous mass, which will not make a clear solution with the rest of the water. But a clear yellow solution is obtained if the liquor and mucilage are each first diluted with half of the water and then mixed, or if the liquor is mixed with all the water and the mucilage added last.

When vegetable substances, wholly or partly soluble in water, especially such as contain tannin or like constituents, have to be mixed with metallic or earthy salts, the rule is that both the vegetable substance and the salt should be separately dissolved in a large portion of the water and mixed. If a precipitate is formed it is then easily diffused by shaking.

#### CHEMICAL CHANGES IN MIXTURES.

It is not improbable that in almost every mixture dispensed chemical change of some kind takes place, either immediately or after a few hours or days have elapsed. There may be a precipitate or change of colour to make the interchange of molecules visible to the eye, or a decomposition may occur in which the products have the same physical characteristics as the original compounds. Even the simple solution of a single salt may involve dissociation, or perhaps chemical combination with the solvent, or some change due to the presence of the ubiquitous germ may arise. The dispenser should be aware of all these changes, and know in each case whether the prescriber's intention is that the reaction should be accelerated or retarded.

In the great majority of cases involving chemical change it is desirable to retard or prevent the reaction as far as possible. This is usually accomplished by separately diluting the opposing ingredients and interposing any protective fluids (e.g., mucilage, glycerin, or syrup) that may be ordered. They often prevent the occurrence of a precipitate, and usually retard chemical change.

Plumbi acet	atis					Эi.
Tincturæ op	oii					zij.
Syrupi .				100		zvj.
Aquæ .					ad	žviij.

Mix the tincture and syrup with 2 ounces of the water, and pour into the remainder of the water in which the lead has been previously dissolved.

Ext. cinchonæ			ъij.		
Ammon. carb.					3j.
Glycerin	-				3ss.
Aquæ ad .					ξvj.

If the liquid extract be poured into a solution of the ammonium carbonate, a lumpy mixture results. The liquid extract should be stirred with the glycerin, and diluted to about 3 ounces; then the carbonate of ammonium, dissolved in the remainder of the water, should be added.

The following is a favourite recipe with a West-end physician:—

Liq. ferri dialysati	(Wye	eth)			3iv.
Liq. arsenicalis.					3ss.
Aq. dest				ad	ξvj.

If the old-fashioned plan of 'putting everything in first and then filling up' be followed, a thick mixture will result. If, however, the dialysed iron be diluted with 4 ounces of the water, and the liquor arsenicalis mixed with the remainder and added gradually to the former solution, a beautifully bright mixture results.

Some mixtures are clear at first, and gradually throw out a precipitate:—

Sodii bicarbon	nat	is .			Jiss.	
Liq. bismuthi	et	ammon.	cit.		· 3j.	
Aquæ .					ad zviij.	

This is clear at first, but slowly deposits bismuth carbonate. The presence of an excess of ammonium citrate retards the precipitation.

Some iron solutions deposit basic compounds on dilu-

This remains a clear solution for a time, then begins to deposit basic phosphate of iron; large excess of phosphoric acid completely prevents the change.

Tr. ferri acetatis .			. 3iv.
Liq. ammon, acetatis			. 3xij.
Aquæ			ad žvj.

This remains bright for several days, and then a copious deposit of ferric hydrate gradually appears, while the solution loses the deep-red colour characteristic of ferric acetate. An excess of acetic acid prevents the change.

These examples sufficiently illustrate the importance of carefully considering the order of mixing. It is useful to note the following:—

First, that where syrup, glycerin, honey, or mucilage is ordered along with fluids which decompose each other or which produce unsightly combinations, it is highly probable the prescriber has anticipated this result, and added this particular ingredient to avoid or mitigate the evil. Glycerin has in many cases a powerful influence in preventing decompositions, as well as in preventing depositions; syrup, less so; while honey and mucilage are favourable to fine division and suspension of insoluble salts and organic matter.

Second, that where any decomposition takes place producing unsightly mixtures, as in the case of resinous solutions, the best result is obtained by pouring the tincture through a dry funnel into the bottle containing all the other ingredients.

Third, in no case should liberties be permitted in the shape of additions to or subtractions from prescriptions, with a view to producing what is called 'elegant pharmacy.' Cases where such expedients are necessary are very rare, and even in these the error is generally due to oversight on the part of the prescriber, and is so apparent that the dispenser cannot possibly have any difficulty in the matter.

A common case of chemical incompatibility is in prescriptions containing potassium iodide and spirit of nitrous ether:—

Potassii bita	art			· 3j.
Potassii iod	idi .			· 3j.
Spt. ætheri	s nitrosi			. 3iv.
Syr. aurant	ii .			· 3j.
Aquæ				ad 3x.

This mixture cannot be dispensed without reaction between the potassium bitartrate and iodide and spirit of nitrous ether, iodine and nitrous oxide being liberated, thus:— .

$$KHC_4H_4O_6 + C_2H_5NO_2 + KI = K_2C_4H_4O_6 + C_2H_5HO + NO + I.$$

If the dispenser can communicate with the prescriber, he should inform him that the mixture will contain free iodine, and also that it will not contain a particle of nitrous ether; if consultation is impossible, proceed as follows: Dissolve I drachm of cream of tartar and 8 grains of potassium iodide in 4 ounces of water contained in a mortar, add the spirit of nitrous ether, stir briskly, so that the gas may escape, and allow to stand for half an hour in order to get rid of the nitrous fumes entirely. Then make up the rest of the mixture and add it to the contents of the mortar. 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 iodide, the liberated nitrous oxide on coming into contact with air is changed to higher oxides, which are capable of decomposing iodide, so that if the mixture were made up in a 10-ounce bottle, iodine would continue to be liberated, until the whole of the iodide of potassium was decomposed.

The question of the reaction between nitrous ether and uva ursi preparations has been discussed for many years without definite result. It is usually assumed that the free acids in the spirit attack the tannin in the uva ursi, thereby giving rise to gases which, if confined in a bottle, cause an explosion. Such mixtures should always be made in a measure and not transferred to the bottle until effervescence ceases. If required to be delivered at once, the customer should be instructed to loosen the cork of the bottle on reaching home.

It frequently happens that chemical changes take place in mixtures which are quite unexpected by the prescriber and dispenser. In the following, apart from separation of sulphate of magnesia in crystals, owing to the presence of so large an amount of spirit, the mixture gradually acquires a bluish colour:—

Ammon. brom.			. 3
Tinct. nucis vom.			. 3iv.
Spt. chloroformi			. ziij.
Magnes. sulph.			. 3ss.
Spt. ammon. co.			. 3iv.
Syr. zingib			· 3j.
Aq. menth. pip.			ad zvj.

It takes some time before this colour is developed, and it appears to be due to reaction between the igasuric acid of the nux vomica and the alkali in the mixture. It also occurs in mixtures of liquor bismuthi and tincture of nux vomica, and the following (A) becomes bluish violet in one day:—

Α.			В.	
Magnesii sulphatis	. 3iv.	Sodii bromid.		. 3iv.
Tinct. nucis vomicæ	. 3ij.	Ammon. carb.		· 9j.
Spt. ammon. aromat.	. ziij.	Tr. chlorof. co.		. 3ij.
Spt. æther. nitrosi	. ʒiij.	Aquæ .		ad zviij.
Aquæ	ad žviij.		*	

In a few hours B mixture becomes colcurless, and throws down a considerable brown precipitate. If the bromide be omitted, the same change takes place, but the brown compound remains in solution instead of being precipitated. The change is due to the action of the ammon. carb. on the cochineal-colouring of the tr. chlorof. co. This may be observed by tinting some water with tr. cocci and adding either ammon. carb. or liq. ammoniæ.

Somewhat analogous changes take place in the following mixtures:—

	I.			II.	
Sodii salicyl.		. 3ij.	Pot. bicarb.		. 3ij.
Sodii bicarb.		• 3ij.	Sodii salicyl.		
Tr. nuc. vom.		· 3ij.	Vin. colchici		. 3iv.
Aq. chloroform	1.	ad zviij.	Aquæ .		ad žviij.

No. I. became black in forty-eight hours, while No. II. assumed a colour almost like compound tincture of cardamoms in the same time. It is a matter of common observation that

aqueous solutions of alkaline salicylates become of a reddishbrown colour on exposure to light, apparently due to the oxidation-products of salicylic acid being accompanied by coloured bodies. Stock solution of the bicarbonate induces the coloration more readily than the bicarbonate itself, owing to the solution containing carbonate. Natural salicylic acid and the physiologically pure artificial acid, and salicylates made from them, are not so liable to change.

The rapidity of change is inversely proportionate to the purity of the salicylate and the freedom of the bicarbonate from carbonate. The bicarbonate should be first dissolved in the whole of the water and the salicylate added afterwards. With impure salicylate the change is much more rapid; but the purest 'artificial' salicylate stands the test almost, if not quite, as well as that prepared with 'natural' salicylate. The coloration is still further postponed by using distilled water containing carbonic acid in solution (i.e., plain aërated water).

III.		IV.	
Sodii salicylat. (natural)	. 3ij.	Sodii salicylat	· · ziiss
Spt. ammon. co	. 3iv.	Spt. æther. nit	3iv.
Spt. chlorof	. 3ij.	Liq. ammon. acet.	·
Tr. nucis vom	· 3j.	Aquæ	. ad zvj.
Aquæ	ad zvj.		

No. III. mixture changes very rapidly, for in a few hours it is deep orange in colour, and a day after it is greatly intensified, finally becoming deep blackish brown. Sodium salicylate and spt. æther. nit. produce a red colour, forming nitro- and diazo-oxybenzoates of sodium, which do not seem to be harmful. No. IV. has frequently been dispensed. Although the spirit was neutralised, the mixture rapidly coloured, and in a few hours it was of a brilliant deep orange colour.

Tincture of nux vomica, owing to the organic acids which it contains, is very apt to change colour when mixed with nitric acid or nitro-muriatic acid. For instance—

Acid. nitrici dil			3iv.
Aquæ destillat.			3vj.
Tinct. nucis vomicæ			ъij.

If mixed in the order written, the mixture soon becomes yellow-coloured and acquires an odour of nitrous acid; if the order be reversed, neither colour nor odour is developed. Various results are produced by mixing part of the water with the acid and part with the tincture. A red or reddish-yellow colour develops in course of time, but is ultimately discharged. This applies particularly to acid. nitro-mur. dil. and nux vomica mixtures.

#### INTENTIONAL CHEMICAL ACTION.

Saline Mixtures.—In many prescriptions chemical action is intended, as in the case of saline mixtures, which are extemporaneously prepared solutions of the alkaline acetates, citrates, or tartrates. For example:—

Potass. bicarb.				. 3ij.
Ammon. carb.				. 3ss.
Acid. citric				. 3ij.
Syrup				. 3ss.
Aq				ad zvj.

Here the prescriber intends the mixture to contain carbonicacid gas in solution. To get this, powder the carbonate of ammonium and dissolve it and the bicarbonate of potassium in the mortar in 5 ounces of water; add the acid, stir, allow the effervescence to pass off, strain the solution into the bottle, add the syrup to the bottle, make up, and quickly cork. The mixture will not effervesce, but it will have the fresh taste of the free carbonic acid which it contains.

Effervescing Mixtures distinct from the foregoing are frequently ordered by medical men, the usual method being to prescribe an alkaline mixture and acid powders, although there are cases in which an alkaline and an acid mixture are sent out together. It is important that the directions should be quite explicit. It sometimes happens that the prescriber leaves the dose of acid to the discretion of the dispenser; if this should occur, the dispenser may put in a slight excess of acid:

it improves the taste in most cases. The following are examples of this class of mixture :-

	Ferri et ammon	. cit.				3j.
	Acid. citric.					3ij.
	Aquæ .				ad	ξvj.
M.	Sig. : No. 1.					
	Potass. bicarb.					ъiij.
	Syr. limonis				,	<b>3</b> j.
	Aquæ .				ad	zxij.
M.	Sig. : No. 2.					

One tablespoonful of No. 1 to be taken with two tablespoonfuls of No. 2 twice a day, &c.

It may appear that the prescriber has erred in placing the syrup of lemon in the alkaline mixture, thereby neutralising it, but it will be observed that there remains after the doses are mixed a slight excess of citric acid—viz., 11 grain in each dose.

Prescribers of effervescing mixtures occasionally err in regard to compatibilities, as the following example shows:—

Liquoris strychninæ	hydr	ochlo	ridi		3iss.
Sodii bicarbonatis					ziiss.
Aquæ ad					ъvj.
Fiat mistura. Sig. : No.	I.				
Acidi citrici .					ziv.
Tincturæ calumbæ					ziv.
Aquæ ad					ξvj.
Fiat mistura. Sig.: No.	2.				

\$88. of No. 1, with \$88. of No. 2, to be taken effervescing at 12 noon and 4 P.M.

Strychnine would be precipitated as hydrate in No. 1, and to avoid this a dispenser put it in No. 2 mixture. Alkaloids should always be put in the acid mixture, and if the acid is prescribed in powders in such cases and the alkaline bicarbonate Si

in solution, the dispenser should reverse the order and indicate the change on the prescription.

	Sodæ tartaratæ			-			5vi.
	Sodii bicarb.						
	Vin. antim.						
	Syr. aurant.						
	Aquæ .				*	ad	Zviij.
ig.	: 3j. 4tis h. ex	aq.					
	Pulv. acid. tart						q.s. [20 gr.]

Tales viij. Sig. : j. with each dose of the medicine.

The directions require slight modification, and the dispenser is quite within his province if he puts on the bottle some such label as this: 'Two tablespoonfuls (by measure-glass) every four hours, in water. Add one of the powders, and drink during effervescence.'

The dispenser must also rely on his own knowledge for the quantity of acid to be sent in each powder, or he may refer to the following table compiled by Dr. John Attfield, F.R.S.

# SATURATION EQUIVALENTS.

In round numbers, for purposes of prescribing and dispensing.

Acidum citricum		20	19	17	14	10	17	24	30
Acidum tartaricum		22	20	18	15	11	18	26	32
Potassii carbonas		24	22	18 20	16	12	20	28	35
Potassii bicarbonas		24 29	27	24	20	14	24	34	42
Sodii carbonas .		40	38	35	28	20		49	60
Sodii bicarbonas		24	20 22 27 38 22	20	17	12	20	20	36
Ammonii carbonas		17	16	14	12	8	14	20	25
Magnesii carbonas		14	13	II	9	7	II	16	20

The table is read thus: 20 grains of citric acid will saturate 29 grains of bicarbonate of potassium; 20 grains of bicarbonate of sodium will saturate, or be saturated by, 18 grains of tartaric acid; 11 grains of tartaric acid = 8 grains of carbonate of ammonium; 20 grains of bicarbonate of sodium is equivalent to, or will do as much work as, 34 grains of

carbonate of sodium; 14 grains of citric acid is as strong as 15 grains of tartaric acid. It is occasionally convenient to double the numbers, halve them, or take some other proportion; also to employ them in weights other than grains.

Lemon-juice contains, on an average, 35 grains of citric acid in 1 fluid ounce, or  $4\frac{1}{2}$  grains (nearly) per fluid drachm.

Chlorinated Solutions.—A prescription which seems to turn up periodically, even in the examination-room, is for chlorate of potassium, hydrochloric acid, and water. The mixture is used for scarlatina, and other disorders in which the throat is affected. The object is to make a solution of chlorine; and this is done by adding the acid direct to the chlorate, corking the bottle, and shaking until effervescence ceases, then adding the water. The prescription is a revived form of a very old recipe invented by the late Mr. Beamish, of Covent Garden. He gained some reputation for the formula, which was intended to be a specific in case of hay-fever. It was as follows:—

Sodii chlorid				5ij.
Potass. chlorat.				5ij.
Acid. hydrochl. pur.				3iv.
Aquæ destillat			ad	Зij.

M. Ft. guttæ secund. art.

The chlorine is likewise liberated in a dilute solution, but, of course, more gradually, and for this reason it used to be thought that it is intended that chlorine should be slowly liberated. This idea is, however, very ridiculous when one bears in mind that the mixture must become chlorinated at some time, and it is better that this should be before it reaches the patient's hands.

## MIXTURES BECOMING GELATINOUS.

We have already referred to the fact that some kinds of distilled water become perfectly gelatinous on keeping. The same thing takes place with some kinds of mixtures. The following are cases which have been observed by correspondents of The Chemist and Druggist:—

Tinct. hamamelidis				m 40
Ext. ergotæ liq.				5j.
Spt. æther. chlor.				5j.
Syr. papav. alb.				5ij.
Tr. nuc. vom				m 40
Aquæ . ,		*	ad	zviij.

Two days after this mixture was dispensed it was returned a perfectly gelatinous mass. It had every appearance of a perfect mixture when sent out, and remained so for about twelve hours, when it changed in colour from almost transparent brown to opaque pink, and became thick and ropy. A mixture containing syr. pap. alb. and syr. scillæ became ropy and of a pink colour when made with old syr. papav., but when made with fresh syrup it kept all right.

Such changes are by no means uncommon, and cannot as a rule be forecast. They are due to one of two micro-organisms—Bacillus viscosus sacchari, Kramer, which acts in neutral or slightly alkaline solutions containing sucrose, albuminoids, and mineral salts, or to B. viscosus vini, Kramer, which grows in acid solutions containing glucose, albuminoids, and mineral salts. In the process of growth the bacilli set up fermentation and produce a viscous substance, C<sub>6</sub>H<sub>10</sub>O<sub>5</sub>, which has all the characters of metamorphosed cellulose, and is precipitated by alcohol. The fermentation takes place in mixtures containing less than 20 per cent. of alcohol. It is precisely the same thing that occurs in ropy ginger-beer. The bacilli doubtless exist in one or other of the galenical preparations, and only require the needful conditions of growth for development. Ergot preparations are especially prone to set up the fermentation.

## QUININE MIXTURES.

Quinine salts give rise to so many curious complications when dispensed in mixture form that some special remarks are necessary regarding them. The complications usually arise

from ignorance of the peculiarities of the alkaloid, whose salts have a wide range of solubility, and our remarks in regard to them largely apply to other alkaloids. On page 70 the properties of all salts of quinine are given, and the following useful table, compiled by Messrs. Howards & Sons, Stratford, E., is good for dispensers to refer to. It shows the solubility and equivalent value of salts of quinine:—

Name of Salt	Percentage of the Alkaloid in the Salt	Solubility in Cold Water	Amount equivalent in value to 1 of Quinine Sulphate
Sulphate	73.5 per cent.	In 800 parts	1.00
Hydrochloride	81.8 ,,	,, 40 ,,	0.0
Bihydrochloride .	72.0 ,,	,, I ,,	1.02
Hydrobromide	76.6 ,,	,, 45 ,,	0.96
Bihydrobromide	60.0 ,,	,, 7 ,,	1.23
Bisulphate	59.1 ,,	,, II ,,	1.24
Phosphate	76.2 ,,	,, 420 ,,	0.96
Valerianate	73.0 ,,	,, 110 ,,	1.01
Lactate	78.2 ,,	,, 10 ,,	0.94
Salicylate	70.1 ,,	,, 225 ,,	1.05
Hydrochloro-sulphate	74'3 .,	,, 2 ,,	0.99
Arsenate	69.4 ,,	slightly soluble	1.06
Tannate	20.0 ,,	,, ,,	3.67

It will be observed that acid salts are much the more soluble. As to the solution of quinine in acids, the fact that the mineral acids, strong or dilute, make presentable pill-masses with quinine salts indicates that an acid should not be poured direct upon any salt, but that the salt should be well diffused in water before the acid is added. Very often, however, no acid is ordered in the prescription. In such a case it is extremely unwise to depart from the letter of the physician's order. The only admissible manner of compounding is to reduce the quinine salt to fine powder and diffuse it in the liquids. In some cases, as when spirit of ether is an ingredient, the quinine tends to adhere to the bottle, but this may be avoided by the addition of a little mucilage of acacia to the mixture. Some dispensers advocate that the quinine should be dissolved in such circumstances, and the view is one

for which there is much to be said; but quinine in solution is more bitter than when in suspension, and this fact throws the balance of opinion in favour of the suspension method.

The greater number of difficulties with quinine mixtures occur through the precipitation of the quinine after it has been brought into solution. The simplest of these, apart from those due to ordinary alkaloidal precipitants, are caused by the formation of less soluble salts owing to double decomposition—for example, in the case of ammonium-acetate solution and a solution of sulphate of quinine there is double decomposition, and the quinine acetate formed is rapidly hydrolysed, with the result that quinine hydrate crystallises out in bulky acicular crystals. Such mixtures sometimes become quite solid, and this was considered to be due to insoluble quinine acetate until Messrs. Kidd and Hill, of Edinburgh, demonstrated the hydration (*The Chemist and Druggist*, LV. 1073, LVI. 664). Salicylates also form sparingly soluble compounds with soluble quinine salts.

The amount of any pharmacopæial dilute mineral acid required to dissolve quinine sulphate is reckoned as 1 minim for each grain of sulphate. As a rule this holds good and provides permanent solutions if no body is present which reacts with the soluble quinine salt to form a less soluble one, or if the soluble salt is not 'salted out.'

Quininæ	sulphati	S				Ai.
Acid. hy	drobron	ic.	dil.			3j.
Glycerin	i .					žj.
Potassii	bromidi					3j.
Ætheris	chlorici					3ij.
Aquæ					ad	žviij.
SA						

This formed a perfectly clear mixture at first, but in a few minutes quinine sulphate began to separate in silky crystals, the amount of sulphate being the surplus unconverted into hydrobromide and insoluble in the liquid.

The most unmanageable mixtures are those in which alkaloidal precipitants are present. The more common of these associated with quinine in prescriptions are the alkaline carbonates and hydrates, iodides and iodine, perchloride of

mercury, and infusions or tinctures containing tannin. In all circumstances these substances precipitate quinine as insoluble compounds which in most cases are adhesive. The alkaline hydrates and carbonates precipitate quinine as hydrate, and there is no means of avoiding the precipitation. Prescribers appear to be fonder of ordering the alkalies-generally in the form of aromatic spirit of ammonia-with citrate of iron and quinine than with the plain salts of quinine, probably under the impression that the double salt is not affected by the alkali. Ammoniated tincture of quinine (in which the alkaloid exists as hydrate dissolved in alcohol) is sometimes prescribed along with water, the result being that quinine hydrate is precipitated. Examples of such cases are given in the following pages, and it will be seen that the addition of mucilage is recommended, this being all that is necessary to diffuse the precipitated quinine permanently in the mixture instead of letting it adhere to the bottle.

Iodide of potassium forms different compounds with quinine salts, the difference depending upon the other ingredients of the mixture. Neutral solutions of quinine sulphate and potassium iodide do not react chemically, but the presence of free acid invariably induces a chemical change, and this is accentuated if there is any substance in the mixture which liberates iodine, such as nitric acid or spirit of nitrous ether. Once an alkaloid in solution comes into contact with free iodine all hope of a satisfactory mixture is gone. In such cases the dispenser should, if possible, communicate with the prescriber, so as to suggest the exclusion of the oxidising body; failing that, the reaction between the alkaline iodide and the oxidising body should be carried out with the minimum quantity of iodide, the rest of the iodide being mixed with the quinine and a little mucilage before the iodine solution is added to it. Double iodides, such as liquor arsenii et hydrargyri iodidi (Donovan's solution), precipitate alkaloids at once; the same is the case with perchloride of mercury, the precipitates being heavy and poisonous, therefore dangerous. Glycerin has a wonderful inhibitive influence in such cases. A few years ago it was shown, as the result of a long research, that many chemical reactions are retarded, and

M.

should be observed, viz. :--

in some cases prevented, by glycerin, sugar, and gum. Long before that (viz., in 1881) Mr. William Martindale had proved before the Pharmaceutical Society the inhibitive influence of glycerin in the following case:—

The first two ingredients form potassio-mercuric iodide, the well-known alkaloidal precipitant, so the mixture would not 'go' at all. After many trials Mr. Martindale produced a solution by using  $1\frac{1}{2}$  ounce of glycerin in place of as much water. The quinine sulphate was rubbed with the glycerin, the iodide added and dissolved, then the tincture and spirit, and lastly the perchloride dissolved in  $\frac{1}{2}$  ounce of water. The precipitate formed on the last addition was immediately redissolved, and the mixture was turned out slightly opaque, owing to the resinous matter in the tincture of cinchona. Galenical preparations containing tannin, especially the acid infusion of roses, are troublesome when prescribed along with quinine salts, and require special treatment. Many of the difficulties with quinine mixtures are amenable to the two rules which

- Chemical reaction should be effected in the most dilute solutions; and
- 2. A means for the proper apportioning of the dose should be adopted. For this purpose mucilage of acacia is not only generally suitable, but it has been shown to retard or modify chemical action.

We now give a number of prescriptions which have actually been met with at the dispensing-counter.

With Acetates quinine salts yield a precipitate of quinine hydrate in feathery crystals if the proportion of the alkaloidal salt is greater than 1 grain in 3 ounces of aqueous mixture.

With Carbonates or Hydrates quinine frequently forms a troublesome precipitate which requires careful management. The best result is usually obtained by diluting, as far as possible, the incompatible solutions before mixing. This method answers with the following:—

Tinct. quinina	е.			· 3j.
Ammon. carb.				· 3j.
Aquæ .				ad zxij.

But if the tincture be poured into a strong solution of the carbonate, the alkaloid separates in flocks, which adhere to the sides of the bottle.

Mixed in whatever manner, the precipitated quinine adheres in lumps. A good mixture was, however, obtained by using a proportionate quantity of pure quinine instead of sulphate; this was diffused through a portion of the water, and the diluted sal volatile added.

```
      Quininæ sulph.
      .
      .
      .
      .
      gr. xvj.

      Spt. ætheris
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The plan to follow in this case is to rub the quinine to fine powder in a mortar, and mix it with 7 ounces of water; add the sal volatile, shake well, then add the rest of the ingredients and sufficient water to make up to 8 ounces.

With Benzoates.—Quinine benzoate is a sparingly soluble salt (see page 70) and may be formed by interaction, as in the following case:—

Here the sodium benzoate and quinine salt in the tincture interact, quinine benzoate being precipitated, and at the same time the acid in the strychnine solution liberates a little benzoic acid from the sodium benzoate.

With Bicarbonates.—When these are ordered with quinine in a prescription, the bicarbonate should be dissolved in the water, and the quinine rubbed to a fine powder and suspended in the liquid. The addition of a little mucilage has the effect in these cases of suspending the quinine and preventing it from adhering to the sides of the bottle.

With Chlorine, quinine salts generally yield yellow solutions. A familiar example of this is Dr. Burney Yeo's mixture (No. I.):—

I.		1	I.	
Potassii chloratis . Acid. hydrochlor. Quininæ sulphatis Syr. aurantii . Aquæ M.S.A.	. 5ss mxl gr. xxiv 3j. ad 3xij.	Quinin. sulphat. Acid. nitric. dil. Spt. æther. nit. Spt. chloroform. Potass. chlorat. Aq. camph		. gr. xxiv ʒiij ʒiij ʒij ʒss. ad ʒvj.

If No. II. is dispensed in the order given, the mixture becomes of an intensely yellow colour. It is colourless if dispensed as follows: (1) Mix the quinine sulphate with 2 ounces of camphor-water, and add the dilute acid and spirit of nitre; (2) dissolve the chlorate in 2 ounces of camphor-water, add the spirit of chloroform, mix with the quinine, and make up. Both the ethyl nitrite and the potassium chlorate appear to take part in the coloration, chlorine being liberated from the chlorate by the acid, and the fact that a few drops of ammonia added to a little of the mixture gives the green colour peculiar to thallioquin, while the same colour is produced as in the Burney Yeo mixture, shows that the chlorine is responsible for the coloration. It would, however, be wrong to assume that a chlorine derivative of quinine is formed, as it is far more likely that an oxidation-product results, cinchona alkaloids being prone, under certain conditions of oxidation, to yield a chinoline-carboxylic acid, which is of a yellow colour. These mixtures might repay chemical investigation, and it will be useful for those interested in that direction to refer to *The Chemist and Druggist*, L. 136, for reports on different methods of dispensing No. II. mixture.

With Iodides.—Prescriptions containing quinine sulphate and potassium iodide are not uncommon, and precipitation frequently happens. Dissolve the sulphate of quinine with as little acid as possible, and separately dissolve the potassium iodide in about four times its weight of water, dilute the quinine solution, and add the iodide to it.

Liq. ferri iodidi			3ss.
Syr. ferri hypophosph.			ъj.
Quininæ phosph			3ij.
Acid. phosph. dil			₹ss.

The liquor added to a solution of the quinine in the acid gives a copious finely divided precipitate of 'quinine iodide,' but if the syrup be added *before* the liquor, a clear solution is obtained, from which the quinine iodide gradually crystallises. The former method should be adopted. Note the solubilities of the iodides (page 70).

The amount of acid used to dissolve the quinine exerts a certain influence on the nature of the precipitate formed, as in the following:—

By using just sufficient dilute acid, mxxv., to dissolve the quinine, a yellow precipitate of iodide of quinine is formed; but if a large excess of acid be added it liberates iodine from the potassium iodide, and the liberated iodine combines with the sulphate of quinine to form the insoluble iodosulphate of quinine, or herapathite, which is gradually deposited as a greenish-brown sediment.

In some cases of this kind it is not herapathite which is

formed, but a brown compound of sulphate of quinine, iodide of quinine, and iodine. This is especially the case with mixtures containing quinine sulphate, potassium iodide, and spirit of nitrous ether, such as the following:—

1	١.		В.	
Quininæ sulph. Potassii iodid. Spt. ammon. ar. Spt. æther. nit. Tinct. zingib. Aq.	:	gr. xxx. gr. xx. yi. jiv. jiv. jiij. ad 3vj.	Potassii iodidi Ammon. chloridi Quininæ hydrochlor. Acid. hydrochlor. dil. Glycerini Spt. æther. nit. Syrup. mori Aquæ anisi	gr. xx. 3ss. gr. xvj. q.s. 3iv. 3iv. 3vj. ad zviij.

Numerous futile attempts were made to combine mixture A in a presentable manner; the prescriber being near, he was consulted, and gave directions to dispense the iodide and sal volatile in a separate mixture. The writer of prescription B was interviewed. He was quite aware that iodine might be liberated in his mixture, and on being informed that the whole of the iodine would be freed and that it would precipitate the quinine as an iodo compound, he suggested the addition of enough acid to dissolve it. Learning, however, that chemistry would not accommodate him in this manner, he directed the addition of I ounce of mucilage to suspend the precipitate. The mixture was therefore dispensed in this way, and produced a reddish-brown muddy compound evolving nitrous fumes. The mixture was never repeated.

The bromides form perfectly clear mixtures with quinine, as the quinine hydrobromides are amongst the most soluble salts of the alkaloid. The following gives a clear mixture:—

Quininæ bromidi				. ʒij.	
Acid. hydrobromici	(me	dic.)		. ziij	
Spt. ætheris chlorici				. 3vj	
Tinc. lavand. co.				· 3j.	
Aq. destillat				ad žvi	ij.

Dissolve the quinine hydrobromide in 4 ounces of water, and add to it the chloric ether. Mix the tincture, acid, and 2 ounces

of water together, and filter into the quinine solution, if an absolutely clear mixture is desired. Sometimes precipitates are induced by salting out, as in the following instance:—

When the quinine sulphate is dissolved in the water and acid, and the potassium salts added, a quinine salt separates in white flocks, but there is no precipitation if the potassium salts are dissolved in 3 ounces of water and the quinine sulphate in 2 ounces with the acid and tincture, then mixed. There is such a thin partition, as it were, between solubility and precipitation that little is required to break through it. Apart from that, it is always bad compounding to add a solid salt to a solution of another salt.

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With Ferric Chloride.—Solution and tincture of perchloride of iron are commonly compounded with quinine sulphate for retail purposes, but not so frequently prescribed. The sulphate is readily soluble in either liquid. Quinine sulphate is much more soluble in tinct. ferri perchlor. than in liquid ferri perchlor. owing to the alcohol contained in the former. The amount of acid in both preparations is insufficient (in the doses generally given) to account for the solubility, and interaction between the quinine sulphate and ferric chloride appears to take place, as in the first of the following:—

I.,			11		
Magnes. sulphat Tr. ferri perchlor	gr. xxiv. šss. 5j. žvj.	Quin. sulph. Tr. ferri pero Spt. chlorof. Glycerin. Aq. Misce.	chlor.		gr. xvj. 3iij. 3j. 3ss. 3viij.

No. I. mixture is muddy in appearance as soon as compounded

and this is generally attributed to the precipitation of 'ferric oxychloride.' There are many compounds which go by that name; some are soluble (e.g., Fe2Cl610Fe2O3), others (all hydrated) insoluble. In such a mixture as No. I. the formation of Fe2Cl610Fe2O3 from 11Fe2Cl6 is induced by the greediness of the quinine for a solvent, and the reaction gives it 40HCl; but once the equilibrium of the ferric chloride is disturbed the hydration process goes on to the precipitation-point, and is not restored until some free acid is added. Twenty-four minims of dilute hydrochloric acid suffices to keep the mixture perfectly bright. No. II. mixture was muddy when dispensed with tap-water (containing earthy carbonates), and clear with distilled water. The muddiness was due to ferric hydroxide. A similar precipitate to No. I. might be expected in No. II., but it will be observed that the amount of tincture is larger, and the glycerin retards precipitation. Mixtures of this class should either be prescribed with quinine hydrochloride, or if the sulphate is desired each grain of it should have a single minim of dilute hydrochloric acid (or dilute nitric acid) ordered along with it, and the quinine salt should be got into solution before the ferric-chloride preparation is added. It is well to note that ferric chloride in solution is unstable, especially in presence of alcohols, and numerous changes are possible in mixtures containing it and organic substances, such as the precipitation of ferric hydroxide and reduction of part of the chloride to ferrous chloride. Light plays a part in the precipitation, and to prevent this we know nothing better than the use of a minim of acid. nitric. dil. for each grain of quinine sulphate in the mixture. The nitric acid is better than hydrochloric acid, as it helps to keep the iron ferric.

With Mercuric Chloride.—Quinine salts are not compatible with mercuric chloride except under certain conditions, such as the absence of free acids. Mercuric chloride is an alkaloidal precipitant, but the precipitates formed are usually dissolved by hydrochloric acid, as in the next example.

Barii chloridi	200					gr. j.
Calcii chloridi						gr. 72
Quininæ hydroch	lorid	i .				gr. 96
Liquoris arsenici	hydi	rochlo	rici			m 96
Liquoris hydrarg	yri p	erchlo	oridi			ξij.
Acidi hydrochlor	ici di	iluti				3iss.
Aquæ destillatæ					ad	ξvj.

M.

The best way to compound this is to dissolve the quinine hydrochloride in 2 ounces of water and 1 drachm of the dilute acid, and add to the liq. hydrarg. perchlor.; dissolve the barium and calcium chlorides in 1 ounce of water, add the rest of the acid and the arsenic solution, mix with the quinine solution, and make up.

With Tannin.—We have already remarked that tannin precipitates alkaloids. Here are good instances:—

. I.			II.		
Quininæ sulph.	. gr. ix.	Quinin. sulph.		· Đ	j.
Acid. sulph. dil.	. 3ij.	Acid. sulph. dil.		· 3j	
Infus. rosæ .	ad žviij.	Tr. chlorof. co.		· 3i	j.
M.		Syr. limonis		. 31	vj.
		Aq		ad 3v	vj.
		M.			

In No. I. there is a very copious precipitate of quinine tannate, and in No. II., after a time, a faint scum is observed, which is due to the same cause. The tannin in No. I. comes from the rose-petals, in No. II. from the ingredients of tr. card. co., which was part of tr. chlorof. co., B.P. 1885. Filtration in the first case is unjustifiable; in the second the quantity of active material removed is so slight, and the gain in appearance so great, that filtration is advisable.

With Salicylates quinine salts form a precipitate of salicylate of quinine. The following are good examples:—

Lithii salicylat				ъij.
Potass. iodid				3ss.
Ferri et quininæ cit.				3j.
Ag. chloroformi .			ad	žviij.

In this case dissolve the citrate in an ounce of chloroformwater, and the salicylate and iodide in the rest contained in a measure or mortar, then add the citrate solution gradually to it, stirring assiduously in order to break up the precipitate thoroughly. The mixture is a bad one, however prepared.

Quininæ sulph.				. gr. xx.
Sodii salicylat.				. 3ss.
Acid. hydrobromi	ci dil.			. <u>3</u> j.
Aquæ				ad zviij.

The hydrobromic acid acts on the salicylate of sodium, precipitating salicylic acid. Salicylate of quinine is also formed if the quinine has been dissolved with the acid. The following is a good method of procedure: Dissolve 90 grains of the salicylate in 4 ounces of water in a mortar, and to this add the hydrobromic acid gradually, stirring constantly. Rub the quinine to fine powder, mix an ounce of water with it, dissolve the rest of the salicylate in 2 ounces of water, and add to the mixture in the mortar.

	salicylat.				· 3j.
Tinct.	quininæ				· 3vj.
Aquæ					ad 3vj.

In this case also a precipitate of salicylate of quinine is formed which is not dissolved by the addition of acids. These examples might be indefinitely multiplied. The dispenser should remember that in most cases where salicylates in aqueous solution are to be mixed with quinine or cinchona-preparations it is desirable that a little mucilage should intervene to prevent the precipitated quinine salicylate from aggregating and adhering to the bottle. With  $1\frac{1}{2}$  grain of quinine sulphate per ounce of mixture no precipitate of salicylate is formed, with 2 grains there is a slight precipitate.

With Liquorice Extract.—This extract is well known as an excellent covering for the taste of quinine; consequently

we occasionally find the two together in mixture, with far from good results. Thus:—

Ferri et quininæ citratis			. 3	iss.
Ammonii chloridi .			. 3	ij.
Ext. glycyrrhizæ liq.			. 3	SS.
Aquæ			ad 3	iv.

In this mixture a dense precipitate is formed which renders it most unsightly. So also in the following:—

Sodii sulphatis					ξj.
Quininæ sulph.					gr. xx.
Acid. sulphuric. di	1.				3ij.
Ext. glycyrrhizæ li	q.				5vj.
Aquæ				ad	Zviij.

However dispensed a precipitate is unavoidable. Compounded as written a thick flaky precipitate is produced, which, when allowed to stand for a day, becomes tenacious and hardly diffusible. Omitting the acid, the precipitate is very fine and easily diffused through the liquid. The explanation is that liquorice extract is very readily decomposed by alkaloidal solutions, with separation of *glycyrrhizin*, the sweet principle of liquorice. There are several inorganic salts which precipitate the glycyrrhizin—as, for example, sodium sulphate and potassium acid tartrate. In the second prescription the acid also has an influence in inducing separation, less of it giving a better-looking mixture.

Tr. Quininæ Ammon. is a preparation in which the quinine exists as hydrate kept in solution by means of the excess of ammonia and by the rectified spirit, especially the latter. Consequently when it is mixed with much water the alkaloid is precipitated, as in the following:—

Tr. quininæ a	mmo	niatæ				3x.
Ammon. bron	nid.					3iss.
Syr. aurantii						3ss.
Aq. camph.					ad	ξvj.

Science cannot prevent the precipitation without inducing chemical change. The addition of a few drachms of mucilage

M.

of acacia is advisable. Dissolve the ammonium bromide in 4 ounces of camphor-water, add the syrup and 2 drachms of mucilage, pour in the tincture, shake gently, and make up. The following is a case of bad prescribing; apparently the doctor desired to counteract the heart-depressing influence of sodium salicylate by ammonia:—

Sodii salicylatis						зij.
Potassii bicarbon	atis					зij.
Tincturæ quinina	e ami	monia	ıtæ			₹j.
Syrupi aurantii						3j.
Aquæ					ad	ξvj.

Here there are two possible forms in which the quinine may be precipitated, hydrate and salicylate; the precipitate is really a mixture of both, and is peculiar in being green at first, and gradually changing to brown.

This tincture and liquor ammon. acet. may occur in prescription together. They afford a peculiar example of the way that contrary things sometimes go smoothly together. As already noted (page 250) the acetate under certain conditions hydrolyses, and quinine hydrate is precipitated when the ammoniated tincture is poured into water, yet the following makes a perfectly clear mixture:—

M.

Mix the tincture and liquor, then add the water.

### SCALE PREPARATIONS IN MIXTURES.

Scale preparations are not difficult of solution, tartarated iron and sulphate of beberine being among the least soluble. Do not shake scale preparations with a solvent, as an abundant and persistent froth is in most cases formed. The following examples of mixtures containing scale preparations

show the difficulties which may arise and how to deal with them:—

Ferri et quininæ cit				gr. xxxvj.
Spt. ammon. arom				ziij.
Syr. zingiberis				діј.
Aquæ			ad	žvj.

Dissolve the ferri et quininæ cit. in 2 ounces of water, and the other ingredients with 2 drachms of acacia mucilage in the remainder; mix with gentle agitation.

Ferri et ammon	. cit.				
Acid. citric.					
Tinct. aurant.					
Syr. aurant.		*/	4		

M.

The solution of the ferri am. cit. is troublesome; it should be dissolved in a test-tube, with a drachm of water, over a spirit-lamp. If the mixture is not wanted immediately the ammonio-citrate will dissolve if added last to the other ingredients contained in the bottle, this being laid on its side; with an occasional shake, in less than half an hour it will be dissolved. Ferri et quin. cit. is sometimes prescribed in this form, and the same procedure is to be adopted.

Ferri et ammonii citras varies considerably in solubility—that is to say, some specimens give perfectly bright solutions which show no deposit after standing for days, while others show a deposit in a few hours. This is due to the heat of scaling, and it is much to be regretted that manufacturers do not supply an unevaporated solution 4 fluid parts representing 1 part of the scaled compound. The scales also vary in reaction, sometimes being so acid as to give a solution which effervesces briskly with bicarbonates. In effervescing mixtures containing ammonio-citrate the acid should be put with the scale compound. If citric acid is prescribed, it is advisable to heat the mixture containing it until the brown colour changes to green. This change occurs in a few days, and might alarm the patient, so that it is as well to carry it out before the

mixture is dispensed. Tartaric acid does not act in this way. The varying reaction of ammonio-citrate of iron is well exemplified in the following:—

Ferri et ammon. citra	ıt.			· 3j.
Potassii chloratis				• 3j•
Magnesii sulphatis				. 3iss.
Syrupi aurantii .				. ziiss.
Aq. menthæ piperit.				ad zviij.

M.

M.

M.

Sometimes this has in it quite a copious precipitate of ferric hydroxide, which dissolves on the addition of a few grains of citric acid. With a markedly acid scale there is no precipitate.

Ferri et quinina	e cit.			. 3j.
Potass. citrat.				. 3iv.
Syr. aurant.				. 3ss
Aquæ .				ad Zvj

Even with perfectly neutral citrate of potash there is a considerable deposit of quinine citrate in this mixture. The addition of a few grains of citric acid produces a perfectly clear mixture.

of a few grains of citric acid produces a perfectly clear mixture, but even with that quinine citrate gradually crystallises out, adhering to the sides of the bottle. This phenomenon is now known to dispensers as 'salting out,' which is a convenient phrase for explaining that some salts neutralise the solvent action of ammonium citrate on quinine citrate, which per se is a feebly soluble salt (1 in 1,000). Perhaps the 'salting-out' process is not observed by the dispenser, as it takes some time, but prescribers should be advised to omit alkaline citrates from such mixtures.

Ferri et				Đij.			
Liq. ammonii acetatis						3iss.	
Syr. au	rantii						ziij.
Aquæ						ad	ξvj.

The liq. ammon. acet. should be distinctly acid, otherwise quinine hydrate will be precipitated.

Tincturæ digitalis .			· 3j.
Ferri et quininæ citratis			. 3ij.
Acidi phosphorici diluti			· 3j.
Infusi quassiæ			ad 3vj.

If compounded in the order of the ingredients—the citrate being dissolved in a little of the infusion—the tincture precipitates a little of the quinine as tannate, and the phosphoric acid throws out a portion of the iron as phosphate.

In the following case we have a more flagrant example of incompatibility:—

Ferri et quin.	cit.				3j.
Ammon. carb.					3ij.
Tinct. aurant.					Зij.
Aquæ .				ad	ξvj.

No plan can be adopted for preventing the precipitation of the quinine in this case. The best results are obtained by dissolving the citrate in  $\frac{1}{2}$  ounce of water, and mixing it with the tincture. Dissolve the ammonium carbonate in the rest of the water and mix the two solutions, pouring the citrate solution into the ammonia one. The addition of a little mucilage to the ammonia solution before mixing prevents the quinine adhering to the bottle.

Bromide of potassium upsets the equilibrium of ferrum tartaratum, e.g.:—

Ferri tartarat.					3j.
Potassii brom.		4			3iij.
Tinct. chlorof.	co.				3ivss.
Syr. zingib.					3vj.
Aq. menthæ pi	p.				ξvj.

The tartrate must be dissolved separately by rubbing down to powder in a mortar and stirring with 3 ounces of the peppermint-water. By attempting to dissolve it along with the bromide an insoluble coating is formed on its surface, and solution is very much retarded.

#### BISMUTH MIXTURES.

So many and peculiar are the changes which occur in mixtures containing one or other of the salts of bismuth that they deserve a section to themselves. Bismuth subnitrate is the most frequently prescribed salt, being oftener used than all the other salts put together; then come bismuth carbonate and solution of bismuth in about equal proportions, and far behind them the salicylate and other special salts. It has already been observed (page 65) that bismuth subnitrate (BiONO<sub>3</sub>.H<sub>2</sub>O) parts with nitric acid when shaken or washed with water. On shaking bismuth subnitrate 3ij. with water 3x. for a few seconds it will be found that the water has become quite acid. It is the acid thus liberated which is active in forming the clot in bismuth-and-tragacanth mixtures; and we find that if the subnitrate be washed with hot water in which a little sodium bicarbonate has been dissolved, it can be easily diffused through the liquid without forming a clot. The following are examples of mixtures that clot :-

I.	i	II.	
Bismuth. subnit.	. 3ij.	Bismuth. subnit	· Div.
Acid. hydrocyan. dil.	. 3ss.	Liq. morph. hydrochlor.	· 3j.
	· 3j.	Tr. bellad	. ziss.
Tr. chlorof. co	. 3ss.	Pulv. tragac. co	· 3j.
Aquæ	ad zviij.	Aq. chlorof	ad zviij.

No. I. made a very curdy mixture, rendered worse by trituration in a mortar, and after several days became so thick that the bismuth would not subside. No. II. also rapidly clotted. After twenty-four hours the lumps admitted of being rubbed up, and then made a passable mixture. There are three ways of obviating the clotting: (1) By making the mixture of bismuth subnitrate and water feebly alkaline before adding the tragacanth, as by the addition of a few drops of ammonia solution or a grain or two of sodium bicarbonate; (2) by the substitution of bismuth subcarbonate for subnitrate; or (3) by

the substitution of acacia for tragacanth in the pulv. tragac. co. By the third method the bismuth is not so well suspended; but as it involves the least important alteration in the prescription, it is the best alternative to adopt. This is well exemplified in the following:—

III.	IV.					
Bismuth. subnit	Bismuth. subnit					

No. III. was first compounded with pulv. tragacanth. co. 3j., and after standing a little the bismuth formed a jelly-like clot with the gum which would not diffuse throughout the mixture. Tragacanth mucilage behaved similarly. A few drops of ammonia solution prevents the gelatinisation, but is inadmissible in the presence of strychnine. The prescription was therefore altered as shown in No. IV., and, dispensed secundum artem (bismuth and liquor in half the water, the powders with the rest, and the two mixed), clotting was obviated.

Bismuth Subnitrate and a Bicarbonate react according to the following equation:—

2BiONO<sub>3</sub> + 2NaHCO<sub>3</sub> = Bi<sub>2</sub>O<sub>2</sub>CO<sub>3</sub> + 2NaNO<sub>3</sub> + H<sub>2</sub>O + CO<sub>2</sub>.

The reaction is sometimes slow, but if it does not occur in dispensing the prescription, it is apt to take place after the mixture is sent out. Potassium bicarbonate acts more rapidly than sodium bicarbonate. Combinations of this kind occasionally burst the bottle. It is a question of time, temperature, quantity of ingredients, and strength of bottle, as to whether an explosion will result.

With the above quantity of liq. strychninæ, there is, of course, no precipitate of strychnine in alkaline solution. As the solubility of strychnine is I in 6,400 or thereabouts, it is safe to remember that I minim of liquor will give a precipitate in a fluid drachm of alkaline mixture, but none in 80 minims.

Potassii bicarbonatis			. 3ij.
Bismuthi subnitratis			. 3ij.
Aquæ destillatæ			ad zvj.

M.

On one occasion, probably on a summer day, this burst the bottle within half an hour; on another occasion, when the temperature was only 60° F., it was dispensed, the bottle securely corked, laid on its side, and agitated at intervals in expectation of an explosion. The result was disappointing, for after twenty-four hours had elapsed it was still intact, and the internal pressure was not sufficient to blow the cork out even when partly released. It was treated as it might be at a patient's house, for several days, agitating occasionally, and removing the cork, but the effervescence was not enough to cause inconvenience. In dispensing such prescriptions the possibility of an explosion must, however, be taken into consideration. Some dispensers substitute bismuth subcarbonate for subnitrate; others object on principle to 'substitution,' so mix the subnitrate and bicarbonate with boiling water to hasten the decomposition. The result is practically the same in both cases, for the finished mixture in either case contains bismuth subcarbonate, and that which has been made up with bismuth subcarbonate contains also the full amount of free alkaline bicarbonate. The dispenser should be guided by the following considerations: -When, as frequently happens, aromatic spirit of ammonia is also an ingredient in the prescription, subnitrate may be used, because the ammonium hydrate will either convert the subnitrate into hydrate of bismuth or else will absorb any carbonic-acid gas that may be produced. When the amount ordered of each ingredient does not exceed 7 or 8 grains to the ounce in the case of sodium bicarbonate, and 5 grains in the case of potassium bicarbonate, there is practically no chance of explosion. If these quantities are largely exceeded, add the bicarbonate to most of the water, and shake until no more will dissolve; then add the subnitrate rubbed down with the remainder of the water, shake up, and loosen the cork occasionally. Then send out with the message, 'This bottle must not be laid on its side; loosen the cork immediately it is received.' Lastly, when no aromatic spirit of ammonia is ordered, and the ingredients are present in large proportion (over 10 grains of each to the ounce), and the medicine has to be packed up at once, so that the cork cannot be loosened for a long time, it is wiser to complete the reaction by heating than to incur any risk of explosion.

Bismuth Salts and Iodides are sometimes prescribed together, with the result that patients and some dispensers become alarmed by the changes that occur in the appearance of the mixtures owing to the formation of bismuth oxyiodide—a brownish-red substance, which, happily, is a therapeutic agent, and may act quite as well as the ingredients from which it is formed. The following are examples of prescriptions in which the change occurs:—

I.			II.	
Bismuth. subnit.  Pulv. trag. co.  Acid. hydrocyan. dil.  Liq. morph. hydrochlor.  Potass. iodid.  Aq. chlorof.  M.	. 3iss.	Potassii iodid. Tr. belladonnæ Mist. bismuthi s M. pro dose.	ed.	. gr. iij. . mx. . ǯss. ǯviij.

The formation of bismuth oxyiodide is slow, being hindered by the mucilage, and doubtless it is proportionate to the amount of bismuth subnitrate which gets into solution. No. II. contains mistura bismuthi sedativa of Guy's Hospital, which is—

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Bismuthi subnitratis . . . . . . . . . . . . gr. x.

Sodii bicarbonatis . . . . . . . . . . . . . . . . . gr. x.

Pulveris tragacanthæ compositæ . . . . . . . . . . . gr. x.

Liquoris morphinæ hydrochloridi . . . . . . . . . . . . ad 3j.

M.
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The powders in this are mixed together in a mortar and made into a thin cream with a little water, allowed to stand for two hours, and the morphine solution added. At this stage the mixture is well stirred, and the potassium iodide (in a drachm of water) and tincture of belladonna added as soon as effervescence ceases.

Bismuth Salicylate is one of a class of compounds (salol is another) which do not mix readily with water. They are best dealt with by placing in a dry mortar and triturating with sufficient undiluted mucilage of acacia to make a thin cream; then gradually stir in the water. If any spirit is available mix it with the bismuth salicylate.

I.			II.		
Potass. bromidi .		ъij.	Bismuthi salicylat.		3j.
Bismuth. salicylat.		3iss.	Liq. bismuthi .		зij.
Pulv. acaciæ .		3iv.	Mucil. acaciæ .		<b>3</b> j.
Spt. chloroformi		ъij.	Spt. chloroformi.		3j.
Aq. cinnamomi .	ad	ъiij.	Aquæ ad		zvj.
М.			M.		

In No. I. rub the salicylate very fine in a mortar, making it into a smooth cream with the spirit of chloroform, thinning it with the water. Separately dissolve the bromide in half the water, and to this add fresh mucilage of acacia equivalent to the powder ordered; pour in the salicylate mixture, shake, and make up. No. II. is peculiar. The prescriber of it asked Mr. Harold Wyatt, jun., why bismuth-salicylate mixtures are always smooth when liquor bismuthi is prescribed along with the salicylate. Mr. Wyatt experimented and found that bismuth salicylate is soluble in ammonium-citrate solution.

Liquor Bismuthi.—The original of this preparation is a solution of bismuth citrate in a slightly alcoholic aqueous solution of ammonium citrate. The 1867 B.P. liquor contained ammonium nitrate and citrate, and was much stronger in bismuth than the original; a change was made in 1885, the solution becoming one of ammonio-citrate of bismuth; and in 1898 the manner of making the solution was altered, its composition remaining the same, substantially, there being no excess of ammonium citrate. Yet there is a difference, for the solution frequently turns quite milky owing to separation of

bismuth citrate, hence manufacturers are inclined to modify the preparation so as to make it permanently clear. These facts account for some of the differences which are reported in the appearance of bismuth mixtures: in the first place, the B.P. liquor is a solution which is nearly on the verge of precipitation; in the second place, precipitation may be induced by comparatively trifling and unobserved differences of method; and, in the third place, the commercial liquor varies considerably in composition, and even in strength.

Liq. bismuth			. 3ij.
Liq. magnes. carb.			. 3iss.
Aq. chlorof			ad zvj.

On compounding this prescription with the B.P. 1885 solution freshly prepared, the result was a mixture containing a copious white deposit of bismuth carbonate. This result cannot be avoided. With the 1867 liquor a clear mixture was obtained, because the excess of citrate of ammonium in it prevents the precipitation of bismuth citrate.

Α.	В.	
Liquor. bismuthi (Schacht) 3ij. Tincturæ calumbæ 3j. Spt. ammon. aromat 3j. Potass. bicarbonatis gr. x. Aquæ ad 3j. M.	Sodii bicarb Spt. chloroformi	0 0

Bicarbonates do not affect Schacht's liquor, yet mixture A rapidly becomes perfectly thick, although neither ammonium carbonate or hydrate nor potassium bicarbonate has this effect immediately. The following reaction appears to take place:—

$$2AmHO + 2KHCO_3 = Am_2CO_3 + K_2CO_3 + H_2O$$
.

This is followed by interaction between the dissolved bismuth citrate and the potassium carbonate, with precipitation of bismuth oxycarbonate. Even aromatic spirit of ammonia produces a precipitate in Schacht's solution in the course of a few days, and ammonium carbonate has a similar effect; but ammonium carbonate and ammonia solution produce a faint

opalescence in Schacht's liquor in an hour or two. More ammonium citrate prevents this. Mixture B becomes milky at once, and the precipitation is most abundant with dispensing solution of bicarbonate because it contains carbonate.

, I.		II.			
Liquor. bismuthi	. 3ij.	Mag. carb. pond.			3j.
Sodii hyposulphit.	. 3ij.	Liq. bismuthi .			žss.
Tr. nucis vom	· 3j.	Liq. opii sed			ziiss.
Inf. calumbæ .	ad zvj.	Glyc. pepsin			3ss.
M.		Aq. dest.		ad	ъij.
		Sig.: 3ss. ex aq	. t.i.d	. p.	cib.

No. I. is substantially bismuth hair-dye. On compounding it there is nothing abnormal-looking about it, but at the end of a day a yellowish-brown precipitate begins to fall, and this becomes darker on exposure. The precipitate is bismuth sulphide. No. II. mixture turns greenish in colour owing to the presence of black bismuth sulphide, which doubtless arises from some sulphuretted compound in the glycerin of pepsin reacting with the bismuth precipitated.

Tinct. ferri perchlor				ъiij.
Liq. bismuthi				ziss.
Acid. phosph. conc. I	3. P.			3ij.
Tr. nucis vom				ziij.
Tr. quassiæ				3iv.
Bromid. potass				ziv.

This can be made into a clear mixture by first mixing the tinct. ferri perchlor, with the phosphoric acid in a glass measure, then adding the two tinctures; afterwards gradually adding the liq. bismuthi, constantly stirring with a glass rod; and, lastly, adding the potassium bromide in fine powder.

## SALTS IN MIXTURES.

The remarks on solution (pages 56-61) specially apply to mixtures of saline substances. The general directions there given as to the formation of solutions should be followed in making mixtures. Three methods of procedure are commonly

observed at dispensing-counters—(1) putting the salt to be dissolved into the bottle in which the mixture is to be dispensed and shaking with the solvent—this is the slovenly way, because it is always advisable to strain solutions into the bottle in which they are to be sent out; (2) dissolving in a solution-bottle or measure by agitation, and (3) in a mortar; this last is the poorest method, unless when hot water is the solvent, then a porcelain mortar may be used. Glass mortars or thick glass vessels should not be used for making solutions. When decoctions or infusions are ordered the salt may be dissolved in them while hot, if the quantity of salt is not more than will remain dissolved in the cold solution. Carbonate of ammonium must be dissolved in the cold. Nearly all salts dissolve to a greater extent in warm than in cold water (compare page 59).

Many salts are more soluble if several are dissolved in the same vehicle, or if there is some acid present. Sulphate of potassium, for instance, is more soluble in a solution of sulphate of magnesium than in pure water. In such cases double salts are formed, which are more soluble than the separate constituents. In the case of 'Henry's Solution of Magnesia' the sulphuric acid makes the sulphate of magnesium dissolve in a smaller proportion of water than would otherwise be required.

The addition of tinctures, or other spirituous liquids, to a solution of a salt tends to throw the salt out of solution, because the mixture of spirit and water is not so good a solvent as water alone.

Liq. sodii arsenatis . . . . . . . m96
Spt. vini rect. . . . . . ad 3iij.

In this case much of the arsenate crystallises out in a few hours. When the prescription was received it was suggested to the doctor that the liquor should be mixed with  $1\frac{1}{2}$  ounce of water and then  $1\frac{1}{2}$  ounce of spirit added, as this solution yields no crystals. The alteration was sanctioned. Of course, there are many substances, but few inorganic salts, which are more soluble in alcohol than in water.

#### MIXTURES OF INSOLUBLE SUBSTANCES.

Powders which are insoluble in aqueous menstrua and which do not readily diffuse in water should be rubbed down in a mortar with some of the fluid, for if put into the bottle and shaken with the fluid, many powders of that kind float about in little balls, which are afterwards difficult to diffuse. Especially is this the case with vegetable powders, carbonate of magnesium, light calcined magnesia, calomel, and precipitated sulphur. Ipecacuanha and some other vegetable powders form a doughy mass if put into a bottle and water be poured upon them.

The best plan is to triturate such powders in a mortar with syrup or glycerin, if ordered, or else with just enough water to make a thin cream (neither more nor less), and rub together until quite uniform before further dilution, e.g.:—

Tr. calumbæ.				5vj.
Ammon. carb.				gr. 50
Pulv. rhei .				gr. 50
Sodii bicarb				3ij.
Syrup. zingib.				<b>3</b> j.
Aquæ			ad	žviij.

The rhubarb and soda may be perfectly diffused by the shakingup method, but more froth is produced than the tincture will dissipate. It is preferable to begin with a mortar, powder the ammonium carbonate, add the rhubarb and soda, triturate with the syrup, dilute with water, add the tincture, and fill up.

A universal rule which no dispenser should neglect is: All potent substances which are slow of solution, such as perchloride of mercury, strychnine, and the like, should be completely dissolved before they are placed in the bottle.

### EXTRACTS IN MIXTURES.

Solid extracts are seldom prescribed in mixture in this country, but they are on the Continent, and the following hints by Dr. Hager will be useful to the English dispenser.

When alcoholic extracts have to be dissolved in a mixture

the vehicle in which they are rubbed down into solution should not be hot.

If purely resinous extracts have to be compounded in a mixture they should first be rubbed in a mortar with twice or three times their weight of powdered gum arabic, then combined with the vehicle perfectly cold. If any syrup is ordered in the mixture the resinous extract should be rubbed down with it. Example:—

Ammonii muriatici				5.0
Succi liquiritiæ				5.0
Aquæ destillatæ				100.0
Ext. cinæ æth.				1.5
at column D C &				

M. et solve. D. S., &c.

The extract should be first rubbed with powdered gum arabic 1.5, and with the chloride of ammonium, then with the liquorice extract in concentrated solution, and, lastly, with the cold water.

Extracts made with water and alcohol are difficult to mix with a purely spirituous solution. Example :—

Extracti hyoscyami, Ph.G.			1.0
Tincturæ valerianæ			5.0
Spiriti ætherei			20.0

Misce.

In this prescription, the spirit of ether being only an adjuvant, a slight modification must be made. The extract must be dissolved in 2 parts of distilled water, then the tincture of valerian, and 18 (instead of 20) parts of spirit of ether added. In the case where the fluid with which the extract is to be mixed is itself a strong medicine (tinct. digitalis æth., for example) nothing remains but to rub it with its own weight of water, and then rub the quasi-solution vigorously with the tincture.

Inspissated Juices are similarly treated; but, when dissolved in water, they should stand in a measure for two or three minutes to settle, and the fluid be poured off carefully from the sediment.

The narcotic non-resinous extracts can be kept in concentrated solutions. Ten parts of extract should be dissolved in a mixture of 12 parts of water, 4 parts of glycerin, and 4 parts of rectified spirit. When dispensing from these solutions three times the quantity of extract ordered must be weighed. The label should indicate this exactly. Some extracts, such as aconite, henbane, and belladonna, kept in solution, will require well shaking before weighing. [It will be remembered that in Germany liquids are weighed.—Editor.]

Lactucarium ought to be rubbed down in a mortar with twice its weight of sugar and a few drops of spirit of wine.

Refined Liquorice-juice can be kept in solution in its own weight of distilled water, or in a mixture of 3 parts of distilled water and 1 part of glycerin, in moderate-sized bottles quite full. Some acids and many salts of alkaloids can only be mixed with solution of liquorice in a very diluted condition, as they precipitate the glycyrrhizin and cause a very disagreeable appearance.

Extract of Opium forms peculiar flakes with the mucilage of carragheen, althæa, and salep, but it can be mixed with them if first rubbed down with syrup or dissolved in 50 times its weight of water. Acetate of lead is sometimes ordered in such a mixture, and this also should be dissolved in 50 times its weight of water before being added.

# MISCELLANEOUS INGREDIENTS.

General rules break down now and then, so that the dispenser should have some acquaintance with the behaviour of certain substances which must be treated according to their characteristics. The chapter on Special Drugs gives useful information for general guidance, and in the paragraphs which here follow various peculiarities are illustrated by actual prescriptions.

Acetanilidum.—The sparing solubility of this drug in water may tempt the dispenser, as in the following instance, to treat it as an insoluble substance when prescribed in mixture:—

Ft. mist.

Sig.: Half a wineglassful every six hours.

The prescriber appears to have considered the antifebrin insoluble, and therefore ordered the gum to suspend it. A dispenser, taken off his guard, compounded the mixture by mixing the gum acacia and glycerin in a mortar, adding some water, and putting in the powders. The result was a thick, muddy mixture. It had been dispensed before as a clear mixture, and properly so, as the glycerin suffices to dissolve and keep in solution the acetanilide, which the water otherwise does not retain in solution at the normal temperature. Dissolve the acetanilide and quinine hydrochloride in 1 ounce of boiling water, add the glycerin and nearly all the rest of the water, then an equivalent of acacia mucilage, and make up.

Acidum Benzoicum is rarely prescribed per se in aqueous mixture, but if it is the dispenser must recollect that although sparingly soluble in water it is readily soluble in alcohol of various dilutions and in glycerin. If, therefore, any tincture is prescribed along with it the acid should be dissolved in the tincture and the water added. If the acid is in excess of the alcohol solubility power, it must be suspended, but it is absolutely requisite to rub it down to fine powder first, owing to its light feathery nature, which would prevent it diffusing, as in this example:—

M.

Acidum Carbolicum.—Whenever possible this should be sent out in complete solution. A cold saturated solution in water contains 7 per cent. When a larger proportion is ordered it is better to see the prescriber and advise the addition of sufficient glycerin or spirit to hold the carbolic acid in solution. Undissolved acid acts as a caustic.

Acidum Gallicum.—Cold water dissolves about I percent.; hot water, one-third of its weight.

Acidum Hydrocyanicum.—Dispensers should never think of dispensing any other preparation than the pharmacopæial one, unless Scheele's acid is specially ordered. Owing to the extreme volatility of the acid it should be the last ingredient added, the mixture being made up and sufficient space left in the bottle for the acid, which is best measured with a graduated syringe. Mixtures containing hydrocyanic acid should be labelled 'Shake the bottle.'

Acidum Salicylicum.—Considering that this acid is really ortho-hydroxybenzoic acid, C<sub>6</sub>H<sub>4</sub>(OH):COOH, benzoic acid being C<sub>6</sub>H<sub>5</sub>.COOH, it is not surprising that the two closely resemble each other in physical characters, especially in solubility. On pages 71 and 72 the properties of salicylic acid are given, and the question of what kind to use in dispensing is discussed. Mention is there made of the solubility of the acid in alkaline acetates. This is sometimes taken advantage of, as in the following:—

Liquoris ammor		tis . ·			ъij.
Acidi salicylici					3ij.
Tincturæ quinin	æ .				žiss.
Syrupi aurantii					₹SS.
Aquæ .					ъij.

There is not sufficient ammonium acetate in this to dissolve the salicylic acid (a drachm of the solution being required for 5 grains of the acid), so that the mixture contains undissolved acid from the first, and at the end of twelve hours quinine salicylate separates. It is therefore advisable to treat the acid as an insoluble substance from the first by rubbing it to fine powder in a mortar, with some of the syrup and water, adding ounce of acacia mucilage, then the liquor ammon. acet., tincture, and syrup, and making up to 6 ounces with water. The mixture contains free acetic acid.

The following are the solubility figures for some substances which react with salicylic acid to form salicylate of the alkali and free acid. For each drachm (60 grains) of salicylic acid there are required, of

Ammonium-acetate	e sol	ution			10 dr.
Borax					75 gr.
Potassium acetate					50 gr.
Potassium citrate					120 gr.

A similar change to the combination of quinine and salicylates occurs in the following:—

Sodii salicylat.			. ziij.
Tinct. buchu .			. 3vj.
Decoct. cinchon.			ad zviij.

Salicylate mixtures are very apt to change colour owing to oxidation (compare page 298). The following is an example of a different change:—

Sodii salicylat			. 3ij.
Ferri sulph			· Đị.
Pulv. tragac. co.			· 3j.
Syrup. aurantii .			· 3ss.
Aquæ chloroformi			ad zvj.

This forms a deep reddish mixture, due to the formation of salicylate of iron. Salicylates are about the most delicate test for ferric salts, and, as it is impossible to preserve ferrous sulphate absolutely from oxidation, it naturally follows that the mixture should be dark-coloured, whether it is prepared from salicylate made with natural or artificial acid. The sulphate of iron should be dissolved in the syrup and I ounce of chloroformwater; the salicylate and compound powder made into a mixture with the rest of the water, and the iron solution then added to it. In this way the most lightly coloured mixture is obtained.

Alkaloids.—A knowledge of the ordinary alkaloidal reactions is very useful at the dispensing-counter. The following is a fair example of the cases in which this knowledge may be turned to practical account. On the addition of liq. strychninæ, the mixture assumes a yellow colour:—

Liq. Donovan				ъij.
Liq. strychninæ				3j.
Syr. ferri iodidi				₹j.
Glycerini			ad	ξij.

Strychnine and other alkaloids are precipitated by alkaline iodides, and especially by mercuric iodide (a solution of which in potassium iodide and water is known as Meyer's alkaloidal reagent). The precipitate in this case is an iodo-hydrargyrate of strychnine, resulting from interaction between the strychnine hydrochloride and the arsenium and mercuric iodide of the Donovan's solution. It should not be forgotten that iodo-hydrargyrate precipitates are heavy, and in consequence dangerous, as the last dose in a bottle may contain nearly all the potent alkaloid originally put into the mixture; therefore the dispenser should ensure its suspension, or, better, its exclusion by consultation with the prescriber.

Ammonium Benzoate.—The commercial salt is sometimes unduly acid and difficultly soluble; if so, it should be neutralised with a little ammonia. The neutral salt is soluble in 5 parts of water. To compound it, lightly rub to a very fine powder in a dry mortar, triturate with a little water to a uniform cream, then dilute further, and shake until dissolved.

Ammonium Carbonate should always be dissolved in the cold, never with hot water. Only translucent pieces should be used at the dispensing-counter, never the effloresced salt nor pulv. ammon. carb., which are deficient. It keeps fairly well in solution, and in dispensaries, where a supply can be used up within three days, a 1-in-8 solution may be stocked.

Borax.—The peculiarities of borax are discussed later, in the chapter on Applications. It is generally used externally. The following prescription is of interest in this section as being for a mixture and having created a lively correspondence in The Chemist and Druggist, August to October, 1898:—

M.

According to the British Pharmacopæia the aqueous solution of gum acacia 'forms with solution of borax a more or less translucent white jelly.' A pharmacist who dispensed the above prescription obtained a jelly, but on communicating with the prescriber a sample of a limpid mixture was sent. On publication of the prescription in The Chemist and Druggist, a number of correspondents sent in mixtures which were more or less limpid, these being obtained by diluting the mucilage to the fullest possible extent before adding a solution of the borax and sodium bromide in warm water. Mr. W. Martindale sent us a pourable mixture made in this way; but the original correspondent, following his directions, could only get a jelly with fresh mucilage, a pourable mixture with mucilage from the same gum not quite fresh, and a limpid mixture with cheap gum. Our own experience is that if made from a gum acacia strictly answering the Pharmacopæia tests the mixture cannot be made limpid, but with old and acid mucilage of any gum a limpid mixture results. It will be observed that borax is in excess of the solubility-point, and some of it crystallises out.

Butyl-chloral. Hydras.—A few general precautions in respect to dispensing butyl-chloral hydrate in solution have already been noted (page 65). The chief difficulty with this substance is its tendency to form water-insoluble oily-like

compounds especially with alcohol, as exemplified in the following prescriptions:—

I.	1	II.	
Croton-chloral. hydrat.	· Đij.	Butyl-chloral. hydrat.	Đij.
Spt. vini	. 3ss.	Glycerini	3ij.
Quininæ sulphat	. 3ss.	Tr. gelsemii .	3ij.
Aq	ad 3x.	Aq. chloroform	. ad zvj.
Fiat mistura.	1	Fiat mistura.	

The writer of No. I. prescription directed that the butyl-chloral hydrate and the quinine sulphate should be rubbed together, the spirit added to dissolve, then the water. The spirit simply makes the alkaloid and chloral an oily mass, which apparently is not at all affected by water. Apart from the effect which alkaloids have on butyl-chloral hydrate (of which examples follow) alcohol converts it into butyl-chloral alcoholate, a compound which is sparingly soluble in water. Dispensing-solutions of the hydrate are sometimes made with a mixture of rectified spirit and glycerin, which on keeping for a few days are quite immiscible with water, and on pouring a little of such solutions into water butyl-chloral alcoholate sinks to the bottom in oily drops. Alcohol as a solvent for the hydrate should be avoided. The British Pharmacopœia states that the hydrate 'is soluble in about 50 parts of water, and in its own weight of glycerin or of alcohol': it would be advisable for the B.P. to add that in alcoholic solution it is changed to an insoluble substance. The best dispensing-solution is made by dissolving 1 ounce of the hydrate in 21 fluid ounces of glycerin and I ounce of boiling water, and when cold making 4 fluid ounces of the solution with water. In making aqueous solutions care should be taken not to heat above 170° F., otherwise the hydrate fuses and an opalescent mixture results. No. II prescription typifies the best method of compounding. Heat the glycerin in a test-tube by dipping the tube in a small basin of boiling water for a few minutes, add the butyl-chloral hydrate, and dissolve. Half fill a 6-ounce bottle with chloroform-water, pour the glycerin solution into it and shake, wash the test-tube with I ounce of chloroform-water and add to the bottle, add the tincture, and make up. Reference has been

made to the influence of alkaloids upon the hydrate. The following are good examples:—

III.	ation of	IV.		
Butyl-chloral, hyd. Ferri et quin. cit. Tr. gelsemii Aq	 · ʒiss. · Əiv. · ʒij. ad ʒviij.	Quin. hydroch. Croton-chloral. hyd Antipyrin. Ammon. brom. Syr. aurant. Aq. chlorof.	 :	gr. 36 3j. gr. 36 3j. 3ss. 3ij.

No. III. dispensed as written (the butyl-chloral hydrate solution being added to the citrate solution) gave a thick, sticky precipitate. A clear mixture was obtained by first dissolving the hydrate in ½ ounce of glycerin and half as much water gently heated, adding the solution to the rest of the ingredients previously mixed and dissolved. An oily deposit forms in No. IV. when either the antipyrin or butyl-chloral hydrate is added to the rest of the ingredients in the prescription. These two ingredients are incompatible (as chloral hydrate and antipyrin are, page 97), and some addition or omission is necessary to make a clear mixture. The following modification does this:-(a) Dissolve the quinine in 2 ounces of water acidulated with 40 drops of dilute hydrochloric acid; (b) dissolve the antipyrin and bromide in the same quantity of water; (c) dissolve the butyl-chloral hydrate in a mixture of spt. chlorof. 3j. and S.V.R. 3j. (or spt. chlorof. 3ij.) and make up to 2 ounces with water. Mix a, b, and c; an oily deposition of butyl-chloral antipyrin immediately takes place, which, after a few hours, with an occasional shake dissolves, forming a clear mixture.

Caffeinæ Citras sometimes gives trouble owing to its loose combination, water sufficing to split it up, partly or wholly, into caffeine and citric acid, both of which dissolve as such. The following show what may happen:—

	I.				1	II.		
Caffeinæ citrat.			зij.	Sodii salicyl.				3iss.
Sodii salicylat.			zij.	Caffein. cit.				gr. xx.
Aq		ad	ъхіј.	Phenazoni				3j.
M.				Syr. aurantii				ziij.
				Aq.			ad	ξviij.

No. I. dispensed as written becomes, after a brisk shake, solid in two minutes. If solutions of the citrate and salicylate are mixed without shaking and left undisturbed, the growth of crystallisation may be observed proceeding with great beauty. This is due to the free citric acid combining with the alkali of the sodium salicylate, thus setting salicylic acid free. Sodiocaffeine salicylate is the most soluble compound of caffeine, and is formed by dissolving caffeine in sodium-salicylate solution; advantage should, therefore, be taken of this fact by dispensing No. I. with an equivalent of caffeine in place of the citrate-that is, half the amount. It is worthy of note that double the quantity of sodium salicylate gives a clear mixture with the caffeine citrate, and this is also obtained by the use of a drachm of sodium citrate, so that in gouty or rheumatic cases, where the citric acid is advantageous, therefore required, either of these expedients may be resorted to. No. II. mixture crystallises after standing a short time, although sodium salicylate is present in greater proportion than that necessary for perfect solution. By mixing the ingredients in the order written, considerable precipitation of crystals takes place a few seconds after the phenazone is added. When the mixture is warmed the crystals dissolve, but separate again after several hours. When the order of mixing is changed—as, for example, (1) sodium salicylate, caffeine citrate, phenazone; (2) caffeine citrate, phenazone, sodium salicylate; (3) phenazone, sodium salicylate, caffeine citrate-different results are obtained. No. 1 immediately gives crystals, Nos. 2 and 3 remain clear for many hours, but the crystals formed are not like those in No. 1, which are phenazone-like, but are nearly 1/2 inch long. All the crystals are soluble in a small quantity of water, and give the characteristic colour with ferric chloride when it is added to a mixture of phenazone and a salicylate. In order to compound the mixture clear, the caffeine citrate should be neutralised with ammonia. A mixture thus made remains clear, but the use of half the amount of caffeine does the same thing. (See also the paragraphs on Phenazone, page 294).

Caffeine per se is more soluble in water than alkaloids

generally are (1 in 80, compare page 42) consequently there is less fear of its being precipitated from its salts by alkalies, as the following shows:—

Sodii bromidi		· Aiv.
Caffeinæ hydrobromidi .		· Đj.
Spiritus ammoniæ aromatici		. 3ss.
Aquæ		ad žviij.

Here the proportion of caffeine to solvent is about 1 to 200, or much in excess of the proportion for complete solution.

Calcii Phosphas.—It is well to remember that fresh precipitates are more soluble in appropriate solvents than the same precipitates when dried. This fact was taken advantage of by a dispenser in compounding the following prescription:—

M.

Take one teaspoonful three times daily.

Treated with citric acid 3vj. and some water the stock calcium phosphate was not completely dissolved after a few hours; therefore, the calcium phosphate was dissolved in hydrochloric acid, reprecipitated with ammonia, and the precipitate collected, washed, and drained. The phosphate now dissolved in ½ ounce of citric acid.

Chloral Hydras behaves towards alcohol like butyichloral hydrate, and is decomposed by alkalies with liberation of chloroform. In the following mixture decomposition is probably intentional:—

Chloralis hydratis.			· 3j.
Ammonii carbonatis		,	· 3j.
Tincturæ digitalis.			· 3j.
Aquæ			ad zvj.

M.

This is a bronchitis-mixture which in two days becomes quite

strong in chloroform, and then seems to be more active. Substances with which chloral hydrate liquefies (see page 97) do not as a rule make good aqueous mixtures with it; thus:—

Sodii bromidi					ziv.
Phenazoni .				. :	ziss.
Chloralis hydrati	S				ziss.
Syrupi limonis					3j.
Aquæ				ad	živ.

M.

In this monochloral antipyrin is formed and is deposited as oily drops, resembling butyl-chloral alcoholate in behaviour. Many cases of liquefaction and precipitation are due to the substitution of one molecule for another in a compound, and the more complex the molecule substituted the more insoluble is the product.

Creosotum.—The utility of creosote and its active principle, guaiacol, in the treatment of consumption has revived the prescribing of this old remedy. In doses of a minim or two creosote presents little difficulty in compounding in liquid form, as an ounce of water dissolves about 2 minims of it. Mistura creosoti, B.P., is a good example of such a mixture, the formula being:—

Creosote					16 mins.
Spirit of	juniper				16 mins.
Syrup .					I fl. oz.
Distilled	water			to	16 fl. oz.

Dissolve the creosote by shaking with 14 ounces of the water, add the spirit and the syrup, and make up with water.

Weak mixtures like this are given for gastric troubles, such as flatulence and hiccough. In the larger doses required in phthisis, 5 minims being frequently given, it is best administered in capsules, the creosote being mixed with its own volume of olive oil. Similar mixtures of oil and creosote are sometimes prescribed as emulsions with gum acacia to be compounded

in the usual manner. Acacia mucilage alone suffices to suspend the creosote, as in the following instance:—

Creosoti							m 160
Tincturæ	gentia	omp.				m 160	
Spiritus v	ini rec	t				m 160	
Extracti g	lycyri	hizæ	liq.				žss.
Aquæ .					- •	ad	zviij.

M.

The prescriber wished this to be dispensed with acacia mucilage, but a much better mixture is obtained by mixing the liquid extract and the same quantity of mucilage with 3 ounces of water in a bottle, and adding, all at once, a mixture of the (1) creosote, (2) S.V.R., and (3) tincture, shaking gently, and making up. It is frequently prescribed with cod-liver oil, but does not give a clear solution in this case. A mixture of equal volumes of creosote, absolute alcohol, and castor oil dissolves in cod-liver oil in any proportion.

Ether.—In regard to mixing with water, see the paragraph on volatile ingredients (page 305). It is worth bearing in mind respecting ether that it generally liberates iodine from potassium-iodide solutions, owing to the fact that on exposure to sunlight ether develops a trace of ozone, which reacts with the potassium iodide. Such mixtures should be made alkaline with potassium bicarbonate.

Extractum Ergotæ Liquidum.—Reference has already been made to the fact that this preparation is apt, on dilution with aqueous fluids, to undergo the viscous fermentation (see page 248). This experience is based upon the old preparation made by exhausting the drug with water, evaporating to three-quarters of the drug bulk, and adding alcohol to preserve. Any preparation made in vacuo which is not sterile before evaporation, and is not sterilised by boiling before the preservative is added, contains micro-organisms and their spores. The preservative may destroy the micro-organisms, but it seldom affects spores, so that when suitable conditions arise the spores

revivify, and fermentation of mixtures may result. Liquid extracts generally are prone to yield somewhat copious precipitates on dilution with water, especially in presence of acids;

M.

A heavy precipitate forms. Pharmaceutical ethics does not permit dispensers to make such mixtures elegant by filtration, which is to be regretted, for rarely are such precipitates of the slightest therapeutic value. Of course, when the precipitates are resinous, it would be wrong to remove them by filtration, but not so when inert extractive matter is the cause of turbidity.

Ferri Sulphas.—Solutions of ferrous salts, if neutral, soon lose their brightness through oxidation of the salt, some ferric hydroxide giving a rusty appearance to the solution. This appearance is prevented by acidifying the solution; thus in the case of ferrous sulphate, dilute sulphuric acid is used, and the fact appeared to be known to the writer of the following prescription, who, however, was 'no chemist':—

M.

Here the aromatic spirit of ammonia neutralises the free acid and precipitates some green ferrous carbonate. Yet the mixture was dispensed clear by two chemists, who probably added sufficient acid to dissolve the ferrous carbonate, which, in the circumstances, is the wisest thing on the whole, considering that the therapeutic properties of the aromatic spirit are extinguished in the combination.

Infusum Rosæ Acidum.—Every student of volumetric analysis knows that in titrating acids or alkalies certain vegetable colours are used as indicators, because they show different colours in acid, alkaline, and neutral solutions. The colour of rose-petals is not so used, but it might be: it is a beautiful red in presence of acids, and a vivid green when alkali is in excess. This should be kept in mind when compounding the acid infusion of roses, and prescribers should be warned not to prescribe alkalies with it, as in the following instance:—

M.

M.

As soon as the magnesium carbonate is added the sulphuric acid of the infusion begins to be neutralised, the mixture becomes blue, and eventually brown.

Infusum Serpentariæ.—For some reason or other doctors are fond of the following prescription:—

It gives dispensers a great deal of trouble, because the mixture may be in colour like black ink, or like pale sherry, or like ric brown sherry. The inky coloured mixtures are of course due to the infusion containing starch taken into solution from the bruised root (see page 55). Sometimes the drug contains no starch at all, but in any case it is advisable to make the fresh infusion from unbruised root, and with water at 160° F., infusing three times longer than the Pharmacopæia directs. Many dispensers prefer to use the concentrated preparation (liq. serpentariæ conc. B.P.), which is free from starch, and gives a sherry-coloured mixture with iodine.

M.

Liquor Hydrargyri Perchloridi.—Remarks have already been made regarding the readiness with which mercuric chloride combines with alkaloids. The matter is further discussed in the *Liquor Strychninæ* paragraph.

Liquor Pepticus.—A correspondent asked us if the following mixture should be dispensed with or without a sediment:—

Liq. peptici (Benger's)					. 3	iij.
Sodii bicarb.					. 3	iv.
Glycerini.					. 3	vj.
Inf. quassiæ					ad 3	viij.

To this Mr. Baden Benger replied: 'I find the prescription yields a clear mixture, which, after standing several days, shows no sign of sediment. Liquor Pepticus (Benger) is slightly acid, and will cause effervescence when mixed with Sodæ bicarb. It is difficult to see the object of the prescriber in this case, as pepsin and its preparations are practically inert in any but acid media. This mixture is strongly alkaline, and the pepsin would certainly have to wait its turn, till after the soda had been neutralised by the acid contents of the stomach.'

Liquor Sodii Arsenatis.—Mr. T. Dunlop, in a paper communicated to the North British Branch of the Pharma ceutical Society (December 20, 1899), reported that the following mixture yielded in a few minutes after compounding a granular precipitate of strychnine hydrate:—

On testing the liq. sodii arsenat. it was found to be alkaline in reaction, and this has been proved to be the normal condition of the solution. Various suggestions have been put forward to account for this (see *The Chemist and Druggist*, Vols. LV. and LVI.), but it suffices for the dispenser to know that the solution is alkaline, and that it should be slightly acidified (in

this case with dilute hydrochloric acid) before mixing with anything which free alkali may decompose to form a precipitate.

Liquor Strychninæ Hydrochloridi.—The feeble solubility of strychnine hydrate has been pointed out (page 41) as a source of danger when solution of strychnine is prescribed in alkaline mixtures. The following are prescriptions in which the strychnine is thrown out of solution:—

I.	II.
Liq. strych. hydrochlor 3iij. Elixir. saccharin ad 3ij. M. [Here the sodium bicarbonate of the elixir throws out the strychnine.]	Liq. strychninæ

The B.P., 1885, solution of strychnine was more acid than the present (1898) one, and sometimes deposited on keeping. The 1898 solution also behaves differently with mercuric chloride:

This remains clear for several days if compounded with the 1898 solution, but with the 1885 one it gives almost immediately a crystalline precipitate.

III.		IV.	
Potassii iodidi Liq. strychninæ Aq. menth. pip M.	. 3iss 3iss. ad 3ij.	Hydrarg. perchlor. Potassii iodidi . Liq. strychninæ Glycerini . Inf. quassiæ . M.	 gr. ij. ziv. zij. ziss. ad zviij.

No. III. is clear when compounded, but the strychnine hydrochloride reacts with potassium iodide, and strychnine hydriodide begins to separate in a few hours. No. IV. is a

hopeless case of incompatibility, the alkaloid being precipitated as iodohydrargyrate.

Magnesii Sulphas.—Although magnesium sulphate gives immediately with soluble alkaline carbonates a precipitate of magnesium carbonate, with many tap-waters no precipitate is formed. For example, the following gives an immediate precipitate if dispensed with distilled water, but none with London tap-water:—

Ammonii carbonatis			. 3iss.
Magnesii sulphatis .			· 3j.
Spiritus chloroformi.			. 3ss.
Tincturæ nucis vomicæ			· 3ij.
Aquæ			ad zxij.

Fiat mistura.

Doubtless the presence of chlorides in the tap-water prevents precipitation of magnesium carbonate, for ammonium chloride is used for that purpose in distinguishing between magnesium and calcium salts. There is a limit to the prevention of a precipitate, and tap-waters vary in preventive power, but the point for dispensers and prescribers to note is that a chloride may with advantage be added to such a mixture as the above.

I.		II.				
Magnes. sulphat		zij.	Mag. carb. pond.		. 3iv.	
Tr. rhei co		<b>3</b> j.	Mag. sulphat		. žiij.	
Tr. zingib		3j.	Aq. menth. pip.		ad 3xij.	
Aq. menth. pip	ad	zvj.	M.		3 3	
М.						

Although the sulphate dissolves easily in its own weight of water, it is practically insoluble in alcohol; hence on adding the tinctures of No. I. to the solution of the salt, the mixture becomes almost solid in a few minutes from separation of the sulphate. No. II. mixture exhibits a characteristic common to magnesium salts—viz., that under certain conditions of hydration they form cements. Owing to the large amount of

sulphate in this mixture the suspended hydrocarbonate gradually aggregates, and in a few days forms a stone-like crust in the bottle.

Menthol is rarely prescribed for internal administration in mixture—in fact, the only prescription which we have met with is the following:—

Fiat mistura.

The normal procedure in this case is to dissolve the menthol in the tincture, and add to the chloroform-water, the result being that the menthol is thrown out in indiffusible form. Acacia mucilage is useless for suspension in this case, but an ounce of rectified spirit provides a fairly good mixture. If the menthol is reduced to powder and triturated with an ounce of acacia mucilage, and water then added, a presentable mixture is obtained; but the best plan of all for administering menthol and substances like it in aqueous mixture is to dissolve in four times their weight of olive oil, and emulsify with acacia.

Olea Essentialia.—The remarks in regard to the preparation of aromatic waters (page 52) must be considered in connection with aqueous mixtures containing excess of essential oils. It has been shown that the solubility of oils in water rarely exceeds 1 minim per ounce, and that the rapidity of solution is increased by dividing the oils into small particles, as by triturating with magnesium carbonate or any other powder, or by dissolving in spirit and pouring the solution into water, when the oil dissolved is precipitated in small particles. This latter example shows the condition which the dispenser should aim to get any essential oil into when it is in excess in mixture, and to keep it in that condition by a suitable emulsifying agent, such as acacia. On the next page are examples which do not come within this rule.

. I.			II.		
Calcii hypophosph.		· 3j.	Ol. anisi	,	mxv.
Liq. Fowleri .		. 3ss.	Tr. cardam. co		3ss.
Glycerin. pur		. ziij.	Aq. menth. pip		3vj.
Ess. limonis .		· 3j.	Aq. chlorof		3vj.
Aq. chloroformi.		ad zvj.	Fiat mistura.		
M.			Sig. : 3j. p.r.n.		
Sig. : One tables	poon	ful with a			
tablespoonful of cod-	liver	oil, &c.			

What is ess. limonis? There is no official preparation of that name, but oil of lemon is commercially known as essence of lemon. It will not, however, make a nice mixture in the case of No. I., but a soluble essence of lemon (or its equivalent, a r-in-r tincture of fresh lemon-peel) produces a mixture of good flavour, which goes well with cod-liver oil. Note the chemical incompatibility of the first two ingredients; fortunately the limited reaction and the presence of glycerin (which should be mixed with the Fowler's solution) prevent a precipitate of calcium carbonate. No. II. was dispensed clear by using spirit and a minim of chloroform instead of aq. chloroformi.

**Phenazonum.**—This is the B.P. name for antipyrin or phenyldimethylpyrazolone,  $C_6H_5(CH_3)_2C_3HN_2O$ . In some respects phenazone may be regarded as an artificial alkaloid, but its characters are *sui generis*: (1) it is alkaloid-like in being an aniline derivative; (2) it is unlike alkaloids in its great solubility (it is a free 'base'); (3) like them it gives heavy precipitates with alkaloidal reagents; and (4) it differs from most medicines in being a potential synthetic dye—that is, although a colourless substance, it is on the verge of colour-production, and certain reagents (occasionally prescribed with it) produce the colour. Again, we have in phenazone an excellent example of the importance of chemical knowledge to the dispenser. The characters of the substance may be classified thus:—

It is precipitated—

As insoluble tannate by tannic acids, therefore is incompatible with galenical preparations containing tannin.

As insoluble salicylate in certain mixtures of phenazone and alkaline salicylates.

As hypnal by chloral hydrate (see page 286).

Similar precipitates are given with phenol solutions and with betanaphthol.

As iodo-antipyrin with free iodine in excess.

As a mercury compound (white) with mercuric chloride in certain proportions.

#### It is coloured -

Green with nitric and nitrous acids, owing to the formation of iso-nitroso-antipyrin, and similarly with spirit of nitrous ether or other alkyl nitrites in presence of water and oxygen (see below).

Red with ferric chloride, and

Yellow on the addition of sulphuric acid to the ferric-chloride mixture, the same effect being produced by alum alone, no doubt owing to the minute traces of iron in commercial alum and the ionisation 1 of the sulphuric radicle in it.

The following prescriptions from every-day practice illustrate a few of these reactions. Although antipyrin salicylate (salipyrin) is but feebly soluble in water (1 in 200), fairly strong solutions of antipyrin and sodium salicylate in dis tilled water may be mixed together without precipitation of antipyrin salicylate—indeed, water seems to split up the salipyrin, precipitating a small amount of salicylic acid, as in the following case:—

I.			II.					
Antipyrin			ъij.	Antipyrini .			gr. xv.	
Sodii salicylat.			3ij.	Vin. antim			3ј.	
Aquæ sambuci		ad	ъvj.	Spt. æther. nit.			3ij.	
Fiat mistura.				Tr. tolutanæ .			ziij.	
				Liq. ammon. acet.			дііj.	
				Aq. chloroformi		ad	ξij.	
				Fiat mistura.				

Ionisation is the condition in which chemicals are supposed to exist in solution, with their constituent radicles in the free state, not as molecules, but as atoms electrically charged with positive or negative electricity, according to the nature of the radicle, and, therefore, in a condition which renders the radicles extremely susceptible to unite with or neutralise other radicles which may be brought into the field of their action, especially if the new radicles are a truer complement to them.

The two solids of No. I. dissolved separately (each in half the water) gave clear solutions, but on mixing a fine crystalline precipitate appeared in a few minutes. This does not happen with plain distilled water, but if it be feebly acidified with acetic acid, the same crystalline precipitate appears, although the amount of acid is insufficient to precipitate salicylic acid from the sodium salicylate. Observations by Millard and Stark show that the oily mixture of antipyrin and sodium salicylate is slightly alkaline, but when water is added the reaction becomes acid.

A correspondent of The Chemist and Druggist observed that if he dissolved the antipyrin of No. II. in the chloroformwater and added it to the other ingredients previously mixed, no green colour developed. This is no doubt owing to the fact, noted on page 73, that ammonium acetate and ethyl nitrite interact, so that there is free acetic acid in the mixture instead of free nitrous acid, consequently no green colour is produced. Professor Chas. Caspari, jun., having questioned the statement that the mixture does not become green, and, if so, that the fact is due to the ammonium-acetate solution being alkaline, Mr. T. Dunlop experimented and proved the correctness of the first observer's statement (see C. & D. LII. 357, 497). It is advisable in any case to add a little potassium bicarbonate to mixtures containing antipyrin and spirit of nitrous ether so that the green colour will not be produced. The observations of Evans (C. & D. XXXIV. 402) proved that iso-nitroso-antipyrin is not poisonous, but Wood and Marshall (same volume) found that in acid solution iso-nitroso-antipyrin gives off on standing a small quantity of hydrocyanic acid-too little, however, to be alarmed about. Amyl nitrite in aqueous solution also gives the green colour, because it, also, liberates nitrous acid.

Antipyrin.				. 3ss.
Aluminis				· 3j.
Aquæ .				ad ziv.

Fiat mistura.

The last prescription is for an Australian cough-mixture. It becomes of a beautiful golden-yellow colour.

Piperazinum.—This substance (diethylene diamine, 2C<sub>2</sub>H<sub>4</sub>NH) is strongly alkaline, and behaves like alkalies, e.g.:—

Fiat mistura.

In this case replace 2 drachms of the syrup with as much acacia mucilage, and mix with the strychnine solution previously mixed with 3 ounces of water. Separately dissolve the piperazine in 2 ounces of water, add to the strychnine mixture, shake, and make up.

Potassii Chloras.—This chemical is one of the most dangerous of explosives because the conditions of explosion are almost unknown; the dangers, however, are confined to the dry substance. In solution or partial solution the salt in powder has a peculiarity of recrystallising as already explained. In association with anything which will liberate its oxygen it becomes a powerful oxidising body, and that is perhaps the reason why French observers state that potassium iodide and potassium chlorate should not be administered together; for even although the salts may not interact in a bottle, they do so as soon as they reach the stomach (the acids of the gastric juice liberating iodine). This a pretty theory, but the following prescription by an eminent West-end physician has been repeatedly dispensed for the same patient without harmful result:—

Potassii iodidi			. <u>3</u> ij	
Potassii chloratis			· 3i	
Tincturæ iodi			· 3j	
Glycerini .			· 3j	
Aquæ			ad zi	v.

Fiat mistura.

Sig. : A teaspoonful twice a day in a wineglass of water,

Pulvis Tragacanthæ must be diffused through a fluid in which it does not readily dissolve (e.g., spirit, glycerin, or syrup) before adding water; otherwise a lumpy mixture results. The vessels used must be quite dry. When as much as 2 or 3 drachms of spirit or spirituous preparation is ordered, put it into a dry bottle, rotate so as to cover the sides, add the tragacanth powder, shake vigorously until thoroughly diffused, add the water (1 ounce for 8 grains of tragacanth), and immediately shake briskly. If no spirit, glycerin, or syrup is prescribed, put the tragacanth into a dry mortar, triturate with sufficient rectified spirit to make a thin cream, then rapidly stir in the water.

Resorcinum.—Changes of colour in solutions of this substance are common. The following are two good examples:—

I.	II.
Resorcini	Hydrarg. perchlor gr. iv. Resorcini 3j. Spt. æther. nit 3ij. Spt. chloroform 3ij. Aquæ ad 3iv. M.

No. I. darkens rapidly in colour. This is owing to absorption of oxygen by the resorcin in presence of alkali. It behaves like hydroquinone and pyrogallol in this respect. No. II. becomes quite red, and stains skin and hair a carroty red. This combination is more common as a lotion, and is referred to later.

Sodii Salicylas.—The following are examples from practice of changes referred to on pages 71 and 72:—

		1.		
Sodii sa	alicyl.			зij.
Potass.				зііј.
Morph.	muri	iatis		gr. ss.
Aq.			ad	zviij.
Fiat	mistu	ra,		

Becomes almost black. Dissolve the bicarbonate in 6 ounces of water, add the morphine dissolved in 1 ounce, and finally the salicylate. The coloration may be considerably delayed by using effervescing sodawater (sine soda), II.

Sodii sal	icylatis			зііj.
Spt. amr	non. a	rom.		3vj.
Aquæ			ad	ъvj.

Fiat mistura.

As bad as No. I., being deep orange in a few hours, and finally black. Prescribers say it is good therapeutically, the ammonia counteracting the heart-depression which the salicylate causes.

III.

M.

This becomes almost black after standing a week or two, and a pleasant odour is developed. The latter is probably due to the formation of ethyl salicylate, and the colour to di- or tri-nitro-salicylic acid. The change was very fully investigated by Mr. A. W. Gerrard and his results were reported to the Pharmaceutical Society of Great Britain (P. J., November 5, 1881).

IV.

Syr. calc. lactophos. . mxxx.
Sodii salicylat. . . gr. ij.
Aq. carui . . ad 3ij.
Mitte \( \frac{1}{2} \) iij.

A correspondent stated that he obtained a precipitate of salicylic acid in this mixture. We tried to get it, and failed, as neither lactic acid nor phosphoric acid in the limited amount present in the syrup is able to precipitate sufficient salicylic acid.

Syrupus Ferri Iodidi.—It is remarkable how many changes and reactions are met with in dispensing this preparation, which is universally 'official,' but differs in ferrous-iodide strength in different Pharmacopæias. The following are a few prescriptions which have come under our notice:—

			A.		
Syr.	ferri	iodid.			3vj.
Aq.				ad	ъvj.
Ft	. mi	st.			

Made with tap-water ferrous hydroxide is precipitated, and with any water containing oxygen ferric oxyiodide is thrown out slightly.

	В.		
Calcii chloridi		. 3	iij.
Syr. ferri iodidi		. 3	SS.
Aq		ad 3	iv.
M.			

A reddish-coloured separation of

ferric hydroxide rises to the surface and is dissolved by a drop or two of dilute hydrochloric acid.

Calcii chloridi . . gr. 320
Potass. bromidi . . gr. 320
Syrupi ferri iodidi . ad živ.
M.

This gave considerable trouble, and varied in colour when made by different operators. The chief cause of this was alkalinity of the calcium salt. A good mixture was turned out by dissolving the bromide in 2 ounces of simple syrup by the aid

of heat and allowing to cool; then dissolving the calcium chloride in  $\frac{1}{2}$  ounce of water and  $\frac{1}{2}$  ounce of syrup, with enough dilute hydrochloric acid to produce a non-alkaline solution. Mix these solutions, and finally add sufficient concentrated liq. ferri iodidi (made with hypophosphorous acid as a preservative) to correspond with 4 ounces of syrup of iodide of iron, making up to 4 ounces with simple syrup.

Potassii iodidi . . . 3iiss.
Syr. ferri iodidi . . . 3j.
Inf. calumbæ . . ad 3viij.
M.

This mixture darkens in colour, becomes red, and precipitates ferric oxyiodide (Fe<sub>2</sub>OI<sub>4</sub>) owing to absorption of oxygen. This must be prevented, otherwise free iodine will ultimately be liberated. Acid. hypophos. mxv. prevents the change.

E.

M.

Ferrous arsenate is precipitated, but not if there is a trace of hypophosphorous acid in the syrup.

It is obvious from these examples that the neutral ferrousiodide syrup of the Pharmacopœias is a mistake, for the
changes referred to do not occur when the mixtures are
compounded with syrup prepared from liquor ferri iodidi, a
preparation which usually contains hypophosphorous acid to
preserve it. Without this the ferrous iodide in the syrup is on
the brink of precipitation. The following series of equations,
suggested by Mr. D. B. Kidd, explain the precipitation in the
first instance and re-solution by hypophosphorous acid:—

- (1) 2FeI2+O=Fe2OI4.
- (2)  $Fe_2OI_4 + O_2 = Fe_2O_3 + 2I_2$ .
- (3)  $4I_2 + 2H_3PO_2 + 4H_2O = 2H_3PO_4 + 8HI$ .
- (4)  $2Fe_2O_3 + 4H_3PO_4 = 4FePO_4 + 6H_2O$ .

A point which students should note is that this cycle of reactions does not go on ad infinitum; it is exceedingly limited, for a small amount of hypophosphorous acid delays precipitation so much that its inhibitory action must be attributed to something else than its deoxidising power. One very important combination with syr. ferri iodidi (viz., with potassium chlorate) is referred to on page 368, as this incompatible is so serious that it should not be dispensed.

Tinctura Cardamomi Composita.—The colouring of this tincture is cochineal, which per se is used as an indicator in volumetric analysis of acids and alkalies. With distilled water the tincture gives much paler mixtures than with tapwater, because the latter is invariably alkaline, therefore darkens the colouring-matter. Generally a little fat is precipitated from the tincture on dilution with water, especially in presence of acids or salts which are not alkaline. Ammonium carbonate discharges the red colour, as in the following:—

	I.	,	-1			II.		
Bismuth, carb.			3ij.	Sodii bi	romidi			3iv.
Potass. bicarb.			3iss.	Ammor	n. carb.			Ðj.
Spt. ammon. ar	om.		дііј.	Tr. chlo	orof. co.			ъij.
Tr. card. co.			ziij.	Aq			ad	zviij.
Aq. calcis .		ad	žviij.	M.				
M.			1					

In both cases the mixture becomes colourless, and a slight precipitate is formed. Experiment has proved this to be due to the ammonium carbonate.

The precipitation referred to is also well illustrated in the following:—

M.

Some dispensers never dream of using distilled water for making infusions. In this case tap-water gives a muddy precipitate in a few minutes; with distilled water the change is not so rapid, yet it does take place, the colouring-matter of the cardamoms and fat from both tinctures being the matters precipitated. It is not to be expected that any tincture above proof strength will give a permanently clear mixture with water, and filtration in such cases is quite permissible.

Tinctura Ferri Perchloridi.—This tincture and its equivalent, liquor ferri perchloridi, give some curious results

now and then owing to interaction of the ferric chloride with other substances. Phosphoric acid is one thing that upsets the unwary dispenser. The following show what may happen:—

	I.				II.	
Tr. ferri mur.				000	Liq. ferri perchlor.	. 3ij.
Tr. digitalis				3j.	Spt. æther. nitrosi	. 3ss.
Acid. phosph. o				3ij.	Acid. phosph. dil.	. 3iss.
Syr. flor. auran				3ss.	Liq. ammon. acet. Glycerini	· 3j.
Aq M.		in	au	ъvj.	Aq. chlorof.	. ǯj. ad ǯvj.
					M.	

The first of these, compounded in the order of the ingredients, is inky owing to the tannin of the digitalis combining with the iron; but if the tr. ferri mur. and acid. phosph. dil. are mixed together, diluted with half the water, then the syrup and tincture added, there is no inky tinge about the product. Ferric phosphate is precipitated in No. II., and cannot be avoided owing to the interaction of liq. ammon. acet. with phosphoric acid and liberation of acetic acid, in which ferric phosphate is insoluble. Liq. ammon. acet. may as well be left out, seeing that the diaphoretic effect of ammonium acetate is lost. A precipitate of ferric phosphate is in some other cases unavoidable, as in the following, but the density of the precipitate varies with the way of mixing:—

III.		IV	
Tr. ferri perchlor. Acid. phosph. dil. Tr. nucis vom.	 m 80 3ij. 3ij. 3iv. 1 zviij.	Quinin. sulph. Magnes. sulphat.	 . gr. xvj . 3iv. . 3iij. . 3iss. . 3ij. . m 80 ad 3viij.

If in No. III. the tincture of iron perchloride and acid be mixed together, and then diluted, a heavy precipitate will fall

at once, increasing in density until about the third day, when the maximum is reached. Dilution of the tincture and acid separately before mixing causes the precipitate to fall slowly and in a very finely divided, almost gelatinous, condition. In No. IV. the magnesium sulphate promotes precipitation of ferric phosphate, but if the phosphoric acid is added last the separation is retarded.

The following mixture is a most dangerous combination, and should never be dispensed:—

Potassii iodidi				. 3iss.
Tr. ferri perchlorie	di.			. 3ss.
Aquæ				ad zvj.

Tinct. ferri perchloridi and all other ferric salts reduce iodide of potassium immediately on mixing solutions, free iodine being precipitated as a black sediment if the potassium iodide is not present in sufficient quantity to keep it in solution. The following equation explains the reaction:—

$$Fe_2Cl_6 + 2KI = 2FeCl_2 + 2KCl + I_2$$
.

A similar reaction occurs with bromides, but not always, as the following show:—

I.		II.	
Ammon. bromid.	. 3v.	Liq. ferri perchlor	. ziij.
Tr. ferri perchlor.	. ziij.	Acid. hydrobrom. dil.	. ziij.
Tr. nucis vom	. 3ij.	Quininæ sulphat	. gr. xij.
Spt. chloroformi .	 · 3j.	Tr. gelsemii	. ziss.
Aquæ	ad ziv.	Spt. chloroformi .	. ʒij.
М.		Syr. aurantii	. <u>zij</u> .
		Aquæ	ad zvj.
		M.	

Bromine was detected in No. I. by the dispenser, but although No. II. becomes of a deep red colour, Mr. Harold Wyatt, jun., found that this was not due to free bromine, but to ferric bromide.

Mucilage of acacia is incompatible with tincture of per-

chloride of iron, a slimy ferric arabate being precipitated; but in some cases it is possible to dispense a clear mixture. The following instance is almost historic through frequent reference to it by Mr. Joseph Ince:—

(1)	Tinct. ferri mur					3ij.
(2)	Spt. æther. nitric.					3ss.
(3)	Mucilag. acaciæ .					<b>3</b> j.
	Syrup q.s. (i.e., 10	drach	ms) u	t ft.		ziij.

Mr. Ince says that, made most ways, this combination assumes the form of a thick jelly, which may be sent out in a covered pot. Reason thus:—Here are three ingredients likely to react upon each other, of which mucilage is chief. There are 10 drachms of protective agent (syrup) at disposal; divide it into 3 ij. with the tincture, 3 iij. with the spirit of nitrous ether, 3 v. with mucilage, which wants it most.

	(1)	Tinct. ferri					зij.
		Syrupi					3ij.
M.							
	(2)	Spt. æther.	nitr.				3SS.
		Syrupi					Ziij.
M.							
	(3)	Mucilag. ac	caciæ				ъj.
		Syrupi					3v.
M.							

Combine the three solutions, and a beautiful preparation is the result.

Occasionally we have seen tr. ferri perchlor. and spt. ammon. aromat. prescribed together, generally in about equal proportions. They are clearly incompatible, but the mixture is a most useful hæmatinic, being much less styptic than tr. ferri perchlor. alone, and that appeared to be known to the prescriber who, in the old days of spt. ammon. co. P.L. (a preparation of most uncertain alkalinity), wrote this prescription:—

On mixing, effervescence (CO<sub>2</sub>) took place, with some precipitation, which quickly resolved itself, and a nice reddish solution resulted.

### Vinum Ferri and Alkalies .-

Vin. ferri B.P.				živ.
Potass. bicarb.				ziiss.
Tr. nucis vom.				mlxxx.

If the iron wine is properly made it gives a precipitate of ferrous hydrocarbonate with the potash. Some houses send out a mixture like this clear. A case of the kind was thoroughly investigated, and it was found that the iron wine which had been used contained a mere trace of iron, and what there was in it was kept in solution owing to the presence of citrate of potash. Vinum ferri and liquor arsenicalis are sometimes prescribed together, the result being a repulsive-looking muddy mixture. Liquor arsenici hydrochlor, should be prescribed instead of the alkaline solution. The following example of this kind has been reported by Mr. Archibald Currie:—

Liq. arsenicalis				3ij.
Syr. simplicis.				3ij.
Vin. ferri .				3j.

The first time the mixture was dispensed it was clear; on the second it contained a green precipitate. Two different wines were used. On testing these a trace only of iron was found, and in the ferric condition in No. 1, while No. 2 contained 0.47 per cent. in the ferrous state, with a trace of ferric No. 1 was a year old, faintly acid, and was a rich, full-bodied, rather sweet sherry, while No. 2 was new, dry, and faintly acid. On examining the mixture made with No. 2, practically all the arsenic was found to be precipitated as ferrous arsenite, the precipitate consisting of a mixture of this and ferrous hydroxide.

Volatile Ingredients in Mixtures.—Volatile substances should never be mixed with hot fluids. If a salt

M.

has to be dissolved in an infusion freshly prepared, or in hot water, either should be made quite cold before adding such things as ether, ammonia, or hydrocyanic acid; then cork quickly and shake thoroughly. Never put such volatile ingredients into an empty bottle and then fill up with water; put the water in first, leaving just room enough for the volatile ingredient—for two reasons: firstly, because the empty space in the bottle becomes charged with the volatile vapour, which is displaced when filling up; and, secondly, what is perhaps not often taken into consideration, most of the vapour from the bottle being filled passes into the water-bottle used for filling it. For instance, in making a chlorine gargle one puts potassium chlorate and hydrochloric acid into an empty 12-ounce bottle, which rapidly becomes charged with chlorine-vapour. Now take a bottle containing 30 ounces of distilled water, and fill up the gargle. In so doing most of the 12 ounces of chlorinevapour will pass into the water-bottle and contaminate the next thing the water-bottle is used for. A case is on record where a dispenser noticed iodine liberated in a bottle of medicine containing potassium iodide. He could not account for it at all, but at last found that the water-bottle had just previously been used to fill up a mixture containing spirit. æther. nit., the vapour of which passed into the water-bottle, was absorbed, and carried into the next bottle of mixture. containing potassium iodide.

Zinci Bromidum may be taken as typical of halogen salts of metals. Usually dispensers are apt to regard bromides as unchangeable or unprecipitable compounds. The following is an example of the error:—

With one sample of sodium bromide this prescription gave a mixture with a flocculent precipitate of zinc hydroxide and carbonate, due to the presence of free alkali in the sodium bromide. A few drops of dilute hydrobromic acid sufficed to clear the mixture. A similar expedient may be adopted in other cases in which a metallic hydroxide is precipitated to a slight extent owing to traces of alkalies; but sometimes the addition of acid must anticipate precipitation, as there are hydroxides which do not redissolve readily once they are formed.

When mixtures are to be administered in parts it will be found that bottles of best quality with moulded graduations are fairly reliable. It is easy to tell at a glance any that may be seriously inaccurate. In dispensing potent medicines, the accuracy of the bottom graduation should always be ascertained, and in all cases the top dose should be correctly measured in. Printed slip graduations may be grossly inaccurate unless used as follows: Measure one dose into the bottle, affix the slip so that the bottom dose-mark is level with the liquid; also measure in the top dose when finished. The nearest approach to perfection is in the use of a blank slip graduated by hand; affix the slip to the empty bottle, and, if of variable calibre, measure in and mark each dose. Bottles having sides of nearly uniform thickness may quickly be satisfactorily graduated thus: Affix the slip, measure in and mark one or two doses (using the prescribed vehicle for the purpose), dispense, and when filled up pour back one dose into the measure and mark the level of the liquid in the bottle; finally divide the ungraduated space into equal divisions of the requisite number.

## EMULSIONS.

An emulsion is a mixture of small particles of solid or liquid substances in a liquid vehicle, the particles being kept in suspension, or easily diffusible, and prevented from coalescing by means of a body called an emulsifier. Many examples of such mixtures occur at the dispensing-counter, but the term 'emulsion' is generally reserved for fluid aqueous mixtures of oils and oleo-resins. In the widest sense it includes any liquid preparations containing something in suspension but not dissolved and not easily separable. For example, a mixture of tr. quininæ ammon. in water, with the quinine hydrate kept from adhering to the sides of the bottle by means of mucilage, is, strictly speaking, an emulsion, but is not generally so regarded by dispensers. Hence, such mixtures are not included in this chapter; but we ought properly to regard as emulsions all

### MIXTURES WITH RESINOUS TINCTURES.

Students will find it advantageous, in their reading about tinctures and fluid extracts, to distinguish between those which mix clear with water and those which do not. First, they should note the constituents of the drugs and the menstrua employed to exhaust them. Here they will learn if the active constituents are water-soluble, in which case a weak alcohol or water alone is the menstruum used to exhaust them, the function of the spirit being to preserve the preparation resulting. Tincture of opium is a good example of these. They form clear mixtures with water. Secondly, students will observe

and collate a group of preparations which contain resins, essential oils, and other water-insoluble active substances. These can be divided into two broad classes: (1) Preparations containing resins, with little other dissolved material, so that on adding water to them a milky mixture is formed, in which the resinous particles more or less rapidly coalesce, and the active substance is thus completely precipitated. Tincture of Indian hemp is a good example of this class. It is impossible to dispense them without a suspending agent or emulsifier. (2) A second class consists of most of the fluid extracts containing resinous bodies, tinctures of gum-resins, and aromatic or resin-containing drugs which are made with the weaker These contain extractive matter, which, under certain conditions, suffices to prevent the precipitated particles from coalescing, and so maintains the emulsified condition Preparations of this latter class do not usually require mucilage, especially as they are frequently prescribed with other ingredients containing extractive or saccharine matter; and if in any case an alkali is present, this may suffice to saponify sufficient of the resinous substance to make a perfect emulsion.

The rule to follow generally in regard to the compounding of resinous fluids in aqueous mixtures is: Mix with the water everything except the resinous fluid, which add last and gently shake. If, for example, it is a mixture like this:—

Tr. asafetidæ					. 3	SS.
Spt. ammon.	aro	m.				SS.
Glycerini						ziij.
Aquæ .					ad	zviij.
M.						

Put into the bottle the glycerin, spirit, and 6 ounces of water; shake; now pour in the tincture in a thin stream without touching the neck of the bottle, shake gently, and make up.

In some cases it is advisable, should a strong alcoholic preparation be prescribed along with the resinous one, to mix both before adding to the water, the object being to get the precipitated resinous particles as small as possible. For the

same reason the resinous preparation is poured into the largest possible volume of aqueous fluid; in fact, the same law applies to this department of compounding as to the manufacture of magnesium carbonate—concentrated solutions give the heavy precipitate and weak solutions the light.

We may now take up consideration of individual medicines which are dispensed in the emulsified condition. Tinctures of guaiacum and Indian hemp cannot be dispensed in aqueous mixtures unless mucilage or a similar substance is used. The best modus operandi is to take a measure of acacia mucilage equal to that of the tincture, dilute it with as much water as possible, pour in the tincture, and gently agitate. When much water has to be added, the finished mixture should not contain less than mxx. or 3ss. of mucilage to the ounce. Syrups, even if present in considerable quantity, do not effectually prevent deposition of resin. The following is another example:—

Vin. colchici .			. 3j.
Potass. bicarb			. 3ss.
Tinct. cannab. ind.			. 3ss.
Spt. ammon. co.			. 3j.
Tinct. calumbæ			· 3ij.
Tinct. gentianæ			. 3ij.
Aquæ			 ad 3vj.

A good mixture may be made as follows: Mix in a dry measure the tincture of cannabis with the sal volatile and other tinctures, and dissolve the potash in about 4 ounces of water, and add the wine. Now make a small cone of white paper with a small opening at the apex. Immerse the apex of the cone just beneath the surface of the bicarbonate solution (which may be held in a 4-ounce measure), and shoot in the tinctures through the cone, which must be quickly and simultaneously more deeply immersed; remove it, stir the mixture, bottle, and finish. Only slight precipitation takes place after several hours, but the dispenser should take into consideration the vicissitudes which the mixture will undergo during the following six or eight days, and remember that the last dose

should be as nearly as possible like the first. It is, therefore, better in the last case to stir 3ij. of mucilage with 3vj. of water, and add the cannabis tincture gradually while stirring; dilute to 3 ounces, add the remaining ingredients, the potash being dissolved in a little water and added last.

With large quantities of resinous tinctures or concentrated mixtures of them the addition of mucilage is essential, as in the following:—

Potassii iodidi .			. :	iss.
Tr. cimicifug			. :	3j.
Tr. guaiaci am			. :	žj.
Tr. nucis vom			. :	3iss.
Aq. chloroformi.			ad :	ziv.

A good mixture can only be obtained by the addition of acacia. Make a mucilage of 2 drachms of the powdered gum with  $\frac{1}{2}$  ounce of chloroform-water; dissolve the iodide in the rest of the water, and mix the mucilage with it; then mix the tincture of guaiacum with the other tinctures and add to the whole of the watery mixture with gentle agitation. It may be noted that recently prepared tinct. guaiaci ammon. poured into water containing 25 per cent. of fresh acacia mucilage forms a nice milky emulsion; but an old sample of tincture with stale mucilage produces an unsightly curdy mixture.

Some extracts form a good substitute for mucilage, thus :-

Tinct. cannabis	inc	lic.				3iv.
Tinct. digitalis						3j.
Ext. taraxaci						3iv.
Ammon. chlor.						3iv.
Aq. chlorof.					ad	ξvj.

Rub the extract down with about 2 ounces of the water, pour in the mixed tinctures, nearly fill the bottle with aq. chlorof., and add the ammon. chlor. dissolved in the rest of the aq. chlorof.

Spt. æth. nit.					3ss.
Tinct. tolut.					3ss.
Tinct. camph.	co.				3j.

If this be mixed in different ways it will present different appearances. The principle to be borne in mind here, as in all similar cases, is that it is far easier to keep a substance in solution than it is to take it up again after precipitation. In the instance before us it is evident that the substances should be mixed in the order of their percentage of alcohol—that is, the spirit of nitre should be mixed with the tinct. tolut, and the tinct. camph. co. added gradually with agitation.

I.		II.		
Thymol	. gr. xxx.	Tr. benzoini co.		. m 320
Spt. chloroform	. ʒiij.	Oxymellis scillæ		· 3j.
Tinct. benzoin. co.	. ziij.	Vini ipecac		. m 80
Magnes. calc. levis	. gr. x.	Syrupi tolut		. m 80
Aquæ	. ad zij.	Aquæ	7.877	ad zviij.
Fiat vapor.		M. Ft. mist.		

The best plan for No. I. is to mix the tincture and the spirit, and dissolve the thymol in the mixture. Then mix the magnesia with 10 drachms of water, and pour the spirituous mixture into it. Light magnesia must be used. Mucilage is inadmissible owing to the alcoholic strength of the preparation. The light carbonate of magnesia is largely employed in making the quasi-emulsion inhalations of such essential oils as oleum pini sylvestris and oleum pini pumilionis. These are generally dispensed by mixing with a small quantity of the light carbonate in a mortar and adding the water. In this way the use of spirit, which might be therapeutically inapplicable in some throat cases, is avoided. No. II. prescription requires the addition of  $\frac{1}{2}$  ounce of acacia mucilage.

One mixture of a resinous tincture with water may be mentioned as a useful cosmetic, making, it has frequently been stated, a perfectly suspended milky compound. It is known as *Lait Virginal*, and is composed of—

Tinct. benzoin	i				ъij.
Aquæ rosæ					ξvj.

Try how you will, you cannot succeed in making an in-

separable mixture without the addition of a few drachms of acacia mucilage.

Tincture of tolu is frequently prescribed in cough-mixtures, and it is desirable that the tolu should be dispensed in a permanent milky condition. If senega or quillaia is in the mixture, the dispenser will bear in mind that the saponin in these bodies is one of the best emulsifying agents, therefore the tincture of tolu should be added to the senega or quillaia preparation. The properties of these saponin emulsifiers are discussed later.

Potassii iodidi				· 3j.
Potassii bicarbonat	is			· 3ij.
Tincturæ quillaiæ				. 3ss.
Tincturæ tolutanæ				. 3vj.
Elixir, simplicis				. <u>zij</u> .
Aquæ chloroformi				ad zviij

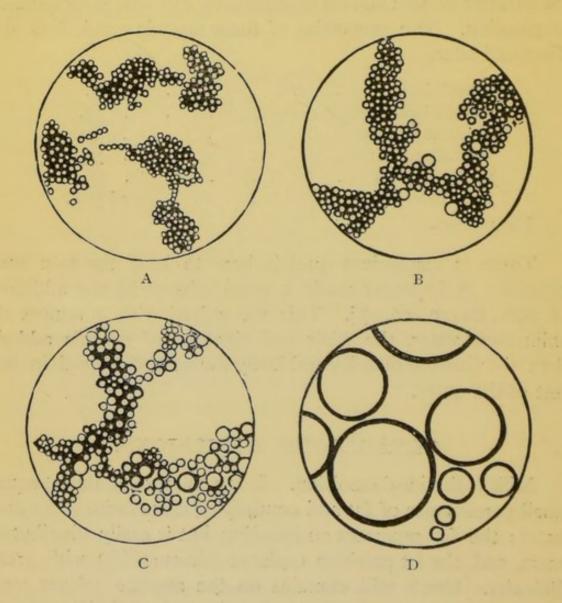
Fiat mistura.

There is insufficient quillaia here to keep the tolu suspended. A dispenser made a good mixture by the addition of pulv. tragac. co. 3j. This was mixed with 2 ounces of chloroform-water, the elixir and tincture of quillaia added, then the tincture of tolu, and lastly the salts dissolved in the rest of the water.

### OLEAGINOUS EMULSIONS.

Milk is the ideal emulsion. It is a mixture of almost equal small percentages of fat and emulsifying agents with sugar and water; the fat separates on standing, but is easily distributed again, and the fat particles coalesce (de-emulsify) with great difficulty. Cow's milk contains on the average 3.6 per cent. of fat, 3.3 per cent. of proteids (casein and albumin), 4.8 per cent. of milk sugar, 0.73 per cent. of inorganic salts, and the rest water. Casein is the emulsifying agent, but the albumin plays its part in this respect, and it seems as if the fat particles were covered by an extremely thin skin of proteid, whereby de-emulsification is prevented.

The emulsions which compounders generally have to prepare are much richer in fat than milk is, but compounders have to keep the ideal in view, for a perfect emulsion is one in which the oil-globules are invisible to the naked eye. Something short of this may look well, but it is only when the more perfect form is attained that it can safely and properly fulfil all its requirements in dispensing.



The figures given here illustrate the various degrees of perfection and badness of emulsification. A shows the appearance of milk under the microscope; B is a cod-liver-oil emulsion made with yolk of egg; C is a cod-liver-oil emulsion made with acacia; and D one made with tragacanth. These are magnified about 100 diameters.

# Several of the B.P. mixtures are emulsions, e.g. :--

Linimenta Ammoniæ, Calcis, et Hydrargyri, in which some alkali forms soap with an oil, and the resulting soap emulsifies the rest of the oil.

Mistura Ammoniaci.—Ammoniacum is a gum-resin containing 2 per cent. of essential oil as well as 28 per cent. of gum and the rest resin. There is sufficient gum in it to keep the resin and oil in suspension when the whole is rubbed with water to a thin paste and further diluted. This may be called a "natural emulsion."

Mistura Amygdalæ.—If sweet almonds are skinned, beaten to a paste, and water added, a white emulsion is formed, which, however, soon separates oil, because there is less than I part of emulsifier (gum) in the almonds for every 5 parts of oil. The B.P. therefore adds gum acacia and sugar to the almonds (pulv. amygdalæ co.), and this mixture forms with water a good emulsion.

Mistura Guaiaci.—Here the artificial emulsifiers gum tragacanth and sugar are added to keep the particles of guaiacum resin from coalescing.

Mistura Olei Ricini.—In an 8-ounce mixture  $1\frac{1}{2}$  ounce of acacia mucilage is employed to emulsify 3 ounces of castor oil, the oil and  $3\frac{1}{2}$  ounces of water being added to the mucilage in alternate portions.

Mistura Scammonii (B.P., 1885).—A mixture of scammony (gumresin) and fresh milk. There is a fair proportion of gum in scammony (about 20 per cent.), but insufficient to emulsify it with water, and the milk supplements its influence.

We may now appropriately consider the properties and uses of

### EMULSIFYING AGENTS.

Acacia Gum is the principal one employed by pharmacists. It is typical of a large class of bodies which emulsify oils, but few of them equal it in convenience and power. The gum contains the calcium, magnesium, and potassium salts of arabic acid, but there are many varieties of the gum, and they differ in composition and emulsifying power. From the nature of the emulsions of oils formed by acacia it is safe to assume that the oil exists in the emulsion in a similar condition to the fat in milk—that is, the particles are coated with a film of gum (probably in molecular association with the oil); this prevents coalescing, and the viscosity produced in the mixture prevents separation. The fact that the acacia gums which are the poorest emulsifiers generally give the most viscous mucilages

indicates that the filming process has something to do with perfection of emulsification, these poor gums being less rich in the arabates than gums answering the official description. The so-called 'English method' of using gum acacia in emulsifying oils is to triturate 1 part of the powdered gum in a mortar with 2 parts of oil, add at one time 1½ part of water, and triturate, when, after a few turns of the pestle, the whole is emulsified. The rest of the water may be added by degrees. At least 3 parts of the powdered gum is required for 8 parts of an essential oil, and 2 parts for 8 parts of fixed oils and balsams, but double these quantities is generally required, according to the amount of water which is present. Why the dry-gum method should be called 'English' by American writers we do not know, for the other, or 'continental,' way (as exemplified by mistura olei ricini) is as commonly followed.

Tragacanth Gum is much inferior to acacia gum as an emulsifier. It does not assist the compounder in dividing the oil into small particles, as acacia gum does, and its action is solely that of a viscoid body—it keeps the oil-globules apart once they are formed. Its influence is well exemplified in the following formula for cod-liver-oil emulsion:—

Place the oil in a Winchester quart, and pour into it the powdered tragacanth, tincture of benzoin, and spirit of chloroform mixed; agitate briskly for one minute, then add all at once a pint of distilled water, and agitate as before; lastly, add the oils, glycerin, and the rest of the water with the hypophosphites dissolved in it.

The condition of the oil in this emulsion is illustrated in D, page 314.

Tragacanth is capable of doing much better than this when powerful mechanical force is employed; but it is scarcely possible to do better at the dispensing-counter.

Starch is in some respects like tragacanth; that is to say, it is as good a suspending agent, but lacks the slightly gummy property of tragacanth. It is employed (as starch mucilage) for making iodoform emulsion, and for suspending or emulsifying medicines which are given by the rectum.

Yolk of Egg is a remarkable emulsifying agent. Sometimes the whole egg is used without disadvantage, if there is nothing in the mixture to coagulate the albumen. The yolk is itself an emulsion of 30 per cent. of fat with 16 per cent. of vitellin, a substance closely resembling the casein of milk in composition and properties. There are also a little albumen and various earthy and alkaline salts in egg-yolk. The vitellin may be regarded as the substantial emulsifying ingredient. It is particularly serviceable for limpid oils, such as turpentine, and it forms emulsions very quickly, perhaps because the emulsifier is a potential emulsion.

Milk is one of the best emulsifying agents for extract of male fern, and, strange to say, fresh milk does better than the skimmed variety.

Casein prepared from milk is now obtainable, and is an excellent emulsifier. The casein may be made as follows: Take I gallon of milk and  $2\frac{1}{2}$  ounces of solution of ammonia, and after shaking well set the mixture aside for twenty-four hours. Two layers are now observed, the semi-saponified butter above and the lacto-serum below. The lower liquid is drawn off, and casein is precipitated from it by acetic acid. The magma is collected and strongly pressed to expel moisture; now add by trituration  $2\frac{1}{2}$  drachms of sodium bicarbonate, and, finally, mix in enough sugar to obtain a powder representing when dry

about 10 per cent. of its weight of casein. The preparation keeps well in securely corked bottles for at least three years. It has a slight, not unpleasant, smell, which is not appreciable in preparations. M. Léger, who suggested the use of casein in 1887, divides substances into (1) those soluble in alcohol, and (2) those insoluble. The first class, which includes resins, balsams, and oleo-resins, can be emulsified in a bottle. The product is first weighed or measured into the bottle, and enough alcohol is added to dissolve it. For a 4-ounce mixture use about 21 drachms of saccharated casein, dissolved in an equal weight of water, add the solution, thoroughly shake, and make up to the required volume with the rest of the water gradually introduced, with continual shaking. For oils a mortar is used, and the manipulation is the same as when acacia gum is employed by the 'English method.' The emulsions are more perfect and more stable than those obtained with any other agent.

Irish Moss.—Cod-liver-oil emulsions have long been prepared with Irish moss. Mr. Peter Boa (Edinburgh) obtains a clear mucilage of the moss by straining the mucilage through absorbent cotton-wool supported on muslin in a hot-water funnel. The mucilage itself is prepared by digesting 1 ounce of washed moss in 24 ounces of water for an hour, boiling for five minutes, and straining the moss mucilage. It serves as well as acacia for chalk mixture. For suspending copaiba it is superior to acacia—separation taking place much more slowly and less completely. Part of the copaiba remains in an emulsified state at the bottom of the bottle when moss is used, but with acacia the whole rises to the top. For emulsifying cod-liver oil it is greatly superior to acacia in preventing separation, but finer division of the oil is obtained with acacia. Moss mucilage 3vj., cod-liver oil 3j., and water 3ij. produce an emulsion that does not readily separate. Using 3vj. acacia mucilage, 3j. cod-liver oil, and 3ij. water, the resulting emulsion soon separates. Irish moss mucilage is not good for suspending heavy powders, such as bismuth subnitrate. It

keeps well in full bottles. Mr. Emlen Painter has suggested that the moss mucilage should be evaporated and scaled, and the scales dissolved when required for making an emulsion.

Malt Extract is considerably used for emulsifying codliver oil without any other emulsifier. The plan is to use a mortar which has been warmed well by filling with boiling water, the pestle also being warmed in the water; put the extract in the mortar, stir to liquefy it, and add the oil in small portions at a time, stirring well. The oil may be mixed with liq. calc. sacch. in the proportion of 5 minims to 1 ounce.

Gelatin has also been proposed as an emulsifying agent, especially for paraffin oils, and is the subject of a patent (No. 3,466, 1886). According to this patent a solution of gelatin or other similar substance is made, in the proportion of 4 ounces to the gallon of water. In 12 parts of this 1 part of phosphate of soda or potash, or carbonate of soda or potash, is dissolved by the aid of heat, and this mixture is capable, by the ordinary means, of emulsifying from 24 to 36 parts of animal or vegetable oils. For embrocations ammonia is substituted for the above-named salts. Chloroform and such liquids may be emulsified in this manner. For mineral oils and the like the alkali is replaced by soft soap. For example, an emulsifying solution is made with 6 ounces of concentrated size, 1 pound of soft soap, and I gallon of water, and this mixture is capable of emulsifying 2 gallons of paraffin oil. The following is an excellent example of the utility of gelatin :-

Ol. cadini					4 parts
Liq. plumbi	fort.				3 parts
Glycerin.					5 parts
Aq					97 parts

The prescriber expected this to form an emulsion, but it does not. Acacia gum, milk, and gelatin were tried as the emulsifiers, and the best results were obtained with 1½ part of gelatin. This was soaked in 20 of the water, dissolved by gentle heat, the glycerin added, and 3 or 4 drops of liquor potassæ to neutralise the acids in the tar. The oil of cade

was then added by degrees, stirring constantly, the emulsion diluted with 30 of water; and finally the liq. plumbi was added, diluted with the remainder of the water.

Senega-root and Quillaia-bark contain a principle (saponin) which possesses powerful emulsifying properties, and imparts to infusions of either of these drugs the frothing property which is not the least important of their characteristics. Mr. H. Collier, teacher of pharmacy at Guy's Hospital, studied the use of a tincture of quillaia in the preparation of emulsions, and communicated his results to the British Pharmaceutical Conference. The tincture which he used was made by digesting 4 ounces of the coarsely powdered inner bark in 20 ounces of rectified spirit for a week, then filtering, but a proof-spirit tincture is equally good. If a little of this tincture is shaken up with mercury the metal is quickly divided into fine particles, and is prevented from reuniting. The tincture is peculiarly valuable for converting an oil into an emulsion in presence of an acid; for example:—

Cod-liver oil .				.5j.
Glycerin				.5j.
Lime-juice .				3j.
Tincture of quillaia				3ij.

This forms a very good emulsion. Ext. filicis maris is a troublesome substance to emulsify, milk being one of the best vehicles. Although it may with care be turned into a perfect emulsion with acacia, the mixture is not at all pleasing in character. The following is, however, all that can be desired:—

Oil of turpentine works well with its own measure of the tincture, e.g.:—

Resinous tinctures require more than their own volume of the quillaia tincture to prevent separation of resin; thus:—

Tinct. tolutan				mxl.
Tinct. quillaiæ.				3j.
Aq. destillat			ad	3j.
Misce.				

After a short time the resin deposits, but it readily diffuses on shaking. It will be found that in cases of this kind acacia acts better—it gives viscosity to the liquid, and thus helps to retain the separated resin. For the same reason acacia or tragacanth is better for resin of copaiba than quillaia—in fact, quillaia is at its best with oils and oleo-resins, and should be avoided for resins.

The rectified-spirit tincture is used in the preparation of liquor picis carbonis, the full-strength spirit being required to dissolve the coal-tar, and the quillaia to emulsify the mixture when it is mixed with water.

Resin Soap.—This is another agent which is used for the purpose of emulsifying phenolic bodies with water. Mr. Collier, whose observations on quillaia appear to have originated from a study of liquor carbonis detergens, obtained equally noteworthy facts from an analysis of creolin, in which a resin soap is present. Mr. Collier prepares resin soap by boiling 3xxx. of yellow resin and 3v. of caustic soda in 20 ounces of distilled water for two hours, replacing water occasionally. The mixture is allowed to cool, when a yellow pasty mass separates, which is drained, squeezed as free as possible from liquid, dried over a water-bath until brittle, and reduced to powder. The powder is soluble in water, and is an excellent emulsifying agent. The following are examples of its utility:—

citation, .	I.		1	II.	
Fixed oil		<b>3</b> j.	Volatile oil		. 3ij.
Resin soap		gr. x.	Resin soap		. gr. x.
Water .		₹j.	Water.		to Ziij.

Dissolve the soap in the water and shake the solution with the oil.

Proceed as in No. I. Excellent for inhalations.

III.	IV.
Copaiba 3j.	Thymol gr. xviij.
Resin soap gr. x.	Rectified spirit 3iij.
Water to zj.	Resin soap Dj.
Prepare as No. I.	Water to ziij.
Sandalwood oil, creosote, and similar medicines are emulsified by	Mix the first three, dissolve, and add the water.
this formula.	Camphor and menthol may be

The resin soap is suitable for emulsifying almost any liquid of an oily nature.

similarly treated.

### THEORY AND PRACTICE.

From all that has preceded the compounder will have little difficulty in formulating a theory of emulsification. It may be put thus: If we shake a fixed oil with water, we break it up into a multitude of minute particles, so that the entire mixture has a milky appearance, but if allowed to stand the oil speedily separates. This is owing to two causes—the lower specific gravity of the oil and the want of adhesion between its particles and those of the water. The art of making emulsions consists in finding and introducing some body which will keep the particles of oil in the minutest possible size, and suspend them in the vehicle, so that when at rest the mixture shall not separate. The emulsifying media vary, as has been seen, but the principle of action is practically the same in every case. The object is to break up the substance to be emulsified into minute particles, and to enclose each of them in a coating of the emulsifying agent. The following examples are instructive :-

Bals. copaib.				· 3vj.	
Pulv. acaciæ				. ziij.	
Spt. æth. nit.				. 3ij.	
Aquæ .				ad zvj.	

Make a thick mucilage with the gum and a little water, then add with constant trituration, alternately, first a little of the oleo-resin, then a little water, and so on till the whole of the copaiba is emulsified; place in a bottle, add more water, and,

lastly, the spt. æth. nit. By this procedure the copaiba is minutely divided, and each particle coated with mucilage. If the mucilage were added to the copaiba, or even the whole of the copaiba added at once to the mucilage, a different result would be effected. The copaiba would doubtless be broken up, but instead of being coated by, it would form the covering of, particles of mucilage, and on standing would quickly separate.

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Mix the liq. potassæ with 3 drachms of water, add the oil, shake until thoroughly emulsified, add more water, and the vin. ipecac. last.

Our next example is an examination prescription upon which a candidate failed:—

Rub the oil down with 28 grains of pulv. acaciæ (which is the equivalent of 3j. of mucilage), and when that is thoroughly mixed add all at once 3j. of water, after which triturate until the whole is emulsified; gradually add more water in small quantities; lastly add the syrup and tinct. zingib., both previously diluted with a little water. Made according to these directions a uniform preparation is produced which does not separate until kept for some time. The prescription is not a difficult one, but requires careful manipulation. In making emulsions it should be borne in mind that syrups, and preparations containing spirit, should invariably be added last.

The question as to whether emulsions of oils and oleo-resins should be made with mortar and pestle or in a bottle has been often discussed, and need not be entered on here, it now being almost universally agreed that the mortar and pestle are best, and a broad pestle should always be used.

### EMULSIFICATION OF SPECIAL DRUGS.

Balsam of Peru may be emulsified with yolk of egg or with powdered acacia, as in the following:—

Potass. acet			. 3ss.
Acid. salicylic.			· 3j.
Liq. morph. acet.			. 3ij.
Balsam. peru.			. 3ss.
Aquæ			ad žviij.

Rub up the balsam with 4 drachms of powdered acacia, exactly as is done in the case of fixed oils, and use from 5 to 6 ounces of water for dilution. Separately rub together the acid and acetate with the morphine solution and the rest of the water. Mix the two.

Balsam of Tolu.—The following is an excellent emulsion:—

Dissolve—				Parts
Balsam of tolu				2
Rectified spirit				10
Tincture of quillaia				10
Water				78

See also previous remarks regarding the use of tincture of quillaia.

Benzoin (Tincture).—The simple tincture makes a good emulsion with a little mucilage, and the compound tincture may be emulsified with yolk of egg or mucilage, the yolk of egg giving a more stable emulsion.

Cod-liver Oil is frequently prescribed with syrups, e.g. :-

I.				11.	
Ol. morrhuæ  Liq. potassæ  Mucil. tragacanth.  Aq. chlorof.		· 35	ss. Syr. Eastoni ss. Ol. jecor. as	elli .	<ul> <li>gr. ½0</li> <li>mx.</li> <li>ad ₹j.</li> </ul>
Fiat emulsio et ad Syr. ferri phos. co. M.	de—	. 3	Mitte zvj.	ıra.	

As soon as the syrup is added to the emulsion of No. I. complete separation results; it is, in fact, a mistake to attempt to emulsify such mixtures, because a brisk shake mixes a syrup and an oil sufficiently to enable a dose to be poured out. In the case of No. II. the iodine was dissolved in a little ether and added to the oil before the Easton's syrup. Cod-liver oil is not at all difficult to emulsify, but, like other things emulsified, it cannot bear being overloaded with acids. The following recipes (from 'Pharmaceutical Formulas') typify the methods followed in compounding the oil into emulsion:—

#### WITH ACACIA.

Mix the oils in a mortar with the gum, add 2 ounces of water and the elixir, and triturate briskly but lightly until an emulsion is formed; then add the rest of the water in portions with diligent stirring.

Some prefer to make the gum into a mucilage with 2 ounces of water, and gradually add the oil to it, with trituration. It is a distinct advantage to use I ounce of limewater in this formula; it greatly assists emulsification—indeed, a good emulsion results from shaking together equal parts of oil and limewater.

#### WITH EGG.

Measure 4 ounces of the distilled water, place the tragacanth in a dry mortar, and triturate with a little of the cod-liver oil; then add the yolk of egg and stir briskly, adding water as the mixture thickens. When of a suitable consistence, add the remainder of the oil and water alternately, with constant stirring, avoiding frothing. Transfer to a pint bottle, add the elixir of saccharin, tincture of benzoin, spirit of chloroform, and oils, previously mixed; shake well, and add distilled water, if necessary, to make 12 ounces.

A tragacanth emulsion has already been given (page 316).

Copaiba.—The methods of emulsifying the 'balsam' have already been described (page 322, see also page 340). When

M.

mucilage and solution of potash are prescribed with it dispensers frequently bungle the emulsion, so that the following example may be noted:—

Copaibæ					. ʒij.
Mucilagi	inis	acaciæ			. 3vj.
Liquoris	po	tassæ			· 3j.
Aquæ					ad ziv.

Mix in a mortar 45 grains of powdered acacia gum and copaiba. Separately mix the liq. potassæ with 7 drachms of water; of this add 70 minims to the mortar-contents and stir vigorously until the emulsion is quite smooth; then add the rest of the solution gradually, and make up.

Copaiba Resin.—Rub the resin with one-third its weight of sugar of milk, and about its own weight of pulv. acaciæ, and add the water gradually. Mr. Gerrard recommends the resin to be rubbed with twice its weight of compound powder of almonds until well incorporated, adding the water after the manner of forming an emulsion.

Chloroform is made into an excellent emulsion by using drachm of the tincture of quillaia to every 10 minims of chloroform.

Ext. Filicis Maris.—For each drachm use 2 ounces of new milk. Resin soap or even powdered soap is excellent, e.g.:—

Rub the soap with the extract, and gradually add the water. The extract also emulsifies with half its weight of powdered acacia gum by the 'English method.'

Iodoform is made into an emulsion (for injection) either

with starch mucilage or with pulv. trag. co. Use precipitated iodoform in impalpable powder. Examples:—

	I.		II.
Iodoformi . Amyli Triturate wel powder with dil q. bullient M.	l and	gr. v. pour on the	Emulsio. iodoformi 10 p.c. ziv.  M.D.U.  In this case 40 grains of pulv. trag. co. made the 175 grains of iodoform into an excellent emulsion.

Petroleum is now commonly prescribed as an emulsion. The heavy oil (paraffinum liquidum) is intended, and the unbleached kind or the Russian water-white should be used, otherwise the emulsion will stink in a few days owing to the sulphur compounds in the bleached oil. Emulsify with acacia in the same manner as cod-liver oil. A correspondent of *The Chemist and Druggist* reports that he was called upon to compound an emulsion of ordinary paraffin oil. The following is his method:—

'Daylight' petroleum					
Powdered acacia .					. 3x.
Mix thoroughly, then add at	once	-			
Distilled water .					. <u>zij</u> .
Triturate well until thorough	hly er	nulsif	ied, a	nd ad	d—
Elixir of saccharin .					· 3j.
Essence of bitter almon	ds.				. 3ij.
Distilled water .					to 3xx.
Mix.					

Spermaceti may be emulsified with yolk of egg after being very finely powdered with rectified spirit.

Terebene may be emulsified in the same way as turpentine. The following prescription is a fairly difficult one to compound:—

Terebeni				3j.
Spt. chloroform.	1			зij.
Tinct. tolutanæ.				3ij.
Syr. tolutani .				3vj.
Aq. menth. pip.			ad	ξvj.

Make a mucilage with 4 drachms of acacia and 6 drachms of peppermint-water in a mortar; of this reserve 2 drachms; with the remainder in the mortar rub the terebene until emulsified, and dilute with 2 ounces of peppermint-water. Dilute the reserved 2 drachms of mucilage with peppermint-water; transfer to a bottle, and with this emulsify the tincture of tolu; to this add the terebene emulsion and finally the other ingredients.

Turpentine.—Yolk of egg emulsifies turpentine well. Triturate the yolk carefully in a mortar, add gradually twice its volume of water, and strain through muslin. Of this mixture transfer to a bottle a measure equal to, or slightly more than, the turpentine to be emulsified, shake, add the whole of the turpentine, shake until thoroughly emulsified, and dilute further if necessary. Forbes's method for the emulsification of essential oils, such as turpentine, consists in the addition of 20 grains of acacia to each ounce of oil contained in a dry bottle, diffusing by a slight shake, then adding  $\frac{1}{2}$  ounce of water, and briskly agitating for a few seconds, when the emulsion is complete, and can be diluted by the further addition of water without separation of the oil.

Terebinthina Chia.—This substance was some years ago introduced by Dr. Clay, of Birmingham, as a cure for cancer, and is prescribed occasionally in the form of an emulsion of the ethereal solution of turpentine with tragacanth and sulphur. The latter is an essential ingredient; indeed, Mr. Valentine Knaggs says it is the sulphur, and not the turpentine, which does the good. The emulsion is made by mixing  $\frac{1}{2}$  ounce of the solution of turpentine (1 ounce in 2 of absolute ether) with 40 grains of sulphur and 24 grains of tragacanth, adding 6 ounces of water, stirring briskly, then an ounce of syrup, and water to 16 ounces. The addition of an ounce of acacia mucilage makes a better emulsion.

# SUPPLEMENTARY NOTES ON EMULSIONS

EMULSIONS are so much employed on the Continent that the methods there pursued are well worth knowing. We here reproduce some hints from the late Dr. Hermann Hager, with editorial comments. This chapter will be found very useful to those who have German prescriptions to dispense.

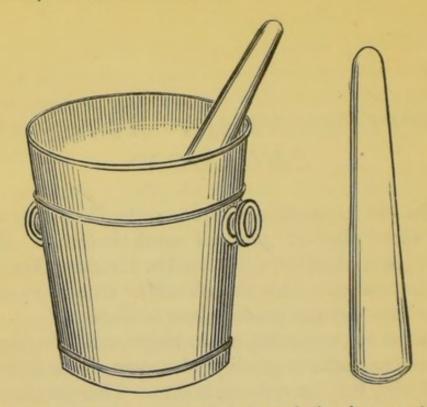
Emulsions are, according to Dr. Hager, milky-looking, thick fluids, of mucilaginous or gummy substances, or combinations of water with oily, fatty, or resinous bodies. They are classified as seed, oil, balsam, gum-resin, resin, wax, or spermaceti emulsions.

### SEED EMULSIONS

are made from seeds containing a fixed oil, such as almonds, poppy or hemp seeds, &c., by crushing these and rubbing them with water. If necessary, the seeds are first washed several times with water; when clean, they are beaten, with about one-tenth their weight of water, into a soft mass, which, when taken between the fingers, reveals no albuminous lumps. The remainder of the fluid is then added gradually, with continual rubbing, until the whole is evenly suspended. The emulsion should lastly be strained through a clean coarse cloth (millers' cloth).

The small proportion of oil contained in the seeds is suspended in the water by means of the albumen and mucilage of the seeds, but, if the seeds are first rubbed down dry, the oil is expressed, and, though it is taken up in the emulsion, it more quickly separates, generally as a cream.

Almonds are always decorticated before being made into an emulsion, unless an order to the contrary is expressed.



Poppy-seeds should be softened before being beaten, by letting them rest for five to ten minutes in warm—not hot—water.



Highly polished brass mortars and marble mortars have been used for making emulsions, but within the last twenty years mortars have been made of a special kind of very hard porcelain, particularly for emulsions. The pestle is made of boxwood, and the forms of both pestle and mortar are shown in the above engraving. The height varies from 5 to 8 inches. The boxwood pestle allows a good force to be used in crushing seeds without danger of injury to the porcelain. [An ordinary Wedg-

wood mortar and pestle should be used for oil emulsions.

The second figure on page 330 shows such a mortar and the way in which the pestle should be used.—ED.]

Seed emulsions must not be made very hot, nor must hot fluids be added to them, else the albumen will be coagulated.

Lycopodium—a seed-like substance containing oil—may be made into an emulsion. After sifting to free it from coarse impurities, it is rubbed in a mortar with a little water until a damp crumbly mass is obtained. An addition of gum acacia is desirable to get a good emulsion. Then syrup or water is added gradually. If gum acacia be added, the prescription should be marked stating the quantity, 'Emulgendo admixtum.'

An oil, such as castor oil, is sometimes ordered with a seed emulsion, as in the following:—

				(	Gramme	es
Amygdal. dulc.					20	
Olei ricini		1.			30	
Aq. fœniculi					100	
Aq. destill.					100	
Sodæ nitrat.					15	
Syrupi sacchari					25	

M. Fiat emulsio.

This is really a double emulsion.

## OIL AND BALSAM EMULSIONS.

Fixed oils, such as almond, poppy, olive, linseed, and castor, and balsams, such as copaiba and Peru, are easily combined with water by means of emulsifiers, of which gum acacia is the best. Yolk of egg and tragacanth are also emulsifiers. An emulsion with oil cannot be made satisfactorily with less gum acacia than one-fourth the weight of the oil. The proportion of water should be at least half of the total weight of the oil and gum.

The emulsifying power of 10 grammes of gum acacia is estimated as equal to the yolk of a large hen's egg, to 1'25 gramme

of tragacanth, or I gramme of salep.

These emulsions may be made in either of three ways:

(1) By adding the water to the powdered gum in a large mixture-mortar, mixing with a large-knobbed pestle; then adding the oil or balsam all at once, and stirring till emulsified, which will require two or three minutes. This is generally the surest plan [and the so-called 'Continental method.'—ED.]. Or (2) the gum may be put in the mortar, the oil poured on the top of it, the water round it, and then all the substances quickly stirred together. This is the method mostly adopted. Or (3) the oil may be rubbed with the gum, and the water added gradually. The proportions for a good emulsion are:—

					-	Parts
Oil or balsam						10
Gum acacia						5
Water to make	the	emul	sion			7.5
Water to add t	to th	ne emu	ilsion			77.5

The first method of emulsification described is not quite so speedy, but it is very sure. Sometimes castor oil or balsam of copaiba cannot be emulsified by the second or third process. Probably this happens in consequence of some peculiarity in the oil or balsam, and the fact that in the two latter cases the gum is not dissolved quickly enough to affect the emulsification.

[The third plan is one which is now much followed in this country and recommended by leading pharmacists. Expertness is, however, required in order to have successful results. The probability is that moderately good results may be obtained by any one of the processes IF THE DISPENSER IS IN THE HABIT OF FOLLOWING IT. If he gets good results from any particular process we would not advise any experiments in the way of changing it. An emulsion at the best is a ticklish affair, and we have generally found it better to let well alone.—Ed.]

Salts, extracts, or other solid bodies to be dissolved in emulsions should be separately dissolved in some of the water to be added, and mixed with the emulsion. If mixed with the emulsifier a separation of some of the oil will occur.

Lycopodium, which is often ordered with oil emulsions, causes such a separation with remarkable rapidity. It is best

to emulsify the oil and the lycopodium separately, and to mix the two in diluted form.

Borax added to a gum-acacia emulsion converts the latter into a jelly. Diluted acetic acid restores the fluidity, but such an addition is by no means justifiable. If an emulsion with borax and gum be ordered in a prescription, the mixture must be sent out in a wide-mouthed bottle. The gelatinisation does not occur till several hours after the mixing.

Balsam of Peru to be combined with an oil emulsion should be mixed with two-thirds of its weight of water, and stirred in with the emulsion in a mortar.

[The better plan is to mix about ½ part of 90-per-cent. alcohol with 1 part of glycerin, and to this add the balsam of Peru, and incorporate thoroughly. This may be diluted to a proper miscible point for an emulsion by the further addition of water, plain, or, better still, a mixture of glycerin and water gradually added.—Ed.]

Emulsions with tragacanth do not keep well, and are but seldom ordered. For their preparation 1 gramme of tragacanth is mixed with 20 grammes of water. To this 20 grammes of oil and 10 grammes of water are added at once, and combined into an emulsion with constant stirring. The rest of the water is added gradually.

[The statement about the keeping properties of tragacanth emulsions is a mistake, as is testified by the sweetness of codliver-oil emulsions prepared with tragacanth. Tragacanth has properties as an emulsifying agent which in some respects are unequalled for such an oil as cod-liver.—Ed.]

If spirit of wine, concentrated acids, solutions of salts, or tannin substances are to be mixed with emulsions, they should always be added in as diluted a form as possible.

Emulsions of Gum Resins.—Gum resins, such as galbanum, ammoniacum, myrrh, asafetida, and scammony, contain gummy matter, as well as resin insoluble in water, so that the addition of an emulsifier is not absolutely required. It is generally only necessary to rub down the gum resin to as fine

a powder as possible, and emulsify with water. In warm weather this is not always practicable, as the gum resin is too soft. It is then best to put it into a mixture-mortar in small pieces, sprinkle it with water, and put the mortar with the pestle in a moderately warm place until the substance has become of the consistence of honey. To each gramme of the gum resin are added 1 drop of almond oil and 3 drops of mucilage of acacia, and then, by the gradual addition of warm water and vigorous working with the pestle, a good emulsion will be obtained.

Generally gum acacia or yolk of egg is ordered with a gum resin to emulsify it better. If either of these is used the gum resin should be in very fine powder. One part of gum acacia to 2 parts of gum resin, or one yolk of egg to 20 grammes of gum resin, is the usual proportion. If the gum resin cannot be powdered it is softened by warming, as explained, but with yolk of egg the temperature must not exceed 60° C.

Emulsions of Resins.—These are prepared from Venice turpentine, guaiacum resin, resin of jalap, and such-like substances.

Venice turpentine is easily emulsified by its own weight of gum acacia or by yolk of egg (two yolks to 20 grammes).

Resin of guaiacum is finely powdered and rubbed in a mortar with half its weight of gum acacia, water being added gradually. This emulsion assumes a bluish tint, varying in intensity according to the degree of concentration. The blue gradually changes to a green. A few drops of sweet spirit of nitre will develop the blue tint, as will also exposure to the air.

Resin of jalap is sometimes combined with almonds into an emulsion (four blanched sweet almonds to I gramme of resin), but it soon separates. If neither almonds nor egg be ordered, but only gum or sugar, it is generally best to rub the resin first with its own weight of spirit before mixing with water.

Quinoidine and some other amorphous alkaloids, tannate of quinine, oleo-resins of cina, male fern, and cubebs may be conveniently treated like resins. By rubbing them with three or four times their weight of sugar, and adding spirit of wine to make a thin electuary, they mix well with water. Without the addition of spirit these substances are apt to form a sediment which is very difficult to mix evenly by shaking.

Emulsions of Essential Oils, such as oil of turpentine, do not last long. They are best formed by brisk shaking with a thick mucilage. They require about ten times their weight of gum acacia or one yolk of egg for 5 to 10 grammes of essential oil. [One yolk will emulsify more if the operation is carefully done.—Ed.]

Camphor should be rubbed to a fine powder with the aid of a few drops of absolute alcohol, then mixed with ten times its weight of gum acacia or the yolk of an egg to 5 grammes (gum in preference), and the water added gradually. Any oil or balsam in the mixture should be mixed with the camphor before the gum is added. Syrup should be mixed up with the powder before the addition of water.

Phosphorus.—The preparation of this powerful medicine requires the greatest care. A mixture containing a few particles of phosphorus the size of a pin's head may easily occasion fatal gastritis. It is, therefore, most important that when it is ordered in a mixture it should be perfectly divided. Some pharmacists have recommended the solution of phosphorus in hot mucilage. It is liable, however, in cooling to form small particles like wax, which makes this method highly dangerous. It should be dissolved in 100 times its weight of almond or poppy oil in a test-tube by frequent dipping into hot water, and the oil solution emulsified in the proper way.

[The best plan to follow in such a case as this is to emulsify the proper quantity of the official ol. phosphori in the same manner as almond oil is emulsified with acacia. Fortunately, emulsions of this kind are seldom ordered in this country.—Ed.]

Wax, Spermaceti, and Cocoa-butter are emulsified like the fixed oils. The wax is melted and poured into a hot

mortar, the pestle also being heated. To 10 grammes of wax an equal weight of gum is added, and 15 grammes of hot water is added gradually. After well mixing the mortar is partly cooled, and 85 grammes of cold water is stirred in gradually. Yellow wax should always be used for an emulsion. It gives a perfectly white emulsion. White wax cannot always be well emulsified, and the small proportion of tallow which it not infrequently contains is likely to impart to it a rancid taste.

[The rule may be safely laid down that fixed oils require the mortar and pestle, while volatile oils are better, as well as more quickly, emulsified by agitation.—ED.]

### HINTS BY MR. JOSEPH INCE.

Let the dispenser know when he has done his task, and when once he has formed his emulsion let him add rapidly the remaining ingredients. Many an emulsion is ruined by over-manipulation, and the oil having been incorporated is thrown out again by continuous stirring when mechanical mixture is concerned.

[Mr. William Gilmour, of Edinburgh, experimenting on the theory that by always stirring an emulsion in one direction the oil is broken up in volume, minute globules resulting, but when the direction of stirring is reversed the oil tends to return to its original state, found that, although a difference in the size of the globules was observable when examined by the microscope, little difference was apparent to the naked eye, and the two emulsions were, from a practical point of view, identical. It was noticed, however, that by stirring in two directions a little longer time was required to finish the emulsion, and this was the case with several oils when operated on with different emulsifying agents. On the whole, he considered that not much importance is to be attached to the theory of stirring one way, but it is advisable not to reverse the direction towards the end of the process, because at that point the tendency to spoil seems to be particularly marked.-ED.]

When liquids, limpid or viscous, are to be compounded, the gentlest manipulation should be employed. Increase of pressure generates heat, and heat is fatal to union. Thus, when olive oil, mucilage, and water are to be emulsified, while care must be taken to have the three entirely under the control and action of the pestle, at the same time lightness of hand cannot be too carefully studied.

On the contrary, when a solid has to be broken down and worked into a pasty saponaceous mass, an exactly opposite mode of treatment must be adopted. The object is to produce a kind of soap, which can only be extemporaneously manufactured by strong, continued muscular action, with evolution of heat to complete the change.

Emulsions with Gum Acacia.—The slightest tendency of the mucilage to acidity will defeat the best manipulation. The Pharmacopæia directs 4 ounces of acacia to be dissolved in 6 ounces of distilled water. No heat should ever be resorted to to facilitate solution, for small picked gum acacia stirred occasionally in cold distilled water until the gum is dissolved gives an excellent result. Powdered gum is a very foolish expedient for gaining time, and, when this mucilage is not bright without filtration, alteration of an injurious character may be anticipated. When finished, mucilage should be strained through muslin and kept in a cool place.

Ol. amygdal.						3iss.
Mucilag. gun	n. aca	ic.				3iij.
Syrupi .						3iss.
Aquæ dest.					ad	Ziij.

Put the whole of the mucilage into the mortar first; add the almond oil by degrees, but rapidly, with constant circular stirring in one direction, from left to right. Never add a second drop of oil until the first quantity has been emulsified. This is known by the creamy character of the product and its tendency to form clear spaces by leaving the sides of the mortar. Study two things—quickness of motion and lightness of hand. To the emulsion add the syrup and the water rapidly; of the

latter  $\frac{1}{2}$  ounce at a time. Five minutes should be employed in the whole operation. Slow dispensing is bad dispensing.

Powdered gum acacia is frequently ordered, and its exclusive use has been advocated by some continental pharmacists.

Acaciæ pulv					Эij.
Ol. amygd					3ss.
Syrup. simpl					3ss.
Aquæ destillat.				ad	ъj.

Misce.

Put the powdered gum into the mortar, and with a fair amount of force make it into a mucilage with  $1\frac{1}{2}$  drachm of water. Proceed as in the last case, lightness of hand being essential when once the mucilage is made. Six minutes should complete the operation: an experienced dispenser will want less, but these remarks are written for beginners, and are not offered as advice to experienced pharmacists.

Gum-resin Emulsions.—The mistura ferri composita will exemplify the subject. It is infinitely preferable to prepare it for stock in a concentrated form of four times the strength, and to keep the ferrous sulphate apart until required.

Myrrhæ .					3ss.
Sacchari .					3ss.
Potass. carb.					gr. xv.
Spt. myrist.					3ij.
Aquæ rosæ					3ixss.
Ferri sulphat.	1				gr. xij.

Beat the myrrh well, divide the beaten mass with the powdered sugar, and make into an emulsion with half the rose-water. Next add the carbonate of potassium dissolved in the remainder of the water, and add the spirit last.

Recollect that potassium carbonate is a hostile ingredient in an emulsion when present with a second emulsifying agent. Proceeding in this way an excellent emulsion is produced in an extemporaneous manner; but there is a better mode.

Beat the myrrh as usual, divide with sugar, add the potash, and make a thick creamy emulsion with just sufficient water.

Let this stand, covered from the air, overnight, and the following morning finish the operation. A few minutes' trituration will restore the whiteness, and such a mistura ferri will keep for some years without alteration.

Ammoniacum and asafetida must both be converted into hydrated masses. Let them, before being manipulated, soak in a small quantity of water, when they are readily reduced to a pulpy condition, and form tolerable emulsions afterwards without any additional emulsifying agent.

Egg Emulsions require a skilful hand, and may be presented as permanent combinations. The first and last requisite is that the dispenser should abstain from the slightest mechanical force. Example:—

Ol. ricin	i					Зj.
Vitelli o	vi					j.
Syrup. s	impl.		1	10.	100	3ij.
Tinct. a	urant.					3j.
Aquæ					ad	Ziij.

Break the egg-shell cleverly on the side-edge of a 2-ounce measure, into which let the albumen run. Entirely clear away the albumen (a fertile source of failure when this precaution is neglected). Keep the albumen to be used as liquid gum, and also for sugar-coating pills. Render the yolk (thrown into the mortar) perfectly smooth under the pestle with rapid circular motion; add the oil by degrees; if occasionally too thick, thin with a little water. Add the syrup next; then wash out the measure with a little water. Add the tincture last, and finally wash out the measure with the remaining water, and the process is complete.

Yolk of egg is supreme with regard to spermaceti, once a very favourite remedy with the accoucheur.

Cetacei .					3ij.
Vitelli ovi .					j.
Syrup. simp	1				3iv.
Aquæ .				ad	Ziij.

Break down the spermaceti; make it quite smooth in the syrup, then proceed as usual. All these egg emulsions keep.

When a dilute acid forms an ingredient in an emulsion, it should be added last, and there should be no fear of imperfect combination.

Copaiba Emulsions.—The practice has been recommended of making certain emulsions by very carefully smearing the bottle with the emulsifying agent. But it has been generally condemned, as not being an effectual method. Copaiba forms an exception, and the balsam may be as well emulsified in this way as by any other.

Copaibæ .				. 3	vj.
Liq. potassæ				. 3	iij.
Mucilag. acaciæ				. 3	j.
Spt. æther. nitr.				. 3	iij.
Aq. cinnamom.				ad 3	viij.

Rotate the mucilage in the bottle, well covering the inside. Add the copaiba by degrees; perfectly emulsify by adding the alkali, previously diluted with 3 drachms of cinnamonwater; then add the rest of the cinnamon-water by degrees, retaining or allowing for 2 ounces with which to cleanse the measure from both the liquor potassæ and the spirit of nitrous ether, which should be added last.

Some prescribers are particular in the exhibition of copaiba, and occasionally want it to be taken without other ingredients. It can be so prepared, or made to combine at pleasure in all strengths by using freshly made thick mucilage; thus:—

Pulv. gum. aca	ciæ					3j.
Aquæ destill.						3j.
Misce, et adde-						
Copaibæ .						3iij.
Aquæ destill.				q.s.	200	Ziv.

Extractum filicis liquidum and tinctura cannabis indicæ may both be compounded in the same manner.

## NOTES.

Glycerin, like an alkaline salt, is a disturbing agent in an emulsion when another emulsifier is present. Many salts spoil

emulsions when they are either neutral or acid, but when alkaline they favour the process. Borax has a beneficial action in the absence of acacia, and is in itself an excellent emulsifying agent.

Professor Redwood used to say that mucilage answers better than an alkali for making an emulsion with castor oil or copaiba, but that the alkali is best for oil of almonds. Moreover, a good emulsion of oil of almonds and alkali is spoiled by the addition of mucilage. This Mr. Ince confirms from constant disappointment.

M. Constantin (in 1854) advocated what may be called the ignition process for emulsion of the gum resins and resins. He took a weighed quantity of gum resin, and, having placed it in a mortar, added about four times its weight of alcohol. The spirit being ignited, the whole was triturated until all the alcohol was burned away. The gum resin became a soft extract; the liquid was then added in small quantities at a time, and a perfectly homogeneous emulsion was produced without subsequent separation. In the case of resins they must be converted into gum resins by the addition of powdered gum arabic. To the resin—balsam of tolu, for instance—twice its weight of gum arabic is to be added, and alcohol used in the same way. The peculiar taste and odour remain undiminished.

The method is expensive, but quite successful.

## APPLICATIONS.

In previous editions this chapter was entitled 'Lotions, Liniments, and Injections.' It includes difficulties arising in compounding prescriptions for liquid topical applications and articles which are not administered per os.

In regard to dispensing such preparations the fact may be recalled that the Poison Regulations (Pharmacy Act, 1868) require embrocations, liniments, and lotions containing scheduled poisons to be sent out in bottles distinguishable by touch (see page 19). There is a large choice of 'poison-bottles,' and it should be the invariable rule to dispense liquid medicines which are not to be taken internally in bottles distinct in shape or colour, no matter how innoxious the preparations may be. Gargles are an exception to the rule; they are dispensed in a 'mixture-bottle'; but if, as sometimes happens, a mixture is prescribed along with a gargle, the bottles in which they are severally dispensed should be different in shape.

Dispensers should not label as 'Poison' external medicines which are not poisonous. 'For external use' and 'Not to be taken' labels should be used where appropriate. Compare the remarks on pages 12 to 17.

### LOTIONS.

'The Lotion' generally is the external analogue of 'The Mixture.' Its functions are varied, but the introduction of the antiseptic system of surgery has somewhat narrowed the composition of this class of preparations. Handsel Griffiths says lotions are 'external applications or washes, generally consisting of simple solutions of medicinal substances, and usually

applied by wetting a piece of linen'—not a precise definition, but it will suffice. Such simple solutions are exemplified by the following medicaments, the quantities appended being the proportions to each ounce of water which are usually prescribed:—

Acidum boricum .	gr. x.	Liq. carbonis deter-	
Acidum carbolicum.	gr. xgr. xx.	gens	mxx.
Acid. hydrocyanic.		Liq. plumbi subacet.	
dil	mv.	fort	mx.
Acid. sulphurosum.	3j.	Liq. sodæ chlorat	3ss.
Acidum tannicum .	gr. viij.	Plumbi acetas .	gr. iijgr. v.
Alumen	gr. v.	Potassii permangan.	gr. j.
Argenti nitras	gr. ij.	Potassa sulphurata.	gr. x.
Borax	gr. x.	Sodii carbonas .	gr. x.
Cupri sulphas	gr. iij.	Sodii hyposulphis .	3ss.
Ext. belladonnæ .	gr. ij.	Zinci chloridum .	gr. ij.
Hydrarg. perchlor	gr. 4	Zinci sulphas	gr. iijgr. v.
Liq. calcis chlorat.	3ss.	Zinci sulphocarb	gr. v.

When a lotion of any of these is prescribed and no strength is mentioned, the proportions in this table may be followed.

It is particularly important that solutions such as the foregoing should be dispensed perfectly free from sediment. Dispensers are sometimes tempted to use tap-water for lotions because 'it does not matter.' If any reaction takes place between the dissolved solids in the water and the medicaments, whereby a deposit forms, the lotion may, on application to a tender surface, cause considerable irritation. Some lead lotions are purposely opalescent, as there is a long-standing notion that the fine lead precipitate is a protective. Subjoined are a selection of prescriptions which illustrate difficulties frequently encountered by dispensers.

Borax.—This salt (sodium pyroborate, 2NaBO<sub>2</sub>.B<sub>2</sub>O<sub>3</sub>) is alkaline in reaction, and behaves as an alkali when added to aqueous solutions of alkaloidal salts, but it is constitutionally an acid salt (as is evident from the formula). It does not behave as such, however, when an alkaline carbonate is added to an aqueous solution of borax, but solutions of borax

in glycerin or honey effervesce when a carbonate is added. For example, the following lotion, typical of many which could be reproduced, burst the bottle a short time after it was dispensed, owing to evolution of carbonic-acid gas:—

Sodii biboratis						3ss.
Sodii bicarbor	natis					3ss.
Glycerini.						3j.
Acidi carbolic	i liqu	efacti				3ij.
Aquæ rosæ					ad	ξvj.
Latio						

Fiat lotio.

The change is due to interaction between the borax and glycerin. When borax and glycerin are heated together in molecular proportions, a decomposition, represented by the following equation, takes place:—

$$2C_3H_5(OH)_3 + 2NaBO_3$$
.  $B_2O_3 = 2C_3H_5BO_3 + 2NaBO_2 + 3H_2O$ . Glycerin Borax Glycerol-borin Sodium metaborate

Glycerol-borin, in presence of water, changes back again thus:—

$$2C_3H_5BO_3 + 3H_2O = 2C_3H_5(OH)_3 + H_3BO_3$$
.
Boric acid

Therefore, if the water resulting from the first reaction is not driven off by heat, the resulting glycerin (as in the case of glycerin. boracis, B.P.) contains free boric acid, and when a bicarbonate is added effervescence immediately ensues. The two reactions also take place in the lotion above mentioned, and in all similar lotions containing glycerin, borax, sodium bicarbonate, and water. The reaction is one common to polyhydric alcohols, of which glycerin, dextrose (in honey), and mannite (in manna) are the most familiar representatives; consequently, if any of these occur along with borax and a carbonate, effervescence is inevitable and should be completed by heating before the solutions are dispensed. The modus operandi for the prescription quoted is: 'Mix the borax with the glycerin and 2 ounces of rose-water, heat, and add the bicarbonate, stirring until effervescence ceases. When cold add the

carbolic acid dissolved in the rest of the water, and make up. The following has an additional peculiarity:—

Acidi salic	ylici.			. ʒij.
Sodii bibo	ratis.			. ziij.
Glycerini.				. žiiss.
Aquæ .				ad zviij.

M. Fiat gargarisma.

Without the glycerin this is a clear solution, with it a precipitate of boric acid is obtained. On heating the mixture the acid dissolved (in the glycerin, doubtless) and was not reprecipitated on cooling.

Sodii biboratis				· 3j.
Aluminis.				· 3j.
Glycerini.				. <u>3j</u> .
Aquæ rosæ				ad žviij.
				1

This yields a precipitate. The presence of glycerin in it ensures that the mixture is acid, therefore the precipitate cannot be aluminium hydroxide. The precipitate is a mixture of an aluminium borate (3Al<sub>2</sub>O<sub>3</sub>.2B<sub>2</sub>O<sub>3</sub>) with alkaline sulphate, the exact composition of which has never been determined.

Boroglyceride is the compound resulting from the displacement of 3OH in glycerin by BO<sub>3</sub>, as described in the preceding paragraphs. Consequently when treated with water it decomposes into boric acid and glycerin, and if sufficient solvent is not present, boric acid is precipitated. This happened in the following:—

M.

M.

If the preparation is warmed the precipitate redissolves.

Cocaine and its Salts are now so commonly used for producing local anæsthesia that prescribers sometimes add

a cocaine salt as an adjunct to caustic or irritating substances whose specific action on the skin or mucous membrane they desire. In consequence incompatibility results frequently. The following are examples:—

#### I. THE ALKALOID ALONE.

Cocainæ . . . gr. x.
Plumbi acetatis . . . 5ss.
Aq. rosæ . . . ad 3x.

Fiat collyrium.

Probably the prescriber knew that if he used cocaine hydrochloride there would be a precipitate of lead chloride. The plan with above is to dissolve the cocaine (diffused in a drachm of water) in a sufficiency of acetic acid carefully added.

#### II. WITH BORAX.

Fiat guttæ pro oculis.

Many more prescriptions with the same incompatibility might be given. They are common. The borax precipitates cocaine hydrate, which rapidly crystallises. Dissolve the borax in the rose-water, and add boric acid until the reaction is distinctly acid, then mix with a solution of the cocaine salt.

#### III. WITH CARBOLIC ACID.

Cocain. hydroch. . . gr. x. Glycer. acid. carbol. . . 5ij. Aquæ . . . ad 3ij.

On dissolving the cocaine hydrochloride in I ounce of water, the glycerin in I ounce, and adding the latter to the former, a precipitate was produced. Spring-water was used, but a clear solution was obtained with distilled water. Carbolic acid gives a milky mixture with solution of cocaine hydrochloride in distilled water, but no apparent precipitate.

#### IV. WITH MERCURIC CHLORIDE.

Hydrargyri perchlorid. . gr. j. Cocainæ hydrochlorid. . gr. iij. Glycerini . . . . . . . . . . . . . . . . ad ʒiij.

Fiat guttæ.

A white precipitate is formed consisting of chloro-hydrargyrate of cocaine. This is one of the B.P. tests for cocaine. The precipitate cannot be avoided.

#### V. WITH SILVER NITRATE.

Cocainæ hydrochloridi . gr. xx. Argenti nitratis . gr. x. Aq. dest. . ad 3j.

M. 'The paint for the throat.' Silver chloride is precipitated. To avoid it, dissolve 21 grains of cocaine hydrochloride in 2 ounces of water, add, with constant stirring, ammonia solution to faint alkalinity, collect the precipitate on a paper filter, wash with I ounce of water, transfer the moist precipitate to a glass mortar, and dissolve with dilute nitric acid added drop by drop. Then proceed sec. art.

2																			
٦	ø	W	VΙ	T	Н	$\mathbf{z}$	8	N	C	a c	o i	н	T.	0	R	П	n	E.	

Zinci chloridi			3ss.
Cocainæ hydrod	hlor.		gr. x.
Glycerini .			žss.
Aq		ad	<b>ž</b> j.

Fiat pigmentum.

This gives a white precipitate of cocaine hydrate, apparently owing

to dissociation of zinc chloride, although the solution is neutral. A clear solution is obtained by dissolving the zinc chloride in water \( \frac{7}{2}\)ss., clearing the solution with dilute hydrochloric acid, adding the glycerin, mixing well, then adding the cocaine salt dissolved in the rest of the water.

Hydrargyri Perchloridum.—This salt, as may have been noticed from many of the difficulties previously exemplified, is one of the most active chemical reagents, and as it is now extensively employed as an antiseptic, dispensers must bring all their chemical knowledge to bear upon it when compounding it. The following is a peculiar prescription:—

Hydrarg. perchlor.			3j.
Spt. methylati .			žiij.
Tr. iodi decoloratæ			ziij.
t injectio.			

With tr. iodi decol., B.P.C., a few months old this gives a clear mixture. Sometimes there is a white precipitate. Note that it is illegal to dispense methylated spirit, even although prescribed by a medical practitioner.

Liquor Carbonis Detergens.—The following is an excellent instance of the advantage of studying order of mixing:—

Liq. carbonis deterg	gent.			,	ъj.
Spiritus tenuioris					зij.
Glycerini					3iss.

M.

Fiat

Mixed in the above order (or any other in which proof spirit per se is used) the lotion is milky; but take rectified spirit 3x., add it to the liquor, then the glycerin, and lastly add water 3vj., and a clear lotion is obtained. It is easier to keep the tar compounds in solution than to redissolve them after precipitation.

**Liquor Hydrogenii Peroxidi.**—Occasionally used medicinally as a deodorant, e.g. :—

· Fiat nebula.

This gives a white precipitate of calcium peroxide.

Liquor Plumbi Subacetatis.—This commonly prescribed preparation may give curious results. Dispensers who find prescribers careless in regard to the suffixes 'dilutus' and 'fortis' must observe from the amount indicated or the directions which is intended. For 'lotio plumbi' the liq. plumbi subacet. dil. is dispensed.

The following are a few typical difficulties:-

#### I. WITH ALBUMIN.

It is impossible to make this without a flocculent precipitate of lead albumin. Tincture of opium alone gives a precipitate of lead meconate with the liquor.

### II. WITH COCAINE HYDRO-CHLORIDE.

Liq. plumbi subacet . . mxx.
Liq. bism. et ammon. cit. . 3ss.
Cocainæ hydrochlor. . . Dj.
Aq. flor. sambuci . ad 3iv.
M.

Lead chloride is formed, but a clear solution is obtained by dissolving the cocaine salt in 1 ounce of water, adding to it the bismuth solution mixed with 2 ounces of water, then adding the liq. plumbi drop by drop, stirring all the time. Make

up. The ammonium citrate keeps the lead chloride in solution.

#### III. WITH ESSENTIAL OIL.

Mix the first two, then add the glycerin, again mix; now stir well, and add, drop by drop, the spirit of peppermint. Do not stop stirring until all the spirit is worked in, otherwise the metallic precipitate becomes sticky.

#### IV. WITH FIXED OIL.

The presentable lotion desired was made by heating the almond oil with water I drachm and potassium

carbonate gr. x. on a water-bath for half an hour, cooling, and adding gradually, with shaking, the eucalyptus oil, carbolic acid, and the rest of the water, leaving room for liq. plumbi and S.V.R. 10 minims each.

1	7. W	TH 1	rr. i	BENZ.	co.	
Liq. p	olum	bi sub	pacet			ъij.
Tr. be	enzoi	n. co.				ъij.
Aquæ						ъij.
M.						

Impossible to mix these without a vehicle. Ol. olivæ 3j. suffices. Add it to the tincture, then add

the liquor very gradually, shaking all the time, and finally the water in the same way.

# VI. WITH TR. BENZ. CO. AND OL. TEREB.

Liq. plumbi suba	cet.		ξj.
Tr. benzoin. co.			žj.
Ol. terebinth.			žj.

M.

Mix the oil and the tincture, then add the liquor gradually with shaking. There is no real difficulty in compounding this, strange to say.

It is not difficult to surmise from some of the foregoing that liq. plumbi subacet. plays the part of a saponifier if it has the chance. Dispensers will also note that 'liq. plumbi subacet.' represents the strong solution.

Menthol.—Some prescribers appear to imagine that menthol is soluble in water, perhaps because the crystals look salt-like. In such a gargle as the following, undissolved particles of menthol may have an injurious action on the throat; therefore it is better to filter:—

Aluminis e				gr. xv.		
Potassii ch	lora	tis				gr. xv.
Mentholis						gr. x.
Glycerini						žiss.
Aquæ					ad	ξvj.

M.

To compound this, rub the powders together, add the glycerin gradually, triturating all the time, pour in the water similarly, and filter. Never hesitate to filter watery solutions containing in suspension particles of menthol or thymol if they are to be used as gargles, and if the prescriber cannot be got at to alter the prescription. This, of course, does not apply to inhalations.

M.

Pix Liquida.—When prescribed with alkali and water, boil all together for half an hour, replacing water evaporated, cool, and strain, e.g.:—

Picis liqu	Picis liquidæ				. <u>zij</u> .
Liquor.	potassæ				· 3j.
Aquæ					ad zvj.
Fiat lotio.					

Resorcin.—Any opportunity should be taken of calling the attention of prescribers to the fact that resorcin solutions colour the hair. A hair-lotion containing mercuric chloride, ammonium chloride, resorcin, eau de Cologne, and water changed silver-white hair into a reddish-yellow colour. On trying to bleach the dyed hair with peroxide of hydrogen it became green!

Sodii Hyposulphis.—This salt is easily decomposed; for example, the following lotion contains precipitated sulphur and has the odour of sulphuretted hydrogen:—

Sodii hypo	itis			. 3vj.	
Acidi sulp	hurosi				. 3ss.
Glycerini				-	. 3ij.
Aquæ					 ad žviij.

The decomposition is probably intentional on the part of the prescriber.

Sulphur Præcipitatum.—No attempt should be made to mix this in the bottle. Put it in a mortar and triturate with any glycerin or spirituous ingredient which there may be in the prescription before adding the water. Let the trituration be thorough, so as to increase the diffusibility of the sulphur.

Sulphurated Alkalies are frequently used in lotions for parasitic skin-diseases. The object is to form on the epidermis a deposit of sulphur. The sulphurated solutions should be perfectly fresh and clear. The most commonly used preparation is *Liquor calcis sulphuratæ*, which is made by boiling together for half an hour in an enamelled-iron dish 16½ ounces

of slaked lime, 25 ounces of sublimed sulphur, and 1 gallon of water, then filtering. The filtrate should measure 100 ounces, and be of an orange colour.

#### EYE-LOTIONS.

Collyria are topical applications employed in the treatment of eye-diseases; in composition they do not differ from lotions. They are frequently applied by dropping into the eye; when so ordered, the dispenser should provide the patient with an eye-drop bottle—a small round bottle with a tube passing through the cork—or a camel-hair pencil for the application of the drops. When the pencil is applied, the inner surface of the upper eyelid should be touched, and not the eyeball. Solution of eserine is often called for as a remedy for the eyes. The solution becomes of a dark-red colour, due to the formation of rubeserine. This, according to Mr. J. E. Saul, may be prevented as follows: - Distilled water is boiled in a flask for a few minutes, the mouth of the flask is then closed with a plug of cotton wool, and the whole allowed to cool. To this sterilised water sulphurous acid is added in the proportion of & minim to the fluid ounce, and the sulphate of eserine dissolved in it. This solution keeps white and clear for months.

The following is a typical eye-lotion of the old class; commonly called 'red lotion':—

Zinci sulph.						gr viij.
Tinct. lavar	nd. co	о.				ъij.
Spt. rosman	rini					3ij.
Aquæ				-	ad	žviij.

Ft. lotio pro oculis.

Pour the tincture and spirit into the bottle containing 7 ounces of distilled water; dissolve the sulphate of zinc in ½ ounce of water and add to the contents of the bottle. In this way there is comparatively little deposit. If spring-water of ordinary hardness be used, there will be a copious deposit of carbonate of zinc and sulphate of lime.

It is generally considered that lead lotions are bad for the eyes because the lead salt is apt to produce pigmentation of the cornea, and thus cause temporary blindness. The following is an example of intentional incompatibility:—

On compounding this a precipitate of sulphate of lead is formed. It should be filtered when required for the eyes. Unfiltered lotions similar to this are commonly used for old wounds, but less frequently for the eyes.

#### INJECTIONS.

Vaginal and Urethral Injections do not differ greatly from lotions, except that they are sometimes weaker in active ingredient, owing to larger quantities being used in irrigating. The following are the quantities of the more common medicaments used in this way for each ounce of distilled water:—

```
Acidum boricum. gr. v. to gr. x.
                                     Plumbi acetas .
                                                        gr. ij. to gr. v.
Alumen . . gr. j. to gr. v.
                                     Plumbi acet. with
Alumen and acid.
                                       ext. opii liq. .
                                                        mij.
  tannic. . gr. v. of each
                                     Potassii perman-
                                       ganas . .
Alumen gr. iij. and
                                                       gr. ss. to gr. j.
                                     Zinci chloridum .
  zinci sulphas . gr. ij.
                                                       gr. ss. to gr. j.
                                    Zinci sulphas .
Argenti nitras . gr. ss. to gr. ij.
                                                       gr. j. to gr. iv.
Cupri sulphas . gr. j. to gr. ij.
                                     Zinci sulphocar-
Hydrargyri per-
                                       bolas
                                             . .
                                                       gr. ij. to gr. v.
  chlor.
         . gr. \(\frac{1}{4}\) to gr. ss.
```

Hypodermic Injections are in most cases plain solutions of alkaloidal or other salts in distilled water, and the principal point to observe in preparing them is that all the utensils used should be sterilised by thorough washing and drying in an oven at a temperature of 220° F. The distilled water must also be recently sterilised by boiling. If these precautions are taken, and the bottles to contain the finished

solutions are also sterilised, the solutions keep for a long time, if excluded from the air. Camphor, saccharin, salicylic acid, and chloroform are amongst the best non-irritant preservatives of hypodermic injections-salicylic acid being the best of all, in the proportion of ½ grain to the ounce. Boric acid is useless. The practice is growing amongst medical men of having the active ingredients for hypodermic injections in the forms of lamels, tabloids, tabellæ, and other compressed or dry forms, as they keep indefinitely, and an injection may be prepared from one of them placed in the barrel of the syringe. Experience has pointed to the conclusion that when sores have resulted from hypodermic injections, these have been occasioned by some micro-organisms in the solution. Glycerin, if it form an ingredient in the injection, should be the purest procurable. Clear solutions may often require filtration, but it is important that the filters should be thoroughly cleansed by passing a quantity of distilled water through them.

We subjoin the hypodermic doses most frequently prescribed (apart from those in the British Pharmacopæia), and from these data dispensers will be able to prepare the respective solutions if the prescriber indicates the *volume* of injection he wishes to administer on each occasion:—

Dispensers will note that there are official (B.P.) formulæ for apomorphine, cocaine, ergotin, and morphine hypodermic injections. Sterilised water is used in each case.

## EMBROCATIONS AND LINIMENTS.

There are seldom great difficulties in this class of preparations. Lime-water to be mixed with oils should be added all at once, and well shaken. By adding gradually, a perfectly homogeneous combination is rarely attained. See that the lime-water is fresh and of full strength. Weak water is generally the cause of failures.

The following are a few examples of exceptional difficulties.

The first is a hair-lotion of the character of a liniment:—

Liq. ammon.					žj.
Ol. olivæ .		,			žj.
Paraffin. mollis					₹j.
Acet. canth.					355
Aq. coloniensis					<b>3</b> j.

Misce.

By a slight modification of the formula, this may be compounded as follows:—

First add gradually the acetum cantharidis to the spirit of hartshorn (use the liquor vol. cornu cervi, and not liquor ammon., B.P.), constantly stirring with a glass rod until gas-bubbles no longer rise, then rub thoroughly well the paraffinum molle (use vaseline) with the oleum olivæ until a creamy compound is formed; afterwards gradually add, little by little, the partly neutralised liquor, constantly rubbing, adding lastly the eau de Cologne.

The prescribing of oils, lanoline, and vaseline in aqueous applications (embrocations or lotions) has now become popular with medical men. The following prescription, with or without ichthyol, or with something else in its place, is one of the hardest nuts to crack.

Zinci oxidi				3j.
Ichthyoli.				3j.
Olei olivæ				3vij.
Liquor. calcis				<b>3</b> j.

A good deal of material will probably be wasted wherever this prescription makes its first appearance, for the methods that would naturally suggest themselves even to an experienced dispenser are unavailing, and he has to begin again. The following proved successful:—Stir the zinc oxide in a mortar with the lime-water; add the ichthyol (this has a remarkably thinning effect); now add all the oil at once, and triturate. This produces a nice thin cream of brown tint. The product is of soft ointment consistence. Another example:—

Calaminæ.						zij.
Zinci oxidi						zij.
Olei lini .						živ.
Sulphur. præ	cipitat.					3ss.
Lot. acid. car	rbolic.	(1-4	.(0)		ad	zvj.

M.

M.

A presentable cream was produced by rubbing the powders with  $\frac{1}{2}$  ounce of water and heating with the linseed oil on a water-bath for half an hour, stirring well all the time; then gradually adding the rest of the water, and, when cold, carbolic acid in requisite proportion.

Lanoline is intractable with more than its own weight of water, but soap and saponifying agents facilitate emulsion, 'creams' resulting:—

M.

Melt the fats in a warm bottle, add the liquor, and shake until cold.

Lanolini				3SS.
Sulphur. sublimat.				3ss.
Mist. amygdal. amaræ	-			ъvj.

M.

To be painted on every night.

Rub the lanoline in a warm mortar with 2 drachms of powdered white soap, and gradually stir in 4 ounces of the almond mixture, slightly warmed. Mix the sublimed sulphur with the rest of the almond mixture, and add it gradually to the contents of the mortar.

Soap is a necessary addition in many cases, e.g.:

Ol. pini sylvestris
Lin. potass. iodid. ē sapone
M. Fiat linimentum.

Put a drachm of powdered soap in a mortar, and mix the oil with it; then add the potassium-iodide liniment. Sooner or later the preparation becomes brownish in colour, owing to liberation of iodine due to the ozonising effect of the essential oil.

Vaseline embrocations are exceedingly troublesome. The following prescription could not be compounded by a first-class house:—

A fairly good cream was made by another dispenser in the following manner:—Pour the melted vaseline into a warm bottle; add the powders, and shake; then add gradually  $\frac{1}{2}$  ounce of warm lime water, shaking well, and gradually fill the bottle with cold lime-water, constantly shaking. The modus operandi is intended to thoroughly comminute the vaseline, and the gradual cooling helps to keep it in suspension.

We have never been able to make a satisfactory preparation of the following:—

M.

The best plan is to use vaseline oil (paraffinum liquidum, B.P.) in place of the vaseline, mixing in the order given.

A favourite prescription with some medical men is a mixture of belladonna extract and liniment, such as the following:—

M. Ft. liniment.

It is the green extract which is here intended, and when it is rubbed up with the liniment there is an abundant separation of chlorophyll and extractive matter, which cannot be avoided. Rub the extract in a mortar with ½ drachm of hot water; then gradually add the liniment and strain through a small piece of calico. This is how the prescription is generally dispensed. The active principles are retained in solution. If the liniment is dispensed unstrained, the suspended matter attaches itself to the sides of the bottle. The following are similar cases which should be treated in the same way:—

In the case of (a), mix the tincture of iodine and liniment of camphor before adding to the thinned extract.

Rub the extract with  $\frac{1}{2}$  ounce of solution of ammonia until solution is effected; then agitate with  $1\frac{1}{2}$  ounce of olive oil.

Thin the extract with hot water, and add the oil gradually. Do not strain.

### NEBULÆ, OR SPRAYS.

The preparations now most in vogue are solutions of alkaloids or aromatics in liquid paraffin, which is known under various fanciful names. Paroleine (B., W. & Co.) is a common form. It dissolves camphor 1 in 4, carbolic acid 1 in 19, eucalyptol 1 in 9, iodoform 1 in 60, and menthol 1 in 7. Subjoined are examples of prescriptions:—

	I		Li di		II.	
Aristol Menthol. Albolin. liq. Solve.			gr. xv. gr. xx. 3ss.	Cocainæ Camphoræ Acid. carbol. Menthol. Ol. petrol. rect. M.	:	gr. iv. gr. xxiv. gr. 48 gr. 48

These present no difficulty, except that in No. II. 'ol. petrol. rect.' means, strictly, water-white petroleum for burning. The prescriber undoubtedly intended liquid paraffin. Note that 'oleum' in association with 'petroleum' is a redundancy. The following is a piece of bad prescribing:—

Mentholis					10 p.c.
Camphoræ					gr. 1/4
S.V.R.					q.s.
Glycerini					5ij.
Paroleini					100

This is a literal reproduction of the prescription. If one knew how much the prescriber meant by 'paroleine to 100,' the prescription would be all right, leaving out the spirit and glycerin, which are useless.

# VAPORES, OR INHALATIONS.

These are preparations which are to be inhaled with steam or heated air. They are generally solutions of aromatic substances in alcohol, but when the physiological effect of alcohol is not desired, the substance is dissolved in glycerin or suspended in water by means of *light* carbonate of magnesium, e.g.:—

	I.			II.		
Creosoti			3j.	Ol. pini sylvestris		3j-
Glycerini			5j.	Magnes. carb. levis		3ss.
M.				Aquæ destill		žiss.
				M.		

In the second case put the magnesium carbonate in a mortar and triturate with the oil, then add the water gradually.

# INCOMPATIBLES.

MEDICAL MEN are but rarely good chemists, for this would necessitate longer devotion to chemistry than the average medical student can afford. Hence the importance of dispensers being thoroughly well up in the general principles of chemical incompatibility. These are to be learnt in the ordinary course of pharmaceutical studies, especially in chemistry. Chemical incompatibility is not violation of chemical laws, but the prescribing of two or more substances together which produce new compounds, the therapeutic action of which may differ from the original substances, while the therapeutic action of the latter is partly or wholly changed. Doubtless many such changes are intentional: that is a point which will be discussed later. For convenience of reference we group together the most important of the substances which are apt to be prescribed with others, and which, on compounding, produce chemical reaction (evidenced by change of colour, evolution of gas, or precipitation of the active substance). It is understood that in nearly every case solution is a condition preliminary to the change.

# DICTIONARY OF INCOMPATIBLES.

Acacia gum, with alcohol, borax, ferric chloride, lead subacetate, and sulphuric acid.

Acid, arsenious, with lime-water, magnesia, iron oxide, and tannin. Acid, benzoic, with ferric salts, lead acetate, and mercuric chloride.

Acid, carbolic, with chloral hydrate, ferrous sulphate, and lime,

Acid, chromic, with alcohol, arsenious acid, ether, glycerin, and organic solvents and substances. (Dangerously explosive.)

Acid, citric, with acetates, potassium tartrate, and sulphides.

Acid, gallic, with iron salts, spt. æther. nit., and metallic salts generally,

- Acid, hydrobromic, same as hydrochloric; also acid. nitro-hydrochlor. dil.
- Acid, hydrochloric, with lead and silver salts and tartar emetic.
- Acid, hydrocyanic, with copper, iron, and silver salts, mercuric oxide, morphine solutions, and sulphides.
- Acid, hypophosphorous, with mercuric chloride.
- Acid, nitric, with ferrous salts, lead acetate, and many organic substances (e.g., carbolic acid), which it may, in strong solution, oxidise.
- Acid, nitro-hydrochloric, with bromides, iodides, and lead and silver salts.
- Acid, osmic, with alcohol, ether, ferrous salts, organic substances, and phosphorus.
- Acid, oxalic, with calcium and iron salts and mineral acids.
- Acid, phosphoric, with ferric chloride and lead acetate.
- Acid, picric, with alkaloids and all oxidisable substances. Should on no account be compounded with phosphorus or sulphur, as it may be fatally explosive.
- Acid, pyrogallic, with alkalies, copper and iron salts, and oxidising agents.
- Acid, salicylic, with iron salts and spt. æther. nit.
- Acid, sulphurous, with hyposulphites.
- Acid, tannic, with albumen, alkalies, alkaloids, chlorates, emulsions, ferrous and ferric salts, gelatin, metallic salts, mineral acids, and tartar emetic.

- Acid, tartaric, with ammonia, lime and potash salts, lead and mercury compounds, and vegetable astringents.
- Acids generally, with all alkalies and their carbonates, and with metallic oxides. As the combining powers of acids vary, one acid may displace another from a compound—e.g., mineral acids split up acetates (acetic acid being set free), and such organic acids as benzoic and salicylic are liberated from their salts by other acids.
- Albumen, with acids, alcohol, mercuric chloride, and tannin.
- Alkalies, with acids, alkaloidal salts, and most metallic salts.
- Alkaloidal salts generally, with alkaline and earthy carbonates, borax, iodine and its compounds, double iodides of heavy metals (e.g., Donovan's solution), mercuric chloride, tannin, and all vegetable astringents.
- Alum, with alkalies and alkaline carbonates.
- Ammonium acetate, with acids, potash and soda and their carbonates, lead and silver salts, and tr. ferri perchlor.
- Ammonium benzoate, with acids and ferric salts.
- Ammonium bromide, with mineral acids, alkaline carbonates, chlorine, chlorate and bichromate of potash, nitrate of silver, calomel, and spt. æther. nit.
- Amyl nitrite, with water behaves like spt. æther. nit.
- Antimony and potassium tartrate, with acacia gum, acids, alka-

lies, soap, calomel, tannin, and all vegetable astringents.

Antimony, golden sulphurated, with acids, bismuth subnitrate, and sodium bicarbonate.

Antipyrin, with acids, alkalies, cinchona preparations, copper sulphate, sodium salicylate, spt. æther. nit., syr. ferri iodid., tannin, and all vegetable astringents.

Apomorphine hydrochloride, with alkalies, iodine, iron salts, potassium iodide, and tannin.

Aristol, with alkalies, ammonia, mercuric chloride and metallic oxides, or anything that decomposes iodides.

Arsenium bromide and chloride are immediately decomposed by water.

Arsenium iodide, with acids, mercuric chloride, and morphine salts.

Atropine and its salts, with alkalies, salts of mercury, and tannin.

Barium chloride, with phosphoric and sulphuric acids and their salts, carbonates and tartrates, medicinal wines, and vegetable infusions.

Bismuth subnitrate, with alkaline bicarbonates, calomel, gallic acid, potassium or sodium iodide, sulphur, golden sulphide of antimony, and tannin.

Borax, with acacia mucilage, alkaloidal salts, glycerin, and mineral acids.

Bromides (water-soluble), with chlorine and lead and silver salts.

Caffeine and its salts, with all alkaloidal reagents except potassium iodohydrargyrate.

Calcium salts, with alkalies and their carbonates, oxalates, and sulphates.

Calomel, with alkalies, alkaline chlorides, bromides, hydrocyanic acid, iodides, organic acids, soap, and sodium carbonate.

Chloralamide, with alkalies.

Chloral hydrate, with alcohol, alkalies, calomel, carbolic acid, and potassium iodide.

Chlorates, with black antimony, ferrous iodide, hypophosphites, mineral acids, sulphur, and many organic compounds (dry and wet), tannin, and tartaric acid.

Chlorine, with alkalies, bromides, iodides, lead and silver salts, tannin, vegetable mucilages, extracts, waters, infusions, tinctures and syrups, milk, and emulsions.

Cocaine and its salts, with alkalies, borax, and other alkaloidal precipitants.

Cochineal is precipitated by salts of zinc, bismuth, and nickel as a lilac powder; iron gives a dark purple, tin a brilliant scarlet, and alumina the lakes.

Codeine salts, with fixed alkalies and other alkaloidal precipitants, except ammonia.

Collodion, with water or aqueous fluids.

Copper sulphate, with alkalies and their carbonates, iodides, and vegetable astringents.

Creosote, with silver oxide and other oxidisers.

Dermatol, with acids.

Digitalis preparations, with alkalies, cinchona preparations, iodides, iron salts, and lead acetate.

Diuretin, with acids and alkalies.

Europhen, with metallic oxides, mercury salts, and starch in presence of fats.

Exalgine behaves like antipyrin.

Formic aldehyde, with ammonia, bisulphites, mercuric chloride, and generally it acts as a reducing agent.

Homatropine salts, with alkalies, mercuric chloride, and other alkaloidal reagents.

Hydrogen peroxide, with oxidisable substances and lime-water.

Hyoscyamine and hyoscine salts, similar to homatropine salts.

Hypophosphites, with mercuric chloride; generally act as reducing agents, greedily absorbing oxygen, and explode when rubbed with oxidisers, such as chlorates and nitrates. (A mixture of equal parts of sodium hypophosphite and nitrate has exploded violently.)

Hyposulphites, with mineral acids and soluble salts of the heavy metals.

Ichthyol, with acids.

Inf. rosæ acidum, with alkalies, borax, and liq. plumbi subacet.

Iodine, with acacia gum, alkalies, alkaloids, metallic salts, essential oils (sometimes explosive), and fixed oils (partly absorbed).

Iron, reduced, with extracts (if acid) and metallic and alkaloida! salts.

Iron salts, with acacia mucilage (persalts), alkalies, alkaline car-

bonates, vegetable infusions and extracts (astringent), gallic acid, and tannin.

Iodoform, with calomel.

Kino preparations, with alkalies, gelatin, mineral acids, and metallic salts.

Lead acetate, with acids, albumen, alkalies, carbonates, chlorides, chromates, citrates, iodides, phosphates, soap, sulphates, tannin, and tartrates.

Lead subacetate, same as as the last, also with acacia mucilage.

Magnesium sulphate, with alkalies, lead acetate, potassium and sodium carbonates, and tartarated soda.

Mercuric chloride, with albumen, alkalies, alkaloids, hypophosphites, lead and silver salts, potassium iodide, reduced iron, soap, sulphurous acid, tannin, and vegetable infusions.

Mercuric oxide, with chlorides. Mercury iodides, with alkalies.

Mercury subchloride (see Calomel).

Morphine salts, with alkalies, tannin, vegetable infusions, and the usual alkaloidal precipitates.

Nux vomica preparations, with alkaloidal precipitants; and note that nitric acid changes colour of mixtures.

Opium, with alkaline carbonates, chlorine-water, iodine, liq. arsenicalis, salts of copper, iron, lead, mercury, and zinc, and tannin.

Pepsin is precipitated by alcohol (above 25 per cent.) and ammonium and magnesium sulphates or any salt which saturates the mixture.

Phenocoll salts, with alkalies and their carbonates.

Physostigmine salts, apart from usual alkaloidal incompatibles, becomes red with ammonia owing to formation of rubeserine.

Pilocarpine hydrochloride, with alkalies, iodine, mercuric chloride, and silver nitrate.

Potash, sulphurated, with acids, carbonated waters, and zinc sulphate.

Potassium bromide (see Bromides).

Potassium chlorate (see Chlorates).

Should never be rubbed with sulphur or any combustible compound, nor should strong sulphuric acid be poured over it.

Potassium cyanide, with acids, morphine salts, and silver nitrate.

Potassium iodide, with tr. ferri perchlor. and lead, mercury and silver salts.

Potassium nitrate, with most sulphates.

Potassium permanganate, with glycerin, alcohol and other oxidisable substances. Solutions should not come in contact with cork.

Quinine salts (dissolved), with alkalies, carbonates, tannin, and vegetable infusions.

Resorcin, with ammonia and other reagents.

Salicylates (alkaline), with acids, some alkaloids, ferric salts, and spt. æther. nit.

Salol, with alkalies.

Silver nitrate, with tap-water, hydrochloric, sulphuric, acetic, and tartaric acids and their salts, hydrocyanic acid and its compounds, iodine, iodides and bromides, alkaline and earthy carbonates, sulphur, arsenites, arsenical solutions, tannin and astringent infusions, essential oils, extracts, and resins.

Silver oxide, with acids, ammonia, bromides, chlorides, creosote, iodides, and tannin.

Sodium nitrite, with weak acids, oxidising agents, and vegetable extracts.

Spt. ætheris nitrosi, with emulsions, ferrous sulphate, gallic and tannic acids, and bromides and iodides.

Strontium salts, with phosphoric and sulphuric acids and their salts.

Strychnine solutions, with alkalies, astringents, and liq. arsenicalis.

Sulpho - carbolates, with ferric salts.

Valerianates, with acids.

Zinc chloride, with hard water.

Zinc permanganate explodes when mixed with alcohol, extracts, glycerin, and sugar.

Zinc valerianate, with acids, soluble carbonates, tannin, and metallic salts.

Numerous examples of most of these decompositions are given in the preceding and succeeding pages. A very large proportion of prescription incompatibles are merely examples of the reactions commonly observed in qualitative analysis.

### DISPENSING OF INCOMPATIBLES.

It is not easy to lay down any rule for the dispenser when he comes across an incompatibility. In such cases he would do well to put to himself, previous to compounding the prescription, such questions as the following:—(1) Was this incompatibility foreseen and intended by the prescriber?

(2) Does it in any way endanger the health of the patient?

(3) Is it necessary to trouble the prescriber (supposing he can be communicated with) regarding the incompatibility? (4) Can the incompatibility be in any way mitigated or avoided? The following examples are given as illustrations of these remarks:—

Magnes. carb				зij.
Acid. sulph. dil.				3iss.
Magnes. sulph				3iss.
Quininæ sulph				3ss.
Aq. menth. pip.			ad	ξiν.
				-

Fiat mistura.

As sulphate of magnesium is already ordered in the prescription, it is improbable that the prescriber intended also the addition of this salt by extemporaneous preparation. Further, the prescriber probably adds the acid merely to assist the solution of the quinine, and an excess is added in this instance, as is generally the case with quinine mixtures. Lastly, there is the probability that the magnesium carbonate was intended to act as an antacid; so that, everything considered, there was no difficulty in substituting q.s. for 3 iss. of acid to dissolve the quinine. On the whole, however, it is better to omit the acid altogether, because the soluble sulphate of quinine will be decomposed by the magnesium carbonate. It answers well to rub the quinine to fine powder and suspend in the mixture along with the carbonate.

						. 3iss.
						. 3iss.
						· 3j.
dil.						· 3ss.
						• <u>3j</u> .
						ad Zviij.
	dil.	dil.	dil	dil.	dil	dil.

Fiat mistura.

It was not easy to arrive at any satisfactory conclusion as to the intention of the prescriber in this instance; but as the ammonium phosphate formed by interaction of ammonium carbonate and phosphoric acid is altogether harmless, and as free phosphoric acid in the mixture would, on exposure to light, liberate iodine from the potassium iodide and precipitate morphine from the nepenthe, there was no hesitation in dispensing the prescription as it stood.

Fiat mistura.

This will probably appear a very innocent mixture when first dispensed, but if prepared strictly according to the letter it will almost certainly bring the dispenser into trouble. It will form a clear mixture when first dispensed, but after an interval, depending on the purity of the ingredients, it will turn first brown and then quite black, and become unfit for use. A prescription such as this should never be dispensed without an explanation to the patient of the changes which may be expected to take place, and a caution not to use the mixture after decomposition.

It is rather a neat dispensing feat to produce a black lotion from the following:--

Make the black wash first, then add the zinc chloride. In the course of a few hours the zinc chloride interacts with the black mercurous oxide, and the lotion becomes white. It is therefore just as well to add the zinc chloride to the lime-water in the first instance.

Hyd. ox. flav					• 3j.
Liq. ammon. fort.					. ziiss.
Chloral, hydratis					• 3j.
Glycerini .					. 3ij.
Inf. rosmarini.					ad zvj.
Et adde—					
Tr. canth.					. <u>*</u> j.
Ft. lot.					
o be applied to the scale	o one	e a d	av.		

Here the oxide of mercury is changed to black suboxide. The prescription is very interesting in more ways than one. There is for the pharmacist to consider the meaning of the writer; he might pause, and wonder if a fluid which has every appearance of 'black wash' is what was intended for a 'scalp' application. It is easy to imagine the dirty condition the head would be in after a few applications, although, in cases of ringworm, more unsightly and sticky applications are often used. The chemistry of the lotion will be best understood when it is considered that ammonia and oxide of mercury form mercurohydroxylamine, thus :-

$$2$$
HgO + NH $_4$ OH = NH $_2$ OH +  $2$ H $_2$ O.

This compound is readily reduced in the presence of a substance capable of oxidation. This we have in chloral hydrate, which is oxidised to trichloracetic acid, the ammonia salt of which is formed in the presence of free ammonia, thus :-

$$CCl_3.CH$$
 $\stackrel{OH}{\swarrow}$  +  $NHg_2OH = Hg_2O + CCl_3.COONH_4.$ 

Many decompositions are intentional, as in the case of mist. ferri co., B.P., or the frequent combination of tincture of opium with solution of subacetate of lead for injections; also in the following:-

Ext. con	ii ,					žss.
Liq. plu	mbi subac	et.	,		,	žss.
Aquæ					ad	ξvj.
Ft. lot.	Modo di	cto ut	end.			

Here an abundant precipitate renders the lotion almost creamy, and hecessitates mixing half the water with the extract, and the remainder with the liquor before mixing, else a disagreeable lumpy mixture is produced. Such combinations may be dispensed as written, and sent out with a 'shake' label.

Occasionally, however, the decompositions are of such a character that the chemist may feel pretty sure that the writer of the prescription is unacquainted with the reaction, or has overlooked it. For example:—

```
Sodii sulphat. . . gr. xv. Zinci sulphat. . . 3j. Potass. cit. . . . 9j. Plumbi acet. . . . 3j. M. Ft. pulv. Mitte vj. M. Ft. pulv. Modo dict. utend.
```

In these cases metathesis takes place, the water of crystallisation of the sulphates is liberated, and the powders become wet. The use of an equivalent quantity of the dried salts removes the difficulty.

The following prescription has become famous in text-books:—

This solution deposits in a few hours the greater part of the strychnine salt as an insoluble bromide in transparent crystals. A lady in England lost her life by taking a similar mixture. She carefully refrained from shaking the bottle, the precipitated strychnine collected at the bottom, and in taking the last dose she swallowed nearly all of it.

One of the most remarkable cases of incompatibility is the following, which at first sight appears perfectly harmless, but at least one case of death is on record from the administration of a similar mixture:—

Potassii chlorat.					zij.
Syr. ferri iodidi					3vj.
Vin. antim.					3ss.
Æther. chlor.					3ij.
Aq				ad	zviij.

This mixture is almost colourless when first prepared, but rapidly acquires a reddish-brown colour, and after a few days crystals of iodine are deposited. This is due to the action of potassium chlorate on ferrous iodide; the latter being oxidised by the former, potassium chloride is produced, iodine set free, and, finally, ferric oxide or hydrate precipitated.

Incompatible mixtures are sometimes the result of impurities in the drugs used, thus :—

Sodii hyposulph,			. <u>3j</u> .
Acid. sulphuros.			· 3j.
Aq. rosæ			ad žviij.

The acid invariably contains some sulphuric acid, which throws out sulphur from the hyposulphite.

```
Liquoris hydrargyri perchloridi . . . . . . . . . . . . gr. v.

Ammonii carbonatis . . . . . . . . . . . . gr. v.

Potassii iodidi . . . . . . . . . ad zj.
```

Misce pro dose. Mitte zviij.

Although an alkaline carbonate forms a precipitate with mercuric chloride, still, if in the above mixture the first and third ingredients be mixed, and the solution of the carbonate then added, no precipitate occurs. If common water be used, a slight precipitate of calcium carbonate forms, but it is free from mercury. As previously mentioned, mercuric chloride forms clear solutions with some tap-waters.

# EXPLOSIVE AND INFLAMMABLE COMPOUNDS.

Whenever substances rich in oxygen or easily deoxidised are ordered to be mixed with other ingredients, the dispenser should always carefully consider the order of mixing. Such substances should never be rubbed with easily oxidisable bodies.

Substances which easily part with their oxygen are picric acid, and chlorates, iodates, bichromates, permanganates, nitrates, and picrates, and oxide of silver. In compounding

these substances each should separately be first rubbed to a powder in a mortar, then be mixed with the safe ingredients, and lightly blended on paper with a bone spatula. The more common oxidisable substances are charcoal, organic powders, iodine, sulphur, sulphides, reduced iron, iodide of iron, hypophosphites, camphor, essential oils, and ammonia salts.

The following are specimens of explosive compounds:-

				G	rammes
Potass. chlorat		**			2.0
Lactis sulphuris.					3.0
Antim. sulph. aur.					0.2
Zinci valerianatis					0.2
Sacchari					5.0

M. Ft. pulv. Divide in partes 20 æquales.

The potassium chlorate should first be rubbed to a fine powder; the other ingredients should be separately mixed; lastly, the chlorate should be combined with the other powders by mixing on paper with a bone spatula. The pressure of a pestle may induce a dangerous explosion—indeed, chlorates are amongst the most explosive compounds known, and should always be handled carefully. The same applies to hypophosphites—never rub them too hard, and be careful how you apply heat to them, either when dry or in solution, especially with glycerin.

Explosion took place in the following when the oil of peppermint was added:—

Fiat pulvis.

Even without the oil the powders explode if rubbed hard in a mortar.

Oxide of Silver, if to be combined with any organic substance, should be first damped with water. If creosote is compounded with oxide of silver in a pill, it will explode. Pills containing oxide of silver are liable to inflame if they become

warm. They have taken fire in a person's pocket, causing severe burns. (See also page 101).

Nitrogen Compounds.—Tincture of iodine and ammonia are often prescribed together, and iodide of nitrogen is produced under certain conditions. An explosion has resulted from the preparation of the following prescription, iodide of nitrogen being evidently the cause:—

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      Iodi
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A concentrated solution of iodine and iodide of ammonium was filtered through paper. The next day the filter was touched with a view to being removed, when the paper and funnel were shivered into atoms with a loud explosion.

Reference has been made to the incompatibility of iodine with essential oils. The reaction may be so rapid as to cause explosion. This happened with the following:—

Fiat solutio.

M.

Erythrol Tetranitrate should be handled with great care. In consequence of a fatal accident to a young chemist at Dartford in 1897 (he was mixing the tetranitrate with sugar of milk in a mortar when the whole thing exploded) the Chief Inspector of Explosives advises dispensers that the tetranitrate 'is more sensitive to percussion than dynamite or guncotton.' A medical man threw a sample bottle of the drug into his waste-paper basket. Next morning the basket was emptied into a dustpan containing hot ashes. An explosion ensued, and the housemaid was partly stunned, and received about two dozen small wounds on the hands, arms, and face. Mannitol hexanitrate explodes violently on being struck with a hammer, or when suddenly heated.

Therapeutical Incompatibility is much too wide a subject to discuss in this volume, nor is it one which a pharmacist can adequately treat. Prescribers rarely sin in this respect, and it is noteworthy that many of the apparent therapeutical incompatibles are not so in reality, for the physiological actions of some substances are exerted or completed before others begin, so that such things may be given together quite appropriately. Doctors are very fond of giving ammonia with salicylates: they must have free ammonia to act as a heart-stimulant, because the salicylate is somewhat depressing. The mixture is chemically incompatible, and becomes brown in a few days, but it acts well nevertheless.

As a rule it is inadvisable to prescribe glucosidal bodies in aqueous mixture, especially in presence of acids, because the bodies sooner or later hydrolyse, and thus the therapeutic action may be obliterated, or untoward results occur. This is observed in the case of tincture of strophanthus, which in aqueous mixture, kept for a week or two, produces disagreeable purgation and little effect on the heart. Pharmacists may be able by observation and application of their peculiar knowledge to explain such things to prescribers, but it is scarcely their province to interfere in supposed instances of therapeutical incompatibility.

# FOREIGN PRESCRIPTIONS.

In seaport towns, health-resorts, and cities in which foreigners sojourn, chemists and druggists are frequently called upon to dispense prescriptions of foreign origin, and it sometimes happens that, owing to want of the necessary initiation into the not very formidable intricacies of foreign dispensing, customers are told that the prescription they have presented for dispensing, being a foreign one, cannot be made out. The consequence, probably, is that the customer goes and gets elsewhere that which the chemist who turns him away has an abundance of on his own shelves, if he was only aware of it. In this chapter such information regarding French and German methods of dispensing is given as will assist in the compounding of continental prescriptions. In the Appendix will be found a table of terms likely to occur in French and German prescriptions.

### GERMAN PRESCRIPTIONS.

The most confusing thing about German prescriptions is the chemical nomenclature, of which the following is a fair example:—

Kali hydrojodici				6,0
Aquæ depuratæ				180,0

Rendered into Anglo-Latin, this is :--

Potassii iodidi				3iss. I nearly
Aquæ destillatæ		,		3iss. nearly

In dealing with German prescriptions the difficulty of the nomenclature, independently of minor grammatical differences, resolves itself into acquiring the English terms for a limited number of drugs and preparations. The use of the adjective is, perhaps, the most striking deviation from the Anglo-Latin nomenclature. Thus, for ferrum sulphuricum we should read, according to English custom, ferri sulphas; for ferrum iodatum, ferri iodidum, and so on. With the exception of particular instances mentioned hereafter, nearly everything will, with a very little thought, be self-evident to the dispenser sufficiently well up in his Latin not to fall into the error attributed to an American confrère, who sent to his wholesale house for a supply of 'aqua fervida.' There still exist, however, in various parts of the Continent, medical men of the old school, who, in addition to prescribing by the old grain, drachm, and ounce system, make use of some of the cabalistic signs handed down to us from past generations. Four of these are met with as abbreviations rather frequently, viz. : 5 for pulvis, V for aqua, # for saccharum, and & for spiritus. These gentlemen also prefer using obsolete terms for well-known preparations.

The following are most frequently met with :-

For Acetum plumbi ,, saturninum ,, Aqua saturni ,, phagædenica ,, fontana 99 Aquila alba Deutojoduretum hydrargyri Flores benzoës naphæ zinci Gummi mimosæ Lapis infernalis Magisterium bismuthi Mercurius Natro-kali tartaricum Natrum carbonicum acidulum Nihilum album ,, Oleum anthos

read Liq. plumbi subacet. dilutus Lotio hydrargyri flava Aqua pura Hydrargyri subchloridum ,, iodid. rubrum Acidum benzoicum Flores aurantii Zinci oxidum Gummi acaciæ Argenti nitras Bismuthi subnitras Hydrargyrum Sodæ bicarbonas Soda tartarata Zinci oxidum Oleum rosmarini

For Oleum de cedro	read Oleum limonis
" Protojoduretum hydrargyri	,, Hydrarg. iodid. viride
" Pulvis Kurellæ	,, Pulv. glycyrrh. comp.
" Saccharum saturni	,, Plumbi acetas
,, Sal amarum	,, Magnesii sulphas
,, ,, mirabile	,, Sodii sulphas
,, Sapo viridis	_ ,, Sapo mollis
,, Spiritus Mindereri	,, Liq. ammon. acet.
,, Syrupus diacodii	,, Syr. papav. alb.
,, Tinctura thebaica	,, Tinct. opii

More modern deviations from the Anglo-Latin nomenclature are given below, those adopted by the Pharmacopæia Germanica having the prefix P.G.:—

0 1	
For Acidum phenylicum	read Acid. carbolic.
,, P.G. Aqua amygdalarum	
amararum	,, Aq. lauro-cerasi
,, P.G. Calcaria usta	,, Calx
" P.G. Chininum	,, Quinina
" P.G. Cortex chinæ	,, Cinchona
" P.G. Flores cinæ	,, Santonica
,, P.G. Gutti	,, Cambogia
,, Hydrargyrum amidato-bichlora	it,, Hydrarg. ammoniat.
,, P.G. Kali	,, Potassa
,, P.G. Kalium	,, Potassium
,, Linimentum volatile	,, Linim. ammoniæ
,, P.G. Liquor ammonii caustici	" Liq. ammoniæ
,, P.G. Natrium	" Sodium
" P.G. Natrum	,, Soda
" P.G. Radix liquiritiæ	,, Glycyrrhiza
" P.G. Semen strychni	" Nux vomica
" P.G. Stibium	,, Antimonium
" Sulfur auratum	,, Antimon. sulphurat.
" P.G. Tartarus depuratus	,, Potass. bitartras
,, P.G. ,, natronatus	,, Soda tartarata
,, P.G. ,, stibiatus	,, Antimon. tartarat.
,, P.G. Tinct. opii benzoica	,, Tinct. camph. co.
,, P.G. Unguent. paraffini	,, Paraffinum molle
,, P.G. Vinum stibiatum	,, Vin. antimoniale

Preparations peculiar to German pharmacy which will require reference to the German Pharmacopœia, or some other text-book such as Hager's 'Manuale Pharmaceuticum,' are:—

Ammonium chloratum ferratum (Ammon. muriatico-ferratum) Aqua chlorata (Liq. chlori) Elixir aurantiorum comp. Elixir e succo liquiritiæ (Elixir pectorale) Elixir proprietatis (Paracelsi) Ferrum aceticum (liq. and tinct.) Ferrum pomatum (ext. and tinct.) Linimentum saponato-camph. Liq. aluminii acetici Liq. ammon. anisatus Mixtura sulfurica acida (Elixir acidum Halleri) Mixtura oleoso-balsamica (Balsamum-vitæ Hoffmani) Mucilago salep

Oleum hyoscyami coctum Sal thermarum carolinensium (Sal carolinum factitium) Sapo jalapinus Species laxantes (St. Germain) Species lignorum Species pectorales Spiritus formicarum Spir. saponis Tinctura amara Tinct, ferri chlorati ætherea (Tinct. nervina Bestuscheffii) Tinctura lignorum Tinctura opii crocata (Laudanum liquidum Sydenhami) Unguent. Hebræ Vinum aromaticum

The above have been selected as being what may be called of every-day occurrence, and, although a knowledge of them does not constitute all that is required of a German dispenser quite au fait with his work, it will help to clear away many primâ-facie difficulties.

All quantities ordered are understood to be by weight, fluid measures not being countenanced by the German authorities. The minim is still very frequently represented by the drop (gutta), of which 20 are considered equal to 1 gramme. As drops vary materially according to the density of the fluid and the size of the bottle, this is very unsatisfactory. The tare of the dispensing-bottle being taken, the various ingredients ordered on the prescription are successively weighed into it, commencing with the smallest quantities and finishing with the vehicle. For this purpose English bottles may be said to hold 30 grammes or more per ounce capacity of water and denser fluids respectively, or 24 grammes of spirit or tinctures.

The very convenient way of prescribing the vehicle, ad so many ounces, is adopted by but few foreign physicians, and the few who do so have mostly practised some time in this country.

As in England, mixtures predominate in German prescribing. Solutions of extracts (such as ext. taraxaci, trifolii, and graminis), decoctions and infusions, and oil or seed emulsions occur, however, somewhat more frequently. Decoctions and infusions are directed to be recently prepared, and, if definite proportions are not indicated by the prescriber, are to be made in the proportion of 1 in 10. Seed emulsions, prepared from almonds, poppy, hemp, or henbane seeds, are also 1 in 10, and are made by crushing the seeds, with the addition of a little water, in a metal mortar, until a pasty, homogeneous mass is produced, to which the bulk of the water is gradually added, and the resulting milky fluid strained through flannel. Oil emulsions are, according to the Ph. Germ., directed to be made of oil 2, gum acacia 1, and water 17 parts.

The Potio Riveri of the Ph. Germ. is a fair type of what are called 'saturations'—i.e., an alkaline carbonate saturated with an organic acid (preferably acetic or citric), the carbonic acid evolved being partly absorbed by the vehicle.

Draughts, in the strict application of the term, are almost unknown. Drops, however, are a favourite form of administering medicines. They usually consist of tinctures or a solution of extract or alkaloid.

Pills are not, perhaps, quite so much in vogue as in England, but large quantities are sometimes prescribed, 120, or even 360, being ordered for one patient. Pill-machines being made to cut 30, that number or its multiples are generally ordered. Their weight scarcely ever exceeds 2 grains, 4 or 5 grain pills being quite the exception. Lycopodium is very generally employed to roll the pills in, unless some other powder, such as p. cinnamomi, is specially prescribed, and gold and silver coating is sometimes directed for better-class patients.

Powders to the number of 12, 16, 24, or 48 are also much in request. When not directed to be divided off into doses they are dispensed in bulk, to be taken by the teaspoonful; in the latter case they are ordered 'ad scatulam,' or, if they contain elæosacchara, narcotic extracts, camphor, musk, or other volatile substances, 'ad vitrum.' Extracts to be incorporated with powders are kept as 'extracta sicca,' containing

equal parts of extract and pulv. glycyrrh. Flæosacchara are mixtures consisting of 1 drop of essential oil to 2 grammes of sugar. Volatile substances, when ordered in powders divided off into doses, are ordered 'in charta cerata'—i.e., waxed paper. Either the dose for each powder is prescribed, with the direction 'dentur tales doses No. X.,' or the ingredients for a number are ordered in the aggregate, with an intimation to 'divide in partes æquales No. X.'

Ointments are much of the same nature as in England, and do not call for special remarks. Ungt. hydr. fort. is occasionally prescribed, weighed off in quantities from 1 to 4 grammes, to be wrapped up separately in waxed paper to the number of 12 to 20.

Plasters are sometimes ordered in bulk for the patient to spread them himself. Empl. vesicatorium stands for empl. cantharidis.

Directions for use are invariably written in German, cer tain abbreviations being made use of—e.g., 3 tgl. 1 Essl. = Dreimal täglich einen Esslöffelvoll—i.e., one tablespoonful three times daily ('to be taken' being understood); 2 stl. 1 Theel. = Zweistündlich einen Theelöffelvoll—i.e., a teaspoonful every two hours. The following words occur constantly:—

Esslöffelvoll	= tablespoo	onful   Pillen	==	pills
Theelöffelvoll	= teaspoon	ful Pulver	=	powder
Kaffeelöffelvoll	= ditto	Ausserlich	-	for external use
Kinderlöffelvoll	= dessertsp	oonful Morgens	=	in the morning
Tropfen	= drops	Abends	=	in the evening
Einreibung	= embrocat	ion In Wasser	=	in water
Einspritzung	= injection	Auf Zucker	=	on sugar
Umschlag	= lotion	Zu nehmen	=	to be taken
Salbe	= ointment	Umgeschüttelt	=	to be shaken

When prescribing doses of the more active substances in excess of the Pharmacopæia maxima the physician adds a note of exclamation after the weight (thus: morph. acet., 0,5!), to indicate that he is well aware of the fact and takes the responsibility on himself.

The word 'cito!' or even 'citissime!' is sometimes added, to signify to the dispenser that the prescription is to be dispensed immediately, as, if delayed, the patient's life may be endangered.

Facsimile Prescriptions.—The difficulties of nomenclature over, the dispenser has now to face the handwriting of German prescriptions, which differs materially from English handwriting. A knowledge of this can only be acquired by practice with the originals, of which we submit a few that will be found useful for exercise and reference. It may surprise English dispensers to learn that these are selected rather for purposes of illustration than as being particularly difficult ones, though one or two present some hard nuts to crack. We add the correct reading of and occasional comments on these prescriptions:—

April amygolamar. 3, a Juli amygolamar. 3, a Uni pector. 20, a Agu dertill. 30, 0 Syrt simple 15,

 Rp. Apomorph. mur. cryst.
  $0.04 \left(\frac{3}{5} \text{ gr.}\right)$  

 Morph. mur.
  $0.02 \left(\frac{3}{10} \text{ gr.}\right)$  

 Aquæ amygd. amar.
  $5.0 \left(77 \text{ grs.}\right)$  

 Elix. pector.
  $20.0 \left(\frac{1}{2} \text{ oz. av. } 85 \text{ grs.}\right)$  

 Aqu. destill.
  $30.0 \left(1 \text{ oz. av. } 25 \text{ grs.}\right)$  

 Syr. simpl.
  $15.0 \left(\frac{1}{2} \text{ oz. av. } 13 \text{ grs.}\right)$ 

M. D. S. 4 mal täglich einen Theelöffelvoll.

In this prescription the quantities are, as usual, given in metric weights. The liquids, as well as the solids, should be weighed into the bottle, which by preference should be of black glass, in order to prevent decomposition of the apomorphine.

The aq. amygd. amar. of the prescription is the aqua laurocerasi, and elixir pectorale is the elixir e succo liquirit. of the German Pharmacopæia.

The directions mean 'four times daily one teaspoonful.'

The mark 1.45 in the margin means that the price charged was 1 mark 45 pfennige = 1s. 5d. The price is regulated in Germany by a Government tariff which the pharmacist may not exceed under penalty of a heavy fine.

Minimi murial.

185. Jan. dirk 50.0

Augh. married . 184. g.

Chinini muriat.				1.0
Aqu. dest				30.0
Acid. muriat. dil.				g.s.

S. Nachmittags einen Esslöffelvoll.

This is quoted chiefly for the directions, which are rather unusual—namely, a tablespoonful in the afternoon.

Jodnform. 3, Marint. eeren Valel. all : 10. Millimarin. of x My Most rings. m. Emil

Iodoform. . . . 3.0Vasel. alb. . . . . 10.0Ungt. cerei . . . 10.0Cumarin . . . 0.4M. Ft. ungt. D. S. Mgs. (Morgens) einzureiben.

An ointment 'to be rubbed in, in the morning.' The ung. cerei is composed of olive oil 7 parts and yellow wax 3 parts. The letters on the margin—'o. a. e. l.'—stand for 'olla alba epistomio ligneo'—a white jar with wooden top. Price charged, 1m. 3opf.

My Tricit diene coup.

- valer ether.

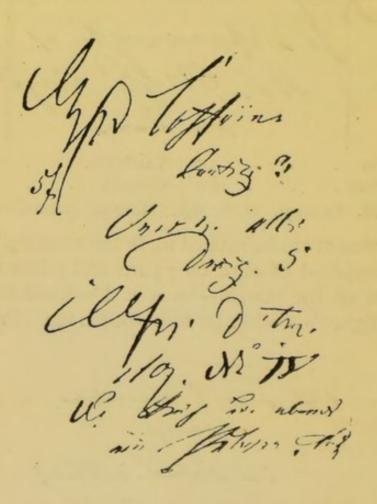
Ais all 2 notes

16 Hough sufficientes.

(ito!

Rp. Tinct	chinæ comp.							
,,	valer. æther.						a.	3ij
M. D. S.	Alle 2 Stunde	en, 15	Tro	pfen	auf Z	ucker.		

This is written by one of the old-fashioned doctors who still use the old measures. The directions mean 'fifteen drops on sugar every two hours.' Observe the word 'cito!' at the end of the prescription as an injunction to the dispenser.



Rp. Coffeini . . . . . centig. 3
Sacch. albi . . . decig. 5

M. Ft. pulv., d. tales dos. No. IV. S. Morg. und Abends ein Pulver.

This prescriber looks like taking first prize for bad writing in this competition. 'Caffeine' in English is 'coffein' in German. The doctor's peculiar care to write out 'centig.' and 'decig.' assists marvellously to obscure his prescription for foreign readers. Price charged, 50pf. = 6d.

£ 11'.
1. Men min
1,85 Valer. 4,00 eni aus cumps
80
2 5 3
Jun 18-207

Rp. Tinct. rhei vinos.					6.00
,, valer					4.00
Elix. aur. comp.			0		8.00
D S. Zweimal täglich,	18_	20 T.			

Vinous tincture of rhubarb is made of rhubarb 8, orange-peel 2, cardamoms 1, and sherry 100 parts. The directions are given here very curtly, but no doubt mean '18 to 20 drops twice daily.' Price charged, 0.85pf.=10d.

;	laur.	nu.	men.
0.70	187	(0,5)	200,0
م	\$ mi	ineccio	

This is simple enough. Half a gramme of sulphate of zinc to be dissolved in 200 grammes of water.

Camp	1 tret	37	
Lere C		37 wres6.	
in hu	ed. 4'	wrest.	DIV
Lorna	. Lig	pro 3	7,
Аут. =	护二	3/1	
	def	3/1	
		J. al	tus
mn	· (	J. al	
Camf. trit.			, 3j.

Camf. tri	t.				,	3j.
Tere c						
Mucil. g.	ara	b				3iv.
Laud. lig	. Sy	d.				3ij.
Syr. #		*				ξvj.
V. dest.						ξvj.

# D. S. Morgens und Abends einen Esslöffelvoll.

In this prescription we come across the old Arabic signs for sugar and water. The directions mean 'one tablespoonful night and morning.'

14/21	tra	21.	ya.	am	à	2	
ut f.		is.	Sa	irai	r. h	V. 5.	
J. S. Vanimus							
Extract. valerian.						gram. 4	

Extract. tarax. . . .

Ut f. pilul. No. 60. Conspergantur pulv. cass. cinnam. D. S Dreimal täglich vier Pille zu nehmen.

The only point about this prescription which needs explanation is the interpolation of the dispenser, who found that I gramme extract. tarax. and 5 grammes of an inert substance, for which he chose pulv. rad. althææ, were required to make the mass. The pills were rolled in pulv. cinnamom.

10 } 30 R						
1.10 lk 22 o. gris. fr						-
					had	•
Iod. pur	-	1			. 0.5	
Kalii iodat					. 2.0	
			1		. 20.0	
F. ungt. D. S.						

It is hardly necessary to say that for 'kalii iodat.' iodide of potassium is intended, and paraffinum molle for 'ungt. paraff.' On the margin the dispenser has run out the calculation of his charge as by law allowed. The first three figures are for the ingredients, the last for the vessel, and the others for the mixing and the labelling, &c., making 1s. 1d. in all. The 'o. gris.' means the ointment was dispensed in an earthenware pot—olla grisea.

### FRENCH PRESCRIPTIONS.

The art of dispensing 'as in France' is fairly told in the following description of a week's work by an English dispenser in a French pharmacy, the work consisting of 33 potions (mixtures), I suppository, 9 powders, 5 drops, 5 solutés (solutions), I inhalation, 4 collutoires (collutoria), 9 pommades (ointments), 10 syrups, 3 hypodermic injections, 7 cachets, 4 liniments, 3 pills, 2 wines, and 4 mélanges.

The Codex gives some general directions to be observed in the preparation of potions. All powders, vegetable or mineral, it directs, should be divided by the syrup or gum which may be prescribed. Kermes mineral, which is frequently occurring, should be well triturated with sugar before the addition of the other ingredients, and all volatile substances, such as ethers, should be added last. The first prescription containing the mineral illustrates the difficulties of the dispenser, and also, what is of far greater importance, the general inaccuracy of the French system. It runs thus:—

Frequently this would be dispensed without gum, as the quantity of powder is so small. The uncertainty as to the use of the gum is troublesome, and so is the quantity of tincture, as drop-measures are unknown. Referring to the Codex, we find that the normal drop-measure should be a glass tube with a capillary opening, having an outside diameter of 3 millimetres, capable of giving drops of distilled water of which 20 will weigh 1 gramme. Practically these tubes are in very little use, the rough-and-ready practice of dropping from the bottle being much more prevalent—in fact, in a large dispensing business it would be difficult to find the time to do otherwise.

The prescription, however, has the advantage of equalling by weight exactly the contents of a 180-gramme bottle, or about an ordinary 6-ounce English bottle—a circumstance for which the dispenser is always thankful. The next presents a dilemma in that respect:—

In this case a 60-gramme or 2-ounce bottle will not contain the exact weight; it has, however, been dispensed to fill both a 2-ounce and 3-ounce bottle—which makes an important difference in the dose of one teaspoonful every half-hour, and also in a 3-ounce bottle, not filled, but containing the exact weight, which an English dispenser would regard as the only correct course. But then occurs a commercial trouble. The customer complains that the bottle is not full, and that in other pharmacies this has not been the case, and he gets the impression either that he is cheated or that a mistake has been made. Moreover, it may be mentioned that French bottles are really remarkable for their inaccuracy; taking twelve bottles marked 180 grammes, perhaps one in the twelve on weighing will be found accurate, the others differing from 5 to 20 grammes.

Another example :-

This mixture has been sent out both in 4-ounce and 5-ounce bottles. Many dispensers take the precaution to note the exact size of bottle in the prescription-book, so as to secure uniformity. Mixtures containing tinctures or other liquids in the quantity of 1 gramme, or even 2 grammes, are another fruitful source of discrepancies, as practically so small a dose cannot be weighed accurately into a 6 or 8 ounce bottle on the counterscales. The Codex offers some assistance with a table showing the numbers of drops contained in 1 gramme of such preparations as are most frequently prescribed; but this is not of practical service, as accurate measurement of drops involves a great loss of time. In this table the number of drops to a gramme varies from 20 of distilled water to 90 of sulphuric ether. The dispenser very soon falls into the usual system of adding these ingredients more or less 'à l'œil.'

Whilst on the subject of mixtures we note the absence in French prescriptions of a safeguard which often prevents mistakes in England. In the majority of cases French prescribers give no directions on the prescriptions as to how the medicine is to be taken. When given the directions are not infrequently shamefully vague. 'Take by spoonfuls' occurs constantly, without indication whether tea, dessert, or table spoons are intended. A consolation for the pharmacien is

that French remedies are generally very innocuous, and the quantity taken is not of so much importance.

Suppositories also give rise to many uncertainties. The standard weight, according to the Codex, should be 4 grammes, which is not the case in the following:—

To make one suppository.

Moulds as used in England are rare in France, their place being roughly supplied by extemporaneous paper cones, which require some practice and dexterity to produce of the same size, so as to obtain suppositories of uniform length and diameter. It is almost certain that no two pharmacies will turn them out in identical style. Suppositories before delivery to the customer are always covered with tinfoil—for what purpose it is difficult to say, as the patient has the trouble of unwrapping each one before using.

Powders, as a rule, are dispensed in as small a compass as possible, and many pharmaciens use powder-papers already folded, with their name and address thereon. This system offers the advantage of uniformity and neatness, not always obtainable by handwork. The papers are made both in ordinary and in waxed paper, the latter being employed for iodide and bromide of sodium and other deliquescent salts, which are frequently prescribed as powders. The following is an ordinary prescription for powders:—

```
Calcined magnesia . . . . O'20 gramme
Subnitrate of bismuth . . O'20 ,,
Pancreatin . . . O'10 ,,
Pepsin . . . . . . O'10 ,,
Prepared chalk . . . . . O'15 ,,
Opium . . . . O'01 ,,
```

For one powder. Send twenty such.

The price usually charged would be 2s. 6d. Powders are often prescribed in bulk, as the following:—

Carbonate of in	ron			10	grammes
Peruvian bark				15	,,
Myrrh .			1 91	15	,,
Liquorice.				15	,,

To be taken by teaspoonfuls.

These are usually dispensed in cardboard boxes, very seldom in wide-mouth bottles, unless at the special request of the customer.

Drops offer no feature of special interest, as they do not appear to be a popular form of prescribing, and are almost confined to arsenical preparations and such tinctures as nux vomica, ignatia, &c. These are generally dispensed in stoppered bottles fitted with a capillary tube, or stoppers with a groove and lip, or, when it is a question of price, in an ordinary phial, with a separate drop tube, at a cheap rate. Collutoires, or applications for brushing out the throat or mouth, usually have as a basis mulberry syrup, honey of roses, or glycerin, with about 10 per cent. of some active ingredient, such as potassium chlorate, borax, &c. The quantity usually ordered is about 1 fluid ounce, which is sent out in a wide-mouth phial sufficiently large to admit a camel-hair brush.

The dispensing of ointments differs little from English procedure, and the formulæ do not, as a rule, present any novel features. Lard as a basis is becoming discarded for vaseline and lanolin. The preparations most in use are mercury, iodine, and zinc; Turpeth mineral occurs as an ointment of 1 part in 30; also sulphate of copper. Ung. belladonnæ is a great favourite with French prescribers, and occurs in all sorts of combinations, such as the following:—

Ext. bellad			I gramme
Ext. opii			I ,,
Ol. menth. pip.			5 gtt.
Adipis glycerinat.			20 grammes

The English style of covered pots for ointments is not common in France, and ointments are usually sent out in

gallipots covered with tinfoil and paper or circular discs of cardboard. Recently screw-capped jars with nickel covers have found a place on the dispensing-counter, and from their convenience and low price will soon supersede the antiquated style of package.

Syrups form the real foundation of French pharmacy. The Codex gives the formulæ of 80, all more or less in daily use, and the non-official may be reckoned at some 600, all of which occur more or less in prescriptions. Sirop de limaille de fer (syrup of iron filings) is a specimen of the more unusual ones. Here, again, discrepancies occur. The instructions of the Codex are seldom followed, as most pharmaciens prepare even the official syrups from fluid extracts. The products differ widely from the original type, especially as the admixture is frequently made, from economical motives, to avoid keeping stocks of perishable preparations. In fact, the dispensing of syrups in France is exactly parallel with that of infusions in England. It is certain, however, that this system of dispensing has told against the pharmacien; many physicians prefer to prescribe the syrups of well-known specialists—such as Laroze, Chassaing, &c .- rather than risk the home-made combinations of the dispenser. Prescriptions for specialities simply are becoming more and more common. For instance, the following:-

One bottle digitalin (Homolle), I granule every two days. One bottle eau Gazost, as directed.
One tin meat powder (Rousseau), a teaspoonful twice a day.
One tube quassin (Burgraeve), one granule at each meal.

In this case nothing is left to the skill of the dispenser, and his loss of profit is very considerable. It is probable, however, that much of this has been brought about by bad work. Glucose frequently forms an important item in syrup dispensing.

Cachets are exceedingly popular in France—the home of their origin. Patients like them, and they afford a good profit to the chemist. Various makes of apparatus for filling and closing the cachets are now obtainable. The following translation of a prescription gives an idea of the French cachet:-

For one cachet. Send twenty.

The price would be 5s. Cachets are sent out in cardboard cylindrical cases of different diameters, according to size, from o to 3, containing from five to twenty. For the exhibition of powders, salts of quinine, &c., nothing can be better adapted than this plan, which has in many instances replaced the use of pills and powders. Cachets of quinine, bismuth, rhubarb, and other popular remedies are very generally kept ready prepared. Extracts are also prescribed in this form, as in the following formula:—

Make one cachet.

It is customary to mark on the prescription the size of the cachet employed, so as to secure uniformity.

Liniments are now generally dispensed in blue glass bottles with distinctive red labels. The formulæ for liniments at times are very curious, as will be seen from the following:—

Ft. lin.

The most frequently prescribed liniments are baume opodel-

doc (similar to Steer's), baume tranquille, and baume fioraventi in conjunction with sedatives.

Pills are going out of fashion in France, aperients being very seldom ordered in this form, nor can special pills be said to have any really popular demand. Mineral waters, such as Hunyadi János and Royale Hongroise, have driven pills out of the field, much to the dispenser's loss. The cheap screw-capped pill-tubes have superseded the old paper box, and are much adopted by specialists; turned wood boxes appear never to have been worth making by French sundriesmen, the few met with being evidently of English origin. Some of the pill formulæ are surprising, and being frequently without any directions for taking are certainly trying to the nerves of the dispenser, e.g.:—

```
Atropinæ . . . . . 5 milligrammes
Conf. rosæ . . . . q.s.
Fiat pilulæ quinque.
```

#### Another :-

```
Veratrine . . . . . 5 centigrammes
Opium . . . . . . . 5 ,,
Make a pill, and send 30.
```

In this case, as the prescriber could not be consulted, the quantity of veratrine was changed from 5 centigrammes to \frac{1}{2} centigramme.

The time and care required for such preparations are never compensated by the price charged. As a powder for rolling pills lycopodium is almost always employed, except when the pills are directed to be sent in orris or cinnamon powder, which happens occasionally. Silvering is becoming a thing of the past.

Wines are a favourite form of administration, and are usually prescribed by bottle or half-bottle; but in this case, as in so many others, proprietary articles are preferred. As examples of wines prescribed take the following:—

Vin de quinquinæ au Malaga, containing in every 100 grammes 10 drops tinct. nucis vomicæ, send ½ litre.

Vin. cinchonæ			I litre
Ferri et sodæ pyrophosph.			2 grammes

These are usually dispensed in special-shaped bottles and capsuled.

Mélange is a word frequently employed to head the label of a preparation, and it is somewhat difficult to define, as the following specimens will show:—

			1				
						G	rammes
Old rum							150
Creosote							5
Glycerin							20
Mix.							
			11				
Honey .							15
Extract of a	rnica	-flowe	ers.				15
Mix.							
			11	Ι.			
Iodoform.							I
Aq. rosæ							50
Aq. destil.							50
Tinct. opii							I
M.							001

Occasionally such prescriptions as the following crop up:— Sulphate of magnesia, rose-leaves, sarsaparilla, fumitory, chinaroot, liquorice-root, agaric (*Boletus laricis*), senna, and soapwort, of each 1 ounce; infuse for twenty-four hours in 4 litres of boiling water. This involves thoroughly cutting up or disintegrating the whole of the materials, so as to produce as uniform a compound as possible. The price charged would be 5s. The species would be dispensed either in a paper bag or cardboard box, according to circumstances. Packets of different preparations for infusions are frequently ordered, besides tisanes, or teas, to be drunk between the medicinal doses. Here is an example:—Quassia, 16 grammes; roasted coffee, 32 grammes. Divide into eight packets as directed.

French prescriptions are even more difficult to read than German. We now give a few examples with English translations. It will be seen that familiarity with the French language is absolutely essential, as the language of the prescriptions is French.

Julfate de quinine 1 grass Eaux gommie 80 gras Inop flux D'oranger 20 gri Lerop D'a comt 25 pi	
Mely I de potran:  pula par authoris	
2 Janiera	>

#### [TRANSLATION.]

B.	Quinine sulphate .		. 1	gramme	
	Gum water		. 80	gramme	s [about 2%
	Syrup of orange-flowers		. 20	,,	[Codex]
	Syrup of aconite .		. 2	5 ,,	,,

Mix according to art.

Mixture to be taken by spoonfuls [tablespoonfuls].

Y heich defoie de moine /2 lite
prendre une mastlance à soupen
au commencement de chaque répas
J landoniqué à 3% - 1/2 litre A allonger avec deux tiens d'ear liers
som injections auriculaires
Une petite senngue en vorre.
9/10 90. [Translation.]
Re Cod-liver oil

 $\beta_0$  Boric-acid solution in water 3% . . .  $\frac{1}{2}$  litre To be mixed with two-thirds as much warm water for aural injections.

A small glass syringe.

4

Calonel a'la vapeur

1 gr

en 10 paquets de 0,10.

Ceityr

Mill papiers Registers

Mil 17 gapes of harders

huil 17 gapes of harders

huil 17 gapes of horizont

### [TRANSLATION.]

Ro Calomel prepared by sublimation. . I gramme Divide into 10 packets of 10 centigrammes each.

1 box papier Rigollot [mustard-leaves]

Honey . . . . 100 grammes

In D? Liber / elycile -Thenot Brakens un flavon pour magecaline Einten D'ivel juu ung o enlimi Flulen de Valler- no 100 Deur a nexters dur 6 10 in anaul a primifical uper a punde le meter

[TRANSLATION.]

Phenol salycilé du Dr. Leben.

Send one bottle.

For external use.

A tablespoonful for 250 grammes of water—external use.

Tincture of iodine . . . . 20 grammes

For external use.

[Tincture of iodine of the French Codex is much stronger than the English, and does not contain any potassium iodide.]

Vallet's pills . . . . . No. 100

Two to be taken in the morning and two in the evening before the principal meal.

Seidlitz water . . . . . 50 grammes

One bottle to be taken in the morning before food (fasting).

[One bottle containing 50 grammes seidlitz salt (mag. sulph.), charged with CO<sub>2</sub> made by adding a little citric acid and sodium bicarbonate and taking quickly.]

Tart. émétre 25 unter Divs en paput éganx nº/2

13 20he 90

& Borreng

[TRANSLATION.]

Tartar emetic . . . 25 centigrammes

Divide into two equal packets.

### FOREIGN EXPERIENCE FOR ASSISTANTS.

It is now becoming a regular custom with English assistants, at least to the number of about a hundred, yearly to go to the South of France for the winter season, and many later on endeavour to get into a Parisian pharmacy. In the former case the duties of the English-speaking assistant are generally confined to attending American and English customers, and dispensing their prescriptions. The following is a brief description of the

duties by an assistant who went to the Riviera in the 1900 season:—

Our pharmacy is large and well-arranged; the garçons do all the dusting and look after the place from about 6 till 8 in the morning, when we make our appearance. 'We' includes a German, a Swiss, and myself. I attend to the English and Americans, and they see to the others. Each alternate Sunday I am on duty all day, except three hours for meals. On week-days we are on duty alternately till 7 and 10, or half-past 9. We have an hour and a half for lunch at 12 o'clock, and the same for dinner at 7. We sleep in, but board out, and many of us go to the same restaurant where, for 90f. a month, we eat, drink, and make merry. English patent medicines are greatly in evidence. We have separate English labels for many of our specialities, and of course for dispensing; in fact, we have so many English things about on the counter and elsewhere that our customers remark on its being quite like an English chemist's shop. Oxygen is in great demand for chest and throat troubles. We make it from potassium chlorate and manganese, store it in a small gasometer, and retail it in indiarubber bags. We have English weights and scales and measures, and, in fact, everything there should be in a well-appointed pharmacy. Prices are very good, especially for dispensing.

This sort of practice initiates the English assistant thoroughly into French methods, he gets his French brushed up, and then if he require a better insight into French pharmacy he may endeavour to get into an establishment which is pure French, or where he will have a share of all the dispensing done. The experience is worth getting, especially as a finish off to pharmaceutical studies, and after experience in a good English, Irish, or Scotch dispensing house.

# NEW REMEDIES.

In this chapter we give brief notes regarding recently introduced remedies, especially of those which are synthetically produced. Articles which are in the British Pharmacopœia are not included, but many remedies are mentioned which are rarely heard of, and this is done because they are the very things that dispensers have difficulty in learning anything about when wanted.

Acid, Agaric, or agaricin, the active principle of white agaric, occurs in white, silky crystals or in crystalline powder. It is given to check the night sweats of consumptives. Dose: 
\frac{1}{2} \text{ to } \frac{1}{2} \text{ grain, in pill three hours before bedtime.}

Acid, Cacodylic.—Dimethylarsenicacid [As(CH<sub>8</sub>)<sub>2</sub>.O.OH] in inodorous rhombic crystals, soluble in water and in alcohol. Used chiefly in the form of sodium cacodylate, which is a white amorphous powder, for the treatment of psoriasis. Enormous doses of arsenic may thus be administered without toxic symptoms. The doses are \(\frac{1}{4}\) to 1 grain in pill, or by hypodermic injection. It is also given per ano. The solutions require a preservative (carbolic acid or thymol) and should be made with distilled water.

Acid, Camphoric.—Crystalline scales, soluble in alcohol, slightly in oils, almost insoluble in water. Has antiseptic properties and is used internally in 10 to 30 grain doses (as powders) for night sweats, bronchitis, cystitis, diarrhœa, and gonorrhœa.

- Acid, Cinnamic.—Properties similar to benzoic acid. Recommended in tuberculosis as intravenous injection, beginning with \(\frac{1}{4}\)-grain doses in almond or olive oil.
- Acid, Cresotic (Para).—Antipyretic and intestinal antiseptic for children, resembling salicylic acid in appearance and properties. Dose: As antiseptic, \(\frac{1}{4}\) to 1 grain; as antipyretic, 2 grains upwards.
- Acid, Filicic.—The active principle of male fern, and given as an anthelmintic in powders of 10 grains or more.
- Acid, Osmic.—In yellow crystals, soluble in water. Given in doses of  $\frac{1}{64}$  grain for muscular rheumatism and neuralgia, and hypodermically in  $\frac{1}{20}$  grain doses for sciatica and tumours. The vapour is intensely irritating.
- Acid, Oxynaphthoic, is a nearly white powder, practically insoluble in water, but soluble on the addition of alkalies, which form salts with it. The acid is easily soluble in alcohol and ether. Is an antiseptic and antizymotic. Used as a 1-in-20 ointment (with lanoline or vaseline) for itch.
- Acid, Picric.—For malaria in  $\frac{1}{2}$  to 2 grain doses (in alcohol), and 1-in-1,000 solution for burns, eczema, and cracked nipples.
- Acoin (Alkyloxyphenylguanidine) is a local anæsthetic recommended in place of cocaine, the duration of the anæsthesia being proportionate to the strength of the solution; thus I in 1,000 produces anæsthesia of the cornea lasting fifteen minutes, I in 200 one hour, and I in 40 one day. It is soluble in water.
- Actol.—The fancy name for lactate of silver, a white powder soluble 1 in 15 of water. Is an active bactericide and is used chiefly in laryngeal affections (gargle or insufflation). Dose:  $\frac{1}{8}$  grain to begin.
- Agathin.—This is the trade name for salicylalphamethylphenylhydrazine, a colourless, inodorous, and tasteless powder or scales, insoluble in water. Used for neuralgia, sciatica, and similar affections in 8-grain doses.

Airol is bismuth oxyiodogallate, and is used as a substitute for iodoform externally, as an antiseptic astringent internally for gonorrhœa and bowel troubles, in 2 to 5 grain doses.

Alginoids are compounds of alginic acid (obtained from seaweed) and bases, introduced by the late Mr. E. C. C. Stanford. The more important are the compounds with arsenic and iron. They pass the stomach unattacked, but in the intestines give the active agent to the circulation. Iron alginate has proved to be advantageous in anæmia, especially where there is gastric disturbance. It contains 11 per cent. of iron, and is given in doses of 2 to 15 grains.

Allyl Tribromide.—Yellowish liquid, soluble in alcohol and ether, given in 5 to 10 minim doses in hysteria, whooping-cough, and asthma.

Alphol.—The salicylate of alphonaphthol, a white crystalline compound resembling salol in appearance and properties. Dose: 8 to 16 grains (as powders) in cystitis, articular rheumatism, and neuralgia.

Alumnol.—A white powder (aluminium sulphonaphtholate), readily soluble in water. Used in venereal complaints.

Amygdophenin.—A crystalline derivative of paramidophenol, which is sparingly soluble in water, and is given in 8 to 15 grain doses in rheumatic fever.

Amylene Hydrate.—This is a colourless, oily liquid, with a slightly camphoraceous odour; soluble in 8 parts of water, and in alcohol, ether and glycerin. Hypnotic in doses of 3ss. to 3j. May be administered in gelatin capsules, each containing 15 minims, or as a mixture such as the following:—

Amylene hydrate					ъij.
Syrup of orange	11.01		.01		3vj.
Orange-flower water		2	110	100	дхііј.
Distilled water					3xiij.

Agitate the hydrate with the waters, then add the syrup, and mix. Dose: One or two tablespoonfuls.

Anemonin.—The crystalline active principle of Anemone nemorosa. Insoluble in water. Given in  $\frac{1}{4}$  to  $\frac{3}{4}$  grain doses (in pill) for asthma, bronchitis, and as an emmenagogue.

Anthrarobin is a synthetic product closely resembling chrysarobin, and proposed to be used in place of it in the treatment of psoriasis, herpes, and other skin-diseases. It has never 'caught on,' however.

Antinosin.—A blue powder, with faint odour of iodine. It is the sodium salt of tetraiodophenolphthalein (nosophen). Soluble in water. Antiseptic; used in cystitis and vesical catarrh as 1-per-cent. injection, gradually strengthened to  $2\frac{1}{2}$  per cent.

Antispasmine.—A reddish, slightly hygroscopic powder, which is a mixture of sodium salicylate and narceine-sodium (narceine 50 per cent.). Is an antispasmodic and sedative used in whooping-cough and other spasmodic bronchial affections, the dose being  $\frac{1}{8}$  grain for children under six months, and I grain for those over three years.

Anusol.—The name applied to proprietary suppositories for intestinal affections.

Apiol.—A green oily fluid, which is the active principle of parsley. Soluble in alcohol, but generally given in capsules (5 to 10 minims) as an emmenagogue, and in 15-minim doses for malaria.

Apocodeine Hydrochloride, a derivative of codeine, in grey powder, hygroscopic and soluble in water. Used in whooping-cough, bronchitis, and similar affections. Dose:  $\frac{1}{4}$  to 1 grain (or more) in pill; hypodermically,  $\frac{1}{6}$  to  $\frac{1}{2}$  grain.

Apolysin (Alphacitrophen).—A greyish crystalline powder, soluble 1 in 50 of water, the solution being acid in reaction. Resembles phenacetin in constitution and action, and is used as an analgesic and antipyretic in doses of 6 grains (as powders) every two hours, or 8 grains in suppository with cocoa-butter.

Argentamine.—An 8-per-cent. solution of silver phosphate in 15-per-cent. solution of ethylene diamine. Of this a 1-in-4,000 solution is used as an injection in gonorrhæa.

Argentol (Silver Chinoseptolate).—A yellow powder, used as an injection (1 in 1,000) for venereal complaints, and in doses of 1 to 5 grains for epilepsy and sciatica.

Argonin.—A compound of casein and silver which occurs as a white powder and contains  $4\frac{1}{4}$  per cent. of metallic silver. Bactericide, and used in 1 to 2 per cent. aqueous solution as injection for gonorrhea.

Aristol, or dithymol di-iodide, is a substitute for iodoform, and is used for the same purposes. It contains about 46 per cent. of iodine. It is a brownish, amorphous, and odourless powder. Used preferably in powder for old ulcers, or in 5 and 10 per cent. ointment (lanoline or vaseline basis heated very cautiously), for the treatment of eczema and ringworm.

Arsenium Bromide.—Deliquescent crystals, given in doses of  $\frac{1}{60}$  to  $\frac{1}{15}$  grain for diabetes.

Asaprol is calcium betanaphthol-alphamonosulphonate,  $(C_{10}H_6OHSO_3)_2CaO,_3H_2O$ . It is a white or greyish powder, soluble in water and alcohol, and is recommended in 8 to 15 grain doses for articular rheumatism and enteric fever.

Aseptol is a 33-per-cent. solution of orthophenol-sulphonic acid. Soluble in water, and recommended as injection for cystitis, and otherwise as an antiseptic. This is not aseptolin.

Aspirin is obtained by the action of acetic anhydride on salicylic acid, and has the formula C<sub>6</sub>H<sub>4</sub>(O.CO.CH<sub>3</sub>)CO<sub>2</sub>H. It is a white crystalline solid, sparingly soluble in water. Dose for articular rheumatism: 15 grains three times daily.

Asterol is paraphenolsulphonate of mercury, a white powder, soluble in hot water, and used in 2 to 4 per cent. solutions as an antiseptic.

Baptisin.—The brown resinoid of Baptisia tinctoria. Dose: 1 to 5 grains in pill as a laxative, chiefly in dysentery.

Benzanilide.—A white powder, insoluble in water but soluble 1 in 58 of alcohol. Given as an antipyretic to children in 1 to 5 grain doses.

Benzeugenol.—The crystalline benzoic ester of eugenol, employed in tuberculosis as 10-per-cent. solution in olive oil by injection. Internal dose:  $\frac{1}{5}$  grain.

Benzonaphthol (Benzoate of Beta-naphthol).— White, microscopic crystals, without odour, and practically insoluble in water, but soluble in rectified spirit to the extent of 2 or 3 grains in an ounce, and soluble 1 in 3 of chloroform. Proposed as an intestinal antiseptic, preferable to betanaphthol. Dose: 10 to 20 grains.

Benzosol (Benzoyl-Guaiacol).—A white crystalline and odourless powder, insoluble in water. Introduced chiefly as a means of effecting the guaiacol treatment of consumption. It is practically tasteless, and splits up in the system into guaiacol and benzoic acid. Dose: 4 to 10 grains, dispensed as powders mixed with sugar.

Betol (Beta-naphthol-Salicylate). — A remedy for rheumatism and gonorrheal affections; occurs in brilliant colourless crystals, insoluble in water, but soluble in alcohol and fixed oils. Dose: 5 to 10 grains in powder or pills. Used for the same purposes as salol.

Bismal is bismuth methylene-digallate, a bluish powder, recommended in 2 to 5 grain doses (in cachets) as an intestinal antiseptic.

Bismuth Oxyiodide.—A brownish-red amorphous powder, chiefly employed as a dusting-powder in place of iodoform, but also given internally in 3 to 10 grain doses for gastric ulcer and in enteric fever. Also in gonorrhœa as an injection (1 per cent. with tragacanth to suspend).

Bromalin is the short name for hexamethylene-tetraminebromethylate, a white powder used in epilepsy as a substitute for bromides, in 30 to 60 grain doses. Soluble in water. Sometimes called *Bromethylformine*.

Bromamide.—A colourless crystalline powder (C<sub>6</sub>H<sub>4</sub>NBr<sub>4</sub>) containing 75 per cent. of bromine, given in 10 to 20 grain doses in neuralgia.

Bromipin.—The fancy name for a preparation made by reacting on sesame oil with 10 per cent. of bromine. Dose: 1 to 4 drachms in emulsion as a nervine sedative.

Bromoform (Tribromomethane).—A heavy, colour-less liquid, analogous in composition to chloroform and iodoform, but more closely resembling the former than the latter in properties. Used for whooping-cough, but not extensively. Dose: I to 2 minims (for children) in flavoured mixture.

Cacodylates. — See Acid, Cacodylic.

Cannabine Tannate.—A preparation of Cannabis indica, occurring in brownish powder, and given in 5 to 15 grain doses as a calmative. Minimum 2 grains, maximum 25 grains.

Captol is a condensation-product of chloral and tannin which is used as a hair-stimulant.

Chinosol is potassium oxychinoline-sulphonate, a yellow powder soluble in water, much used as an antiseptic and disinfectant, and also internally in 5-grain doses for enteric fever. Should be given in cachets or tablets.

Chloralamide.—A hypnotic for nervous affections unaccompanied by pain. Occurs in white micaceous crystals, dissolving slowly in water (1 in 10), but more readily in spirit. Dose: 15 to 40 grains; should be dispensed in draughts, e.g.—

Chloralamide .					gr. xxx.
Rectified spirit					3j·
Dissolve by shaking, an	d add	d-			
· Syrup of orange					зij.
Distilled water				to	ziss.

Mix.

This for a draught. The solution should not be heated, as the compound may decompose. Should not be dispensed as powders.

Chloralimide is the trade name for trichlor-ethylenimide, a crystalline substance, insoluble in water but soluble in alcohol, ether, and oils. Dose: 30 to 45 grains as a hypnotic.

Chloralose.—Obtained by the interaction of anhydrous chloral and glucose. White crystalline powder, almost insoluble in water, and given in doses of 3 to 12 grains (in cachet) as a hypnotic.

Chloretone.—The commercial name of acetone-chloroform (CH<sub>3</sub>)<sub>2</sub>C(OH).CCl<sub>3</sub> (not to be confounded with chloroform, CHCl<sub>3</sub>, made from acetone). It is a white crystalline solid, resembling camphor in appearance, and like it rotates in water. Soluble in alcohol, chloroform, and glacial acetic acid, almost insoluble in water. Recommended as a hypnotic in 5 to 20 grain doses, also as an anæsthetic.

Cinnamyl Eugenol.—A crystalline body, resembling benzeugenol in properties and used similarly.

Citrophen.—A combination of one molecule of citric acid and two molecules of phenetidine, occurring as a white powder, and used in 8-grain doses (as powders) for neuralgia and as an antipyretic.

Cosaprin.—A sulpho-derivative of acetanilide, which is milder in action than that medicine, and is given in similar doses—preferably in mixture with a little sweetening.

Cotarnine Hydrochloride.—A derivative of narcotine, occurring in yellowish crystals, and called *Stypticin*, owing to its powerful styptic properties. Is given in ½ to 1 grain doses for uterine hæmorrhage and as a uterine sedative, also subcutaneously (1 to 3 grains) in urgent cases.

Creolin.—A proprietary antiseptic, extensively used in surgery, and administered internally in doses of 2 to 5 minims

in capsules. Used externally as an ointment (5 to 10 minims to 1 ounce), and as an injection in gonorrhœa (5 to 25 minims to 1 ounce).

Creosoform.—A solid condensation-product of creosote and formic aldehyde, used as a disinfectant.

Creosotal (Carbonate of Creosote) is an amber-coloured viscid fluid containing 90 per cent. of creosote, and used in the treatment of tuberculosis. Insoluble in water, glycerin, and alcohol, but soluble in oils, and is best given along with cod-liver oil, or in capsules. Dose: 15 grains, gradually increased to five times as much, three times a day.

**Crurin** is the name given to quinoline bismuth sulphocyanide, a yellowish-red powder introduced as a substitute for iodoform, especially for scabbing wounds.

Cryophin is a condensation-product of phenetidine and methyl-glycolic acid, which occurs as a crystalline powder, and is said to be superior in action to phenacetin in the same doses—4 to 8 grains—and for the same purposes.

Dermatol (Subgallate of Bismuth).—A heavy, pale yellow, and odourless powder, used as a substitute for iodoform. May be used alone as a dusting-powder, but preferably diluted (e.g., dermatol 3j., starch 3j., talc 3vij.). The ointment may be made with lanoline or vaseline (3j. or 3ij. to 3j.).

**Diabetin** is levulose, and is used by diabetics in place of sugar.

Di-iodoform (Ethylene Periodide), C<sub>2</sub>I<sub>4</sub>, is a substitute for iodoform which is used in gynecological and venereal practice in France. A 5-per-cent. ointment with vaseline (and 1 per cent. cocaine hydrochloride) is preferred.

Dionine (Ethylmorphine Hydrochloride).—Codeine is methylmorphine. Recommended in the treatment of bronchial affections, especially bronchitis, in doses of  $\frac{1}{4}$  to  $\frac{1}{2}$ 

grain, either in mixture or pill. It is a white crystalline powder, and is best given in any pectoral mixture.

Diuretin (Sodio-theobromine Salicylate).—A white and odourless powder, with an alkaline, bitter taste. Deliquescent. A powerful diuretic, less hurtful to the heart than alkaline salicylates. Dose: 15 grains dissolved in a tablespoonful of chloroform-water.

Dormiol.—A combination of amylene hydrate and chloral hydrate, which is an oily liquid insoluble in cold water, is decomposed by hot water, and is soluble in alcohol. As a hypnotic is given in 10-grain doses to begin with (may be increased to 30). Emulsified with an equal volume of acacia mucilage and water and syrup q.s.

Duotal.—The fancy name for guaiacol carbonate, a white powder, insoluble in water, and used in doses beginning with 5 grains for pulmonary tuberculosis.

Eosote.—A liquid and inodorous valerianate of creosote, given in doses of 10 to 30 grains (in capsules) for tuberculous affections.

Erythrol Tetranitrate.—A crystalline substance of the nitroglycerin class used in angina pectoris in  $\frac{1}{2}$  to  $\tau$  grain doses made into tablets with cocoa-butter and chocolate. Must be handled with caution (see page 371). Under the name of Erythrol a double iodide of bismuth and cinchonidine is in use in France for treatment of dyspepsia. It is given in doses of  $\frac{1}{8}$  to  $\frac{1}{2}$  grain with  $\tau$  to 2 grains of magnesia. Dispensers should be careful in regard to these two totally distinct compounds.

Ethyl Bromide (Hydrobromic Ether).—A colourless, volatile fluid possessing an odour like chloroform. Its specific gravity should be 1.420 if pure. It is used as an anæsthetic, like chloroform. Dose: 15 minims. A distinct compound, Ethylene Bromide (C<sub>2</sub>H<sub>4</sub>Br<sub>2</sub>), which is a heavy, colourless liquid (s.g. 2.189), becoming crystalline at 9° C., has been recommended for the cure of epilepsy in doses of 1 to 2 minims.

Ethyl Chloride (Hydrochloric Ether) is a gas at the ordinary temperature, but is supplied liquefied in tubes for producing local anæsthesia.

Ethyl Iodide (Hydriodic Ether).—An almost colourless ethereal liquid (s.g. 1.915), used by inhalation, in 5 to 10 minim doses, for the relief of asthma, chronic bronchitis, and dyspnœa. Dispensed in glass capsules.

Eucaine Hydrochloride.—There are alpha and beta varieties of this. It is a local anæsthetic of the same power as, but of only one-fifth the toxicity of, cocaine. The alpha variety is for general use, is soluble 1 in 10 of water, 15 to 60 minims of a 6-per-cent. solution being employed. The beta variety is for ophthalmic purposes, is soluble 1 in 28 of water, and is used in 2-per-cent solution. Both are white powders.

Eudermol.—A crystalline, colourless, water-soluble salicylate of nicotine, recommended as a 1-in-1,000 ointment for parasitic affections of the skin, and as a nursery parasiticide.

**Eudoxine.**—The bismuth salt of nosophen (q.v.). Brown powder, containing 53 per cent. of iodine, used as an intestinal antiseptic in doses of 4 to 10 grains.

Eugallol is pyrogallol monacetate, a syrupy substance, soluble in water. Used like pyrogallic acid for chronic psoriasis.

Eugenol is the active principle of oil of cloves, and has come into extensive use per se and as compounds for tubercular affections. It is an oily liquid, with the characters of oil of cloves, and is given internally in 5 to 30 minim doses; also used externally for eczema and other skin-diseases in combination with wool-fat.

Euphorine (Phenyl Urethane).—A white crystalline powder, insoluble in water. Used chiefly for rheumatic affections in doses of 5 to 10 grains. Should not be confounded with *Europhen* (isobutyl-orthocresol iodide), which is an iodoform substitute for external use.

Euquinine.—The ethyl carbonate of quinine, a white powder which is almost tasteless yet exerts all the physiological action of quinine. The dose is the same as quinine sulphate, and the salt is specially useful for children. Must be given in powders. It is tasteless because it is so feebly soluble.

Euresol is monacetate of resorcin, a substance which can be reduced to powder, and is used as 1-in-20 or 1-in-10 ointment in place of resorcin.

Eurobin is chrysarobin triacetate, resembling chrysarobin in appearance and properties, and like it used in skin-diseases—preferably as acetone solution (1 to 20 per cent.).

Exalgin (Methylacetanilide).—In white crystals, not unlike strychnine. Sparingly soluble in water. A powerful analgesic, specially serviceable in certain forms of headache and neuralgia. Dose: ½ to 4 grains (not more). Dissolve the dose in 10 minims of rectified spirit, add 20 minims of syrup, and make up to 1 drachm with chloroform-water.

Ferropyrin.—An orange-red powder representing in combination about 2 parts of antipyrin and 1 part of ferric chloride. Readily soluble in water (1 in 5). Used in doses of 5 to 15 grains for anæmia, especially when accompanied by neuralgia, and externally in 1-per-cent. solution as a gonorrhœa injection and in saturated solution or powder as a styptic.

Fluorescein, a well-known yellow dye, is, in weak solution, used in ophthalmic work for diagnosing ulcers, denudations, and the like which are dyed green, while healthy surfaces are stained yellow only. The solution is made by 10 grains of the dye and 13 grains of sodium bicarbonate in 1 ounce of water.

Formaldehyde.—In 40-per-cent. solution was introduced under the name of 'Formalin' as an antiseptic, and is much used in solution for general antisepsis. A 1-in-1,000 solution is used as an eye-lotion, and for surgical purposes generally 1-in-400 to 1-in-200 solutions are employed. The vapour is also much used.

Formin is hexamythene-tetramine, a crystalline powder (obtained by acting upon formaldehyde with ammonia) employed in doses of 5 to 10 grains as a remedy for cystitis, gout, and other diseases in which uric-acid deposits are formed. Soluble in water and best given in aërated water. The salicylate of the substance is known as *Saliformin*, and the iodised body  $(C_3H_6N_2I_2)$  is a red crystalline powder called *Iodoformin* which contains 80 per cent. of iodine.

Fortoine.—The trade name of a compound of cotoine and formaldehyde. Occurs as a yellow powder, insoluble in water, soluble in alcohol and alkalies, and given in various forms of diarrhea. Dose: 3 grains or more every four hours.

Gallacetophenone.—Under this name the methyl-ketone derivative of pyrogallol has been introduced for the treatment of psoriasis. It is a yellowish powder, and is used as an ointment (10-per-cent.) or aqueous solution (1 part of the powder and 8 parts of sodium acetate in 25 parts of water).

Gallanol.—A compound of aniline and gallic acid, occurring as a grey powder, and used in skin-diseases in place of chrysarobin and pyrogallol. It is a powerful antiseptic, and is used as a dusting-powder (pure or 1 to 3 of salt), as an ointment with vaseline (9j.-3j. to 3j.), or in alcoholic solution (20 per cent. with 1 per cent. of liquor ammoniæ).

Gallicin.—Methyl ether of gallic acid, in prismatic white crystals. Resembles pyrogallol in properties, and used in the treatment of conjunctivitis by applying to the eye as a powder, preceded by cocaine to produce anæsthesia of the part.

Gallobromol is dibromogallic acid, a greyish crystalline powder, soluble 1 in 10 of water. Introduced for the treatment of epilepsy (dose 10 to 30 grains), but is also used as an antiseptic in gonorrhœa, gleet, cystitis, and eczema.

Gelanthum.—A basis for the application of dermatological remedies introduced by Unna. Is a tragacanth preparation (see 'Pharmaceutical Formulas,' fourth edition, page 494).

Glutol.—Gelatin saturated with formaldehyde and reduced to powder. An antiseptic application for indolent ulcers.

Glycerophosphates.—By the action of anhydrous phosphoric acid upon glycerin, the three hydroxyl groups in the glycerin are replaced by phosphoric anhydride, a compound resulting which combines as an acid with various bases. A few years ago Dr. A. Robin, of Paris, found that the glycerophosphates have tonic properties in the treatment of neurasthenia and other nervous diseases, as well as in chlorosis, sciatica, tic doloreux, phosphaturia, and locomotor ataxia. At first hypodermic injections of the calcium or sodium glycerophosphate were used, but various preparations are now given per os. The calcium, lithium, potassium, and sodium salts are given in doses of 5 to 15 grains, the iron salt 3 to 5 grains, and quinine glycerophosphate in the usual doses of quinine salts: there are a basic and a neutral glycerophosphate, and either may be given in pill. The other glycerophosphates are usually given in cachet, elixir, or wine. The salts of the inorganic bases named are soluble in water.

Guaiacol.—The principal constituent of creosote; is a colourless liquid, soluble in ether, alcohol, and fixed oils, but only sparingly soluble in water. It is used as a remedy in phthisis, in doses of a minim three times a day, gradually increased to 4 minims four times a day, given in mixture or along with cod-liver oil. Thus:—

Guaiacol					m xvj.
Spirit. rectificat.					
Tr. gentianæ co.					3j.
Aquæ destillatæ			100	ad	Zviij.

M.

Dose: A tablespoonful in a glassful of water thrice a day.

## Guaiacol Benzoate.—See Benzosol.

Guaiacol Cacodylate, or Cacodyliacol, forms a white crystalline powder, is very hygroscopic, soluble in water, alcohol, or glycerin, with a slight caustic taste and alliaceous

odour. It has the formula As(CH<sub>3</sub>)<sub>2</sub>O<sub>2</sub>.C<sub>6</sub>H<sub>4</sub>OCH<sub>3</sub>, and is 'the remedy par excellence for tuberculosis.'

Guaiacol Camphorate.—A white crystalline compound of guaiacol and camphoric acid, and possessing the therapeutic properties of both. Dose: 5 grains, gradually increased to 30 grains, thrice daily.

Guaiacol Carbonate (Carboxylate).—See Duotal.

Guaiacol Ethylenate.—The ethylenic ester of guaiacol, which is crystalline at ordinary temperatures, inodorous, tasteless, and is said to be tolerated better by the stomach than other guaiacol compounds or guaiacol itself. Dose:  $7\frac{1}{2}$  grains in cachet thrice daily, gradually increased.

Guaiacol Salicylate.—White crystalline powder, combining the properties of its constituents, and given in doses of 15 grains for diarrhœa of phthisis, dysentery, rheumatism, and as an intestinal antiseptic.

Guaiaquin is quinine guaiacol bisulphonate, a yellowish powder, which dissolves in water, and is employed in 5 to 10 grain doses as an antiperiodic and intestinal antiseptic. Best given in cachets.

Guethol.—An oily liquid prepared from guaiacol by putting C<sub>2</sub>H<sub>5</sub> into the molecule in place of CH<sub>3</sub>. Used internally like guaiacol, and externally as a pain-killer in combination with chloroform.

Hemogallol.—A reddish-brown powder obtained by acting upon hæmoglobin with pyrogallol. A hæmatinic in anæmia in doses of 4 to 8 grains (in cachets).

Hemol is hæmoglobin reduced by the action of zinc dust. It is a brown powder; dose 2 to 8 grains (with as much sugar) in chlorosis. Various metallic compounds of it are also offered.

Heroine.—A diacetic derivative of morphine, which is recommended in place of codeine and morphine as a con-

stituent of bronchitis-mixtures. Dose and methods of dispensing similar to morphine.

**Hetol** is a fancy name for sodium cinnamate, which is used in tuberculosis.

Holocaine Hydrochloride.—The white crystalline salt of a synthetic body, which is used solely as a substitute for cocaine in ophthalmic practice as a 1-per-cent. solution in water. Its solubility is 1 in 40 of water.

Hydrargyrol.—Reddish-brown scales of mercury paraphenol-sulphonate, containing 53 per cent. of the metal, and soluble in water and glycerin. An antiseptic of similar power to mercuric chloride, but non-caustic and does not coagulate albumen.

Hydronaphthol.—Betanaphthol having a molecule of hydroxyl in place of a hydrogen atom. Occurs in greyish laminæ, sparingly soluble in water (1 in 1,150), but dissolves freely in alcohol, glycerin, and fixed oils. It is an antiseptic.

Hypnal (Monochloral Antipyrin).—Colourless, odourless, and tasteless crystals. Used as a hypnotic in doses of 15 to 30 grains in an ounce of aromatic water.

Hypnone (Acetophenone) is a colourless fluid, sparingly soluble in water, and more soluble in alcohol. Dose: 3 to 10 minims as a hypnotic. Being caustic, should be dispensed in gelatin capsules, each containing 1 minim of hypnone dissolved in 9 minims of almond oil.

Ichthyol (Ammonium Ichthyolate).—A dark-brown and thickish fluid, insoluble in water, but soluble in alcohol and ether. Internally ichthyol is given in doses of 4 to 20 minims, but it is much more used externally as an ointment with lanoline, and in other forms. For this purpose the ammonium ichthyolate is generally used, but it is preferable to use the sodium ichthyolate for pills, as that salt is much thicker than the ammonium one. The best pill of all is made with magnesium ichthyolate. This salt can be made by heating

together 120 grains of ammonium ichthyolate and 15 grains of freshly-burnt magnesia (made into a paste with 2 drachms of water). Use the heat of a water-bath. A light chocolate, powdery mass is obtained, which only requires a little water to make into a suitable pill-mass. Two grains of the magnesium salt equals 3 grains of ammonium ichthyolate (see The Chemist and Druggist, April 11, 1891, page 498, for further particulars). Zinc ichthyolate is preferred for injections and the like. Ichthalbin is albuminate of ichthyol, an excellent form for internal use. Dose: 15 to 30 grains.

Iodine Terchloride.—Is supplied in 15-grain tubes, sufficient to make 40 ounces of lotion (about 1 in 1,000). The solution in water on coming in contact with organic matter liberates chlorine and iodine in a nascent state. Hence its action as an antiseptic. It is also useful as an anti-fermentative in dyspepsia, and as an injection in gonorrhœa.

Iodipin.—A yellow fluid consisting of sesame oil combined with 10 per cent. of iodine. Is used in syphilis, scrofula, and other disorders in which iodine is an alterative tonic. Dose: 3j. to 3iv., emulsified like an oil, and flavoured with peppermint or other aromatic.

Iodocasein.—A brown powder containing 17.8 per cent. of iodine in combination. Is supposed to resemble the thyroid in action.

Iodoformin is an iodoform substitute (see Formin).

**Iodoformogen.**—An albuminate of iodoform, a brownish-yellow powder, much lighter in bulk than iodoform and utilised on that account for precisely the same purposes as iodoform.

Iodogallicin.—A compound (C<sub>8</sub>H<sub>8</sub>BiIO<sub>6</sub>) of gallicin and bismuth oxyiodide, occurring as a light, amorphous, dark-grey powder, which is decomposed by acids, and is an antiseptic.

Iodol.—A tetraiodopyrrol (C<sub>4</sub>HI<sub>4</sub>N) which occurs as a palebrown powder and is used as a substitute for iodoform. It is insoluble in water, but soluble in alcohol and fixed oils, For the same purposes as iodide of potassium it is given internally in doses of 10 grains. Externally it is used, like iodoform, chiefly as a dusting-powder, but also in the form of ointment (1 in 4 of basis). The solution for gynecological purposes is made by dissolving 1 drachm of iodol in 2 ounces of rectified spirit and adding 3 ounces of glycerin; with this tampons are saturated.

Iodophenin.—An iodo derivative of phenacetin. It is a brown powder, containing 50 per cent. of iodine, and is a bactericide.

Iodothyrin, or thyroiodin, is a preparation of the thyroid gland which is given in myxœdema and similar affections in doses of 15 grains or more daily.

Iso-butyl Nitrite is the chemically-pure form of amyl nitrite, and is used for the same purposes and in the same doses.

Itrol.—The fancy name for silver citrate. A white powder, almost insoluble in water (1 in 3,800). Is used in the treatment of gonorrhœa and, externally, as an iodoform substitute. The injection is made 1 grain to 10 ounces of water, the gargle 1 grain to 24 ounces, and the ointment 8 grains to 1 ounce of benzoated lard.

Kryofin, an analgesic and antipyretic powder (methoxy-acet-phenetidin), of which the dose is 8 to 16 grains.

Lactol is naphthol lactate, and is a French intestinal antiseptic for the treatment of diarrhœa. Dose: 4 to 8 grains, in cachets.

Lactophenin.—A homologue of phenacetin, the acetic radicle being replaced by the lactic. Resembles phenacetin in physical and therapeutical properties, but is not so depressing. Dose: 5 to 15 grains.

Largin, or silver albuminate, is a greyish powder containing 11 per cent. of silver, and soluble 1 in 9 of water, from which solution it is not precipitated either by albumen or by

sodium chloride. Used as an injection (1 to 5 grains per ounce) in gonorrhœa.

Lenigallol.—Triacetate of pyrogallol. Is a white powder, insoluble in water, milder in action than pyrogallol, and does not stain. The ointment is made with vaseline, 2 to 20 grains per ounce.

Lenirobin.—Tetracetate of chrysarobin, and milder in action than chrysarobin.

Loretin is an iodo-oxy-quinoline-sulphonic acid (C<sub>9</sub>H<sub>4</sub>N.I.OH.HSO<sub>3</sub>). It occurs in yellow crystalline powder, soluble in water and alcohol. Is used as an antiseptic like iodoform.

Losophane (tri-iodo-metacresol, C<sub>6</sub>HI<sub>3</sub>OHCH<sub>3</sub>) is a crystalline, colourless solid, insoluble in water, soluble in ether, chloroform, and fixed oils, and containing 80 per cent. of iodine. Substitute for iodoform.

Lycetol (dimethyl-piperazine tartrate).—A white powder, soluble in water. Is a good solvent for uric acid, and relieves gouty symptoms. Dose: 4 to 8 grains.

Lysidine is the name given to a 50-per-cent. solution of methyl-glyoxalidine, which is used in 15-grain doses, or more, in aërated water, for uric-acid disorders.

Malakine, or salicylidene-paraphenetidin, occurs in yellow crystals, insoluble in water, and combining the properties of phenacetin and salicylic acid. Dose: 15 grains, in cachets or powders.

Meconarceine, or narceine meconate, has been recommended in doses of  $\frac{1}{10}$  grain to  $\frac{1}{2}$  grain (in pill) as a hypnotic.

Mercury Carbolate.—Introduced as the safest mercuric salt for administration in syphilis. In colourless crystalline needles, nearly insoluble in water, and difficultly soluble in alcohol. Dose:  $\frac{1}{4}$  grain, made into pill with its own weight of liquorice and glycerin of tragacanth.

Mercury Salicylate.—An amorphous white powder, difficultly soluble in water and alcohol, easily soluble in an aqueous solution of sodium chloride or sodium bicarbonate. Used in the treatment of syphilis, gonorrhæa, and similar diseases. Internally given in doses of  $\frac{1}{60}$  to  $\frac{1}{8}$  grain, made into pill with a little liquorice powder and glycerin of tragacanth. One grain of the salicylate, 15 grains of sodium bicarbonate, and 5 ounces of distilled water make the injection.

Other unofficial and comparatively new mercury compounds which figure in medical literature are :—

Mercuro-iodo-hemol.—Brown powder; antisyphilitic. Dose: 2 to 5 grains.

Mercurol.—A nuclein compound of mercury, used in ½ to 3 per cent. solutions as an injection in gonorrhœa and cystitis.

Mercury asparaginate. —Used hypodermically in syphilis. Dose:  $\frac{1}{6}$  grain.

Mercury benzoate.—White crystals. Dose:  $\frac{1}{30}$  to  $\frac{1}{8}$  grain in pill, for syphilis.

Mercury oxycyanide.—White crystals, soluble in water; antiseptic 3 grains to the ounce.

Mercury succinimide.—White powder, soluble I in 25 water; anti-syphilitic in  $\frac{1}{5}$ -grain hypodermic doses.

Mercury tannate.—Green powder; antisyphilitic in 1 to 2 grain doses in pill.

Methacetin (paraoxymethylacetanilide).—A colourless crystalline powder, odourless, but having a saline, bitter taste. Therapeutically like acetanilide. Dose: 5 grains carefully increased to 10; given in powder form.

Methylal.—A colourless and highly volatile ethereal fluid, soluble in water, alcohol, and fixed oils. Dose as a hypnotic: 15 to 60 minims. Is also used externally as a local anæsthetic in the form of ointment or oleaceous liniment (1 in 8).

Methylene Blue is a crystalline solid, soluble 1 in 50 water, and has been recommended as an antirheumatic in doses of 2 to 4 grains in capsules.

Microcidine is a whitish powder, consisting chiefly of naphthalate of soda, and, in 3-per-cent. aqueous solution, is recommended as an antiseptic.

Migrainin contains antipyrin 90, caffeine 9, and citric acid 1 part. Dose for migraine and the periodic headache of women: 15 grains.

**Naftalan** is a greenish - black, oily distillate from Armenian petroleum, which is used like *huile de cade* and other tarry compounds for skin-diseases.

Naphthalin.—Colourless crystals, insoluble in water and sparingly soluble in cold alcohol and fixed oils, but readily soluble if heated. Is used internally for gastric disorders (2 grains cautiously increased), for tapeworm (15 grains followed by castor oil), and externally in skin-diseases.

Naphthol (Alpha).—Slightly pink crystals. Prescribed as an intestinal antiseptic in diarrhœa and dysentery. Dose: 2 to 5 grains.

Naphthol (Beta).—Resplendent crystalline scales, nearly insoluble in cold water, but very soluble in alcohol and fixed oils. It is used externally as ointment or in alcoholic solution in the treatment of skin-diseases, scabies, &c. The ointment is made by dissolving the naphthol in the melted fatty basis, the strength varying from 1 in 20 to 1 in 10. For itch the stronger preparation is most beneficial.

Neurodine is a derivative of urethane, being acetyl-paraoxyphenylurethane. In colourless crystals, slightly soluble in water. Dose as an antipyretic and antineuralgic: 5 to 15 grains.

Nirvanine is the name applied to a variety of orthoform occurring in white prisms and soluble in water. Recommended as a substitute for cocaine to produce local anæsthesia. Dose: 1 to 2 grains hypodermically.

Nosophen is tetraiodophenolphthalein. It is a yellow powder, and is used in place of iodoform.

Nuclein.—This term is applied to nitrogenous and phosphorus compounds occurring in the organism. They consist of nucleinic acid and a basic substance of a complex nature (albumen). They are insoluble in alcohol, but soluble in caustic alkalies, and resist peptic digestive agents. Experiments show that these nucleins are found in the white blood-corpuscles, which, on the phagocyte theory, are the natural defenders against bacteria. The nucleins possess the same properties as these corpuscles, and are regarded as the 'defensive proteids' with which the organism combats the bacteria. Nuclein derived from yeast is principally used.

Orexin Hydrochloride.—A synthetic appetiser, occurring as a colourless and odourless crystalline powder, with a biting and bitter taste. Dose: 3 to 5 grains. Warm fluids. such as beef tea, should be taken immediately after. The tannate is used similarly.

Orthoform is the methyl ester of para-amidometoxybenzoic acid. Is a white powder, slightly soluble in water. Used externally as an anodyne for painful wounds and burns, and internally (the hydrochloride), in doses of 8 to 15 grains, as an anodyne.

Oxycamphor, or camphoroxime. A white, crystalline substance obtained by replacing a hydrogen atom in camphor by hydroxyl, and used in 5-grain doses to relieve difficulty of breathing in bronchitis. Soluble 1 in 50 of water. Commercially is supplied in 50-per-cent. alcoholic solution as oxaphor. Dose: 10 to 20 minims.

Paraform, sometimes called triformol, bears the same relation to formaldehyde that paraldehyde does to aldehyde. By heating it gives off formaldehyde. It is a white, crystalline powder, with antiseptic and astringent properties, and is given in doses of 8 grains or more in choleraic diarrhœa. It is also used as a surgical antiseptic.

**Peronine.**—The trade name for hydrochloride of benzyl morphine, a codeine-like derivative of morphine which is used as a sedative in bronchial affections. Dose: ½ to 1 grain.

Phenocoll Hydrochloride.—An antipyretic (the hydrochloride of the amido-acetic derivative of paraphenetidin—i.e., phenacetin plus an amido group) occurring as a colour-less, crystalline powder, soluble 1 in 16 of water. Dose: 5 to 15 grains in acute rheumatism.

Piperazine is a synthetic product (diethylene diamine) in colourless needle-shaped crystals, freely soluble in water. It is stated to have a marvellous action in freeing the system from deposits of insoluble urates, and consequently rivals lithium salts in the treatment of gout. Dose: 5 to 10 grains.

**Protargol.**—A proteid compound of silver. It is a fine yellow powder, containing 8.3 per cent. of silver, is soluble in water, and the silver is not precipitated from the solution by albumen, sodium chloride, or other silver-precipitants. A  $\frac{1}{4}$  to 2 per cent. solution is used as an antiseptic injection in gonorrhæa, and a 10 to 20 per cent. solution by oculists in place of silver nitrate.

Pyoktanin.—A fanciful name for two aniline dyes related to methyl violet, and used in surgery, on the supposition that microbes are stained and killed by them. Yellow pyoktanin is used for eye-diseases (o·5-per-cent. solution), the blue for surgical cases (1 to 2 per cent. solution, ointment, and dusting-powder).

Pyramidon.—The dimethyl-amido derivative of antipyrin, and used like it as an antipyretic, with the advantage that its action is more prolonged. Dose: 5 grains or more, as a powder or in mixture.

Pyrantin is a succinic derivative of phenetidin possessing antipyretic properties. The sodium salt is recommended because it is soluble.

Pyridine.—Used for inhalation in asthma. It is a colourless fluid, soluble in water and alcohol. A fluid drachm of it is poured upon a plate and inhaled.

Resorcin occurs in colourless crystals, readily soluble in water and alcohol. It is used internally in doses of 10 to 20 grains for asthma and nausea and vomiting, and externally, in the form of ointment or solution, in the treatment of skindiseases and in urethral affections. The injection is made by dissolving 30 grains in 4 ounces of water.

Retinol, or resin oil, is obtained by the distillation of Burgundy pitch or resin. It is a solvent for many synthetic preparations, such as salol, aristol, and iodol. Resinol is a proprietary article.

Salacetol, or salicylacetol.—A substitute for salol prepared by the interaction of monochloracetone and sodium salicylate. It is a crystalline powder, insoluble in water, but soluble in alcohol and ether. Dose: Эij. to 3j. per diem.

Salicylamide (C<sub>6</sub>H<sub>4</sub>.OH.CONH<sub>2</sub>) has the advantage over salicylic acid of being tasteless and more soluble, and acting more readily in smaller doses.

Saliformin.—See Formin.

Saligallol is a compound of pyrogallol (1 molecule) with salicylic acid (2 molecules). A 2 to 15 per cent. solution in acetone forms a varnish which is useful in certain skindiseases.

Salipyrin.—A colourless and odourless powder, of a sweetish taste, formed by the interaction of antipyrin and salicylic acid. Possesses the medicinal properties of its constituents. Dose: 15 to 30 grains as a powder, being insoluble in water.

Salitannol.—A compound of equal molecular proportions of salicylic and tannic acids. Is a white, amorphous powder, used as a substitute for iodoform.

Salocoll (salicylate of phenocoll).—A white, crystalline powder, soluble in water. It is an antirheumatic and antipyretic, and is administered in doses of 5 to 10 grains.

Salophen.—The salicylate of acetyl para-amidophenol. Occurs in white scales, insoluble in water, and given as a powder in 15 to 30 grain doses for rheumatism.

Sanoform.—A white inodorous powder obtained by acting upon methyl salicylate (oil of wintergreen) with iodine, of which it contains 62.7 per cent. Used in place of iodoform, it appears to slowly resolve itself into its constituents; hence its antiseptic action.

Scopolamine is substantially hyoscine prepared from scopola-root.

Sodium Paracreosotate.—Similar in physical appearance, therapeutical action, and dose to sodium salicylate. Is preferred to salicylate in infantile diarrhœa.

Solveol.—A name given to a surgical antiseptic which consists of cresol in the form of cresotinate of soda.

Somnal is an ethylated chloral urethane. It is a crystalline solid, soluble in water and alcohol. Dose as a hypnotic: 30 grains in sweetened water.

Sozal, the aluminium salt of paraphenol-sulphonic acid, obtained by dissolving aluminium hydrate in the acid. It is a crystalline powder, soluble in water, glycerin, and alcohol, and is an antiseptic.

Sozoiodol.—The substance found in commerce under this name is a sodium salt of iodoparaphenolsulphonic acid. Mercury, potassium, and zinc salts are also to be had, and they are more or less soluble in water. All are crystalline solids. Sozoiodol is an iodoform substitute, used externally as an ointment, 20 to 40 grains to the ounce.

Symphorol, also known as 'nasrol,' is a name given to the caffeine sulphonates of the alkali and alkaline earth-metals, in particular the sodium, lithium, and strontium salts. Diuretics in kidney and heart complaints. Dose: 10 to 15 grains.

Taka-diastase.—A form of diastase prepared by a symbiotic process from rice, and presented in the form of a brown powder. Dose: 1 to 5 grains.

Tannalbin, or tannin albuminate, is a light-brown powder containing 50 per cent. of tannin, which is liberated in the intestines; hence the substance is recommended as an astringent in diarrhœa, especially of children, in doses of 5 grains upwards.

Tannigene (acetyl tannin).—A yellowish-grey, odourless, and tasteless powder, recommended as a remedy in diarrhœa. Dose: 2 to 8 grains.

Tannocol.—Similar to tannalbin, but is a combination of tannin and gelatin. Dose: 15 grains or more; for infants, 5 grains or more.

Tannoform.—A red powder, which is a condensation-product of gallo-tannic acid and formaldehyde, and is used per se or diluted with starch as a dusting-powder in hyperhydrosis, bromhydrosis, and similar troubles, to dry the secretion and reduce the foul odour.

Tannone, or Tannopine, is the tannate of urotropin (q.v.), a brown hygroscopic powder, given as an intestinal astringent—antiseptic in doses of 15 grains.

Tenaline is a proprietary mixture of the alkaloids of arecanut, and is a powerful vermifuge.

Terpin Hydrate.—A colourless crystalline solid, difficultly soluble in cold, but more soluble in hot, water, and soluble in alcohol. Used in bronchitis and other chest affections. Dose: 3 to 10 grains. Suitable forms:—

Terpin. hydrat					3j.
Glycerin. tragacanth.					q.s.
t massa. Divide in pilu	las :	xxx.			
Terpin hydrat		112	200		zi

Fiat

Terpin. hydrat.				3j.
Glycerini .				ξij.
Spirit. rectificat.				Зij.
Syrupi				ξij.

Mix the terpine hydrate with the glycerin, heat on a water-bath until dissolved, and add the spirit and syrup, previously mixed.

**Terpinol** is a colourless, oily liquid, obtained by boiling terpin hydrate with dilute mineral acid. It is insoluble in water, but soluble in alcohol and ether. Its uses are the same as terpin hydrate. Dose: 8 to 15 minims in gelatin capsules.

Tetronal.—An analogue of sulphonal (it is diethylsulphon-diethylmethane), occurring in white crystals, scarcely soluble in water, fairly so in alcohol. Dose as a hypnotic: 15 grains.

Thallin.—The sulphate is generally used. It is a crystalline solid, soluble in water and less soluble in alcohol. Dose: 3 to 8 grains in pill. For gonorrhœa as an injection, 4 to 8 grains in 1 ounce of water, or as bougies with cocoa-butter.

Thermodine is acetyl-para-ethoxy-phenylurethane, a crystalline substance possessing analgesic and antipyretic properties, which has been recommended in typhoid, pneumonia, influenza, and the like. Dose: as an antipyretic, 5 grains; as an analgesic, 15 grains—in each case gradually increased. To be given as powders.

Thiocol is potassium-guaiacol sulphonate, one of the best forms for administering guaiacol, as it is a white powder freely soluble in water. Dose: 6 grains, gradually increased.

Thioform, a bismuth salt of dithiosalicylic acid, introduced as a substitute for iodoform. Is a brownish-yellow

powder, odourless, and insoluble in water and alcohol. May be administered internally in doses of 4 to 5 grains.

Thiol, a synthetic product of hydrocarbons, introduced as a substitute for ichthyol. It is a dark-brown syrupy liquid, soluble in water. By evaporation a powder is obtained about two and a half times the strength of the liquid, which is used as a dusting-powder mixed with starch, and also internally in doses of from 2 to 10 grains.

Thiosinamine, or allyl-sulpho-urea, occurs in colourless prisms, soluble in water and alcohol, and has a faint garlic odour and bitter taste. Introduced by Hebra as a subcutaneous injection in lupus and tuberculosis in doses of from 4 to 8 grains in dilute alcohol.

Thyroglandin.—A preparation representing all the active principles of the thyroid. A greyish powder, of which  $8\frac{1}{2}$  grains represents one gland. Dose: 4 grains.

Toluene, or toluol, one of the constituents of commercial benzene, is used in the pure state as Loeffler's solution—a topical application for diphtheria.

Tribromophenol (or bromol) is used as an antiseptic. It is a solid, in very soft white crystals, scarcely soluble in water, but soluble in alcohol. The dose is 1 to 2 grains.

Trional is sulphonal in which two methyl groups are replaced by two ethyl groups. It occurs in white scales, soluble 1 in 320 of water, and given in doses of 15 to 30 grains as a hypnotic.

Triphenin, or propionylphenetidin, is a phenacetin substitute in white crystals. Dose: as an antipyretic, 4 to 10 grains; as an analgesic in neuralgia, 15 grains.

Tussol.—The fancy name for antipyrin amygdalate, a combination more suitable for children than antipyrin itself. Dose:  $\frac{1}{2}$  grain upwards.

Urethane (Ethyl Carbamide) is a white crystalline solid, soluble in water and alcohol. Used as a hypnotic in doses of 15 to 40 grains. The following is a nice mixture:—

Urethani				. 3ij.
Syrupi .				· 3j.
Aquæ .				ad 3iv.

M.

Dose: Two tablespoonfuls.

Uropherin.—There are two varieties of this—B uropherin, which is theobromine and lithium benzoate, dose, 5 to 15 grains as a diuretic; S uropherin, which is theobromine and lithium salicylate, dose and use as B uropherin.

Urosin.—The name applied to a compound tablet, containing chinic acid o'5 gramme, lithium citrate o'15 gramme, and sugar o'3 gramme, for uric-acid diathesis.

Urotropin is the proprietary name for hexamethylene tetramine, which is described under Formin.

Validol.—A thick, colourless liquid, formed by the combination of menthol and valerianic acid, and used as an antispasmodic in hysteria, nervous affections, and dyspepsia, in doses of 10 to 20 drops on sugar.

Valorydin, a valerianic compound of para-amidophenetol in white crystals, insoluble in water, and given in 8 to 15 grain doses for neuralgia and sick-headache.

Vasogen, or oxygenated petrolatum, is a vehicle for the application of medicinal agents to the skin. The advantage claimed for it is that the compounds are more quickly absorbed and taken into the circulation than by any other means. Various medicated vasogens, some liquid, some solid, are supplied—e.g., creosote, ichthyol, iodine, menthol, and mercury—each with a suitable percentage of the medicament.

Xeroform, or tribromophenol bismuth, is a yellowishgreen powder, containing 50 per cent. of tribromophenol. It is an antiseptic, and as such is used in place of iodoform.

# HOMŒOPATHIC DISPENSING.

Whatever views may be held as to the value of homoeopathic treatment or the truth of the dictum similia similibus curantur, no one can dispute that homoeopathic pharmacy is elegant. Indeed, the globules and pilules of Hahnemann in their dainty little tubes carefully excluded from the deleterious light-rays by neat outer cartons, were the forerunners of the tabloids and parvules, the granules and pellets, &c., with which we are so familiar to-day. And, if for this reason alone, the memory of the old German physician should be held in respect by modern pharmacists as the founder of elegant pharmacy, even if they deny his claims to be the first exponent of scientific therapeutics.

Until a few years ago homœopathic prescriptions were dispensed almost exclusively by homœopathic chemists, and if a stray one found its way to an ordinary chemist's, it was usually sent on to the nearest homœopathic chemist to be dispensed; the ordinary man either not caring to attempt to decipher the eccentric recipe or regarding it with contempt. Nowadays, doubtless due to increased competition, this procedure is seldom followed, many chemists not only dispensing homœopathic prescriptions—sometimes more and sometimes less correctly—but also advertising a special 'homœopathic department.'

Homoeopathic prescriptions present few difficulties to a trained pharmacist, but they call for scrupulous delicacy and exactitude in dispensing which are absolutely essential, and without which the dispenser is not rendering justice either to the patient or to his physician. The prescriptions may be

for tinctures, powders or triturations, pilules, globules, compressed tablets, and tablet-triturates.

Tinctures.—Prescriptions for tinctures usually consist of a single tincture, thus:—

Sig.: Gtt. ij. n. et m.

or of two tinctures to be taken in alternation, thus :-

Sig. : Gtt. iij. 2dis hor. alt. sumend.

If no quantity of water is specified, the drops should be directed to be taken in half a wineglassful. The bottles used should be of green or amber glass, and provided with a good lip or spout for dropping. Good corks are essential to dispensing of every kind, but for homeeopathic work they are a sine quâ non.

The tinctures may be prescribed with the addition of water as mixtures, thus:—

M. Ft. mistura, cujus capiat cochlearia duo magna tertiis horis.

In this instance twelve drops of the sixth dilution are prescribed and water to 6 ounces.

**Powders** are much in favour with homoeopathic doctors, and generally consist of so many grains of an ordinary sugar-of-milk trituration, thus:—

Trit. mercurii sol. 3x . . . . gr. iij.

Mitte tales chart. xij. Direct a powder to be taken dry on the tongue every four hours.

Or they may consist of a tincture dropped on to sugar of milk, dried, and weighed out, thus:—

Tinct. pulsat. 6 . . . . . . . . m vj. Sacch. lactis . . . . . . . . q.s.

Ft. pulv. Direct this powder to be dissolved in six tablespoonfuls of water, and a tablespoonful to be taken every morning and evening.

In this case the 6 minims of the tincture is to be dropped on 18 grains of sacch. lactis, carefully incorporated by means of a bone spatula, allowed to dry, and then divided into 3-grain powders.

All homoeopathic powders are wrapped in tinfoil in addition

to the ordinary powder-paper.

Sometimes the powders are ordered to be prepared from globules or pilules. In this case the globules or pilules are simply crushed and triturated with the sacch. lactis:—

Glob. ignatiæ 6 . . . . . . . iij. Sacch. lactis . . . . . . . q.s.

Ft. pulv. Mitte tales xij. Direct a powder to be taken every four hours.

Frequently the triturations are ordered in bulk, and if no quantity is specified a 3ij. bottle should be dispensed:—

Hepar sulphuris 3x . . . . . 3ij. Sig. : Gr. v. nocte maneque sumend.

As a rule homœopathic physicians prescribe bulk powders in doses of 3 or 5 grains, and homœopathic chemists keep trituration-scoops of these sizes in stock. In the absence of a scoop, however, it is usual to direct as much as covers a threepenny-piece as the equivalent of 3 grains, and a sixpenny-piece for 5 grains. This method of measuring is signified by a 3 or a 6 enclosed in a triangle, thus:—

Separate mortars should be kept for homœopathic work, and all operations should be conducted remote from strong-smelling substances.

Pilules and Globules present but little difficulty. The method of medication will be found in the Pharmacopæia. Globules are used much less in these days than formerly, although it was with globules that Hahnemann founded the system.

Compressed Tablets are not so popular with homeopaths as the trituration-tablets because of the manipulation required, which is calculated (in homeopathic opinion) to interfere with the purity of the medicine. Any trituration can be made into tablets, and any of the small machines advertised are suitable for the purpose.

Merc. biniodid. 3x . . . . . gr. v. Ft. tab. Mitte tales xxxvj.

The trituration is slightly damped with weak gum-water and passed through a moderately fine sieve, thus obtaining it in the form of minute granules. These are carefully dried, and then lightly sprayed with liquid paraffin—to prevent the powder from sticking to the moulds—and then compressed in the usual manner.

Trituration-tablets.—The moulds for this purpose are made for 50 and 100 tablets respectively, and for homœopathic work should preferably be of ivory or, failing that, of celluloid. Metallic moulds are unsuitable. The trituration is previously rubbed up with a little dry pulv. gum. acaciæ, then damped with spirit and water to the consistency of stiff putty, pressed with a bone spatula into the moulds, and set aside to dry.

### APPLICATIONS.

Tinct. arnicæ $\theta$			. 3ss.
Aquæ destill.			ad Zviij.

Ft. lotio.

Sig.—For external application.

Direct a piece of lint in three folds to be soaked in the lotion, then applied to the bruise, and covered with oiled silk.

Linim.	rhus .				ξij.
Linim.	saponis	simplicis			Ziv.

Ft. linimentum.

Label. - For external application.

Direct to be gently rubbed into the joint every four hours.

All homœopathic medicines should be dispensed in green or amber bottles, and these enclosed in card cases. The homœopathic department should be kept quite free of strong-smelling substances, and all utensils used should be kept specially apart from the ordinary dispensing. Homœopaths have sharp noses, and object strongly to odours foreign to the medicine, so that a faint suggestion of lavender or turpentine on cork or bottle may lose you a good customer.

## ILLEGIBLE PRESCRIPTIONS.

The capability of pharmacists to decipher illegible caligraphy is so generally known as to be almost proverbial. It is a kind of expertness which they have acquired through long practice in reading the prescriptions of physicians. Their business requires this art; it has received official recognition by being made a part of the requirements of the qualifying examination, at which badly-written medical prescriptions have to be read by candidates, and teachers find it necessary to collect specimens of bad medical penmanship on behalf of their pupils.

The duty of the dispenser who has an illegible prescription presented to him has never been clearly defined; he has certainly a perfect right, legally, to refuse to compound a prescription which he cannot read; but it is believed that in the case of prescriptions which have previously been dispensed he is justified in doing his best. The best, however, may be a serious matter to the patient if it happens to be contrary to the intentions of the prescriber. It is far better for the dispenser that he should not risk his own reputation or the comfort of his customer by undertaking a task respecting which he is uncertain.

We print here examples of such prescriptions which have actually been dispensed. The study of these may afford assistance to any who have had little practice in deciphering bad writing. It is important to remember that in deciphering handwriting the peculiarities of the specimen should be picked out. These frequently give a clue to the whole thing, and once a writer's style has been grasped, difficulties in the future appear to vanish. This is the case with the following:—

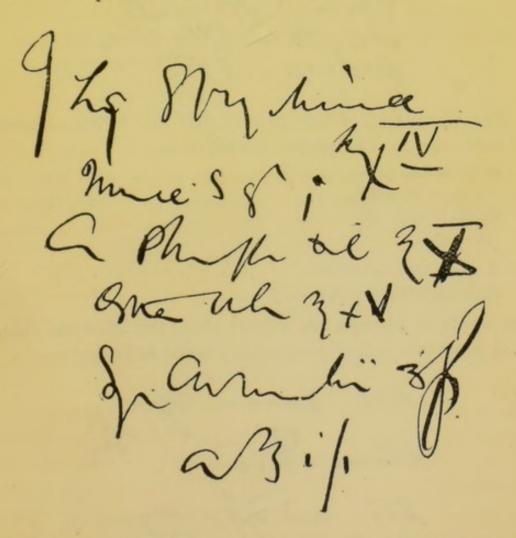
Par Doven Dri Brunsh for Aller

The above is a prescription of Dr. Cecil W. Hastings, 'a well-known bad writer,' remarked a correspondent of *The Chemist and Druggist* at the time the facsimile was first published. The most difficult point about it is the quantity of the second ingredient of the 'drops'; opinions are divided as to whether it should be mv. or 3ss. The former is, however, on the whole more in accordance with the writer's style, for, in the case of the other drachm signs, they are distinctly separated from the names of the ingredients, whereas the

opposite is the case with the 'ol. menth. pip.' The translation is:—

Benzol						ъij.
Ol. menth. pi						
Ol. olivæ.						ъх.
F. mist. Cap. gut	tt. xx	x. t. (	lie.			C. W. H.
Bo Calomel						g. iv.
Pulv. Doveri						Эij.
Bism. subnit.						Эij.
Ol. carui .						q.s.
Misce. Ft. pil. xx	civ. (	Cap. j	. 2 h	oris.		C. W. H.

The next specimen is much less obscure :-



The quantity of liquor strychniæ looks like 'mxiv.,' but

this is not intended. Dr. Ward Cousins is the writer of this, and the rendering is:—

Bo.	Liq. strychniæ				. m iv.
	Quin. s				. gr. j.
	Ac. phosph. dil.				. mx.
	Æther. chlor				. m xv.
	Syr. aurantii .		-	Him	. 3ss.
	Aq				ad Ziss.

The subjoined prescription is an extremely carelessly written one, of the 'scrap of paper' class which cause numerous mistakes:—

Some upon to John Some Some Come Com Splasonar Colored Colored

The peculiarity of this prescription lies in the contraction 'y' for 'every.' The proper rendering is:—

Be Disulph. quinæ					3ss.
Bromid. sodii .					3ij.
Divid. in pulv. xij.					0.5
One y 8hrs.					
Be Liq. ferri chloroxid	i.				.3j.
20 drops in water v [8 h	ours	1.			-

The words in brackets are written along the left-hand side.

A most misleading prescription is the following:—

Ant- Jun Ofm Hen 3 iv m Sig as of again No fewer than eight different renderings of this have been given by experienced dispensers. It was rendered as follows by the pharmacist who sent it to *The Chemist and Druggist*:—

Haust.	ferri ap	er.	bis.				
Alum.							Ziv.
ad Oss.	aquam	(sic)	once	day.			

Thoote landthamone 3;

This last is a carelessly written prescription, the second ingredient being particularly obscure; but after careful examination the dispenser will render it:—

B <sub>o</sub>	Aceti	cantharidis			3vj.
	Spir.	camphoræ			3ij.

This is correct. There is little in the writing to guide the dispenser, but it is highly unlikely that the writer would mean 'Lin. camphoræ' (an oleaceous preparation) to be mixed with a vinegar.

## EXAMINATION PRESCRIPTIONS.

Those who use this volume preparatory to entering for a qualifying pharmaceutical examination will find the following prescriptions useful for practice. They were given by the Boards in Edinburgh and London during 1898, 1899, and 1900. We do not comment upon these prescriptions, so far as giving the methods of procedure, the object of printing them here being to make them exercises for students. It will be noticed that about six articles are generally given to each candidate, including a British Pharmacopæia galenical to make, and three hours is allowed in which to do the work. That is at least an hour longer than should be taken by a competent dispenser.

I.	Mist. ol. ricini (B.P.) . živ.
Inj. morph. hypoderm 3iij. (B. P. process.) mxij. 1 gr.	II.
Ext. belladon gr. j.  Fiat suppos. Mitte vj.	Mist. ferri co
One to be used when required.  Acid. boric 2 %  Zinci oxid 3ss.	Ung. hyd. co., B.P., qty. in drachms. 'The Ointment.'
Pulv. tragacanth gr. x.  Glycerin 3ij.  Aq ad 3ij.  Fiat pigment.  To be used with a camel-hair	Creosoti mj. Pulv. capsici gr. ss. Ft. pil. Mitte xxiv. Varnish. j. t.d.s.
brush.  Ferri sulph. exsic gr. iij.  Fiat pil. Mitte xij. Silver.  One night and morning.	Ext. opii gr. vj. Ext. bellad gr. ij. Ol. theobrom q.s. Ft. suppos. vj.

III.	v.
Make 4 fl. oz. syr. calcis lactophosph.	Hyd. ē cretâ gr. iij. M. Ft. pil. Mitte vj.
Ferri et quin. cit gr. ij. Inf. calumbæ ad \( \frac{2}{3}\) ss. Mitte \( \frac{2}{3}\) iv. Sig.: To be taken after dinner daily.  Quin. sulph gr. ij. Ft. pil. Mitte vj. Sig.: One when the pain recurs.	Hyd. iodid. rub gr. j.  Morph. mur gr. ij.  M. Ft. suppos. vj.  Send a belladonna-plaster, the size of the prescription-paper, with an adhesive margin.  Send quite cold—  Oss. liq. plumbi
Pot. chlor	VI.  Tr. opii
IV.  Linimentum terebinth.  1/4 B.P. quantity.	Quinin. sulph gr. j.  Fiat pil. Mitte xij. Varnish.  Emp. bellad. 6-inches diam. for the breast.
Hyd. perchlor gr. $\frac{3}{8}$ Tr. tolu 3j. Aq ad $\frac{3}{2}$ iv.  Fiat lotio.  Ferri arsenatis gr. $\frac{1}{10}$	Santonin gr. x.  Ol. ricini
Quin. sulph gr. j.  Ft. pil. Mitte xxiv. Silver.  Sulphonal	Aloin gr. ij. Ext. bellad gr. j. Ol. theobrom q.s. Fiat suppos. Mitte vj.
Fiat mistura.  3j. t.d.s.	Make Ath B.P. quantity syr. ferri iodid.
Emp. picis 6 × 4 inches  Spread on leather.	Menthol plaster. Spread one, 4" × 4".

Ferri sulph gr. $\frac{1}{2}$	x.
Ext. belladon gr. ½	Bismuth. subnit gr. iss.
Ext. nucis vomic gr. $\frac{1}{2}$	Pepsin gr. iss.
Pil. rhei co gr. 2	Quin. sulph gr. j.
Misce. Fiat pilula. Mitte xij.	Strych gr. $\frac{1}{40}$
Silver.	M. et ft. pil. Mitte tales xxiv.
One night and morning.	Sig. : j. nocte et mane.
Olei ricini 3j.	
Pulv. acaciæ q.s.	Acid. salicylic 12%
Aquam ad 3iij.	Zinci oxid 8 %
4th part for a dose. Divide bottle.	Acid. boric 9 %
Pulv. opii gr. ½	P. cret. gall ad 3ij.
Sacch. lact gr. j.	M.
Ft. pulv. Mitte vj.	Bismuth. cit gr. 160
One every night.	Liq. ammon q.s.
	Aq ad 3iv.
VIII.	М.
Lotio. plumbi fort Oss.	Sig. : 3j. more dicto.
Blaud's pill gr. iv.	
Mitte xxiv. Varnish.	Quin. sulph gr. iss.
Pot. iod	Antifebrin gr. x.
Mist. ferri co ad 3vj.	Ft. pulv. Mitte xij. Cachets.
Emp. bellad 5 × 4	Ext. opii gr. 1/4
IX.	Ol. theobrom q.s.
Søl. hyd. perchlor ½ %	Ft. sup. Mitte sex.
Mitte živ.	Pt. sup. Mitte sex.
Emp. menthol 4×3	XI.
Menthol 2 %	Pil. ferri gr. v.
Adip. præp ad 3j.	Mitte 24. Varnish.
	Witte 24. Varmsn.
Inj. morph. hypoderm 3ss.	Ung. eucalypti
Pot. iod	Suppos. plumbi co. Mitte vj.
Liq. Donovani 3J.	Suppos. plantor co. Milite vj.
Liq. strychnin	Bismuth. carb I gramme
Liq. hyd. perchlor	Sod. bicarb 2 grammes
Syr. aurant	Ft. pulv. vj. To be dispensed
Inf. aurant. co ad 3vj.	in cachets.
You have to make 3j. liq. Dono-	
vani, and your own inf. auran-	A powder containing sod. sal. to
tii co.	be granulated.

Lin. terebinth gr. j gr. j	Ext. aloes, B.P gr. vj. Saponis pulv gr. vj. Ext. bellad gr. $\frac{1}{4}$ Ext. nuc. vom gr. $\frac{1}{2}$ Ft. pil. Mitte vj. Silver.
Cocainæ gr. iij. Ol. carbolici 2 % . ad zij. M.  Pot. bic ziss. Ac. hydrocy. dil mxij. Aq ad zvj. M. zj. with a powder.	Acid. gallic
P. acid. cit gr. xv.  XIII.  Emp. resinæ 6 × 6 on leather.	$xv$ .  Butyl. chloral. hyd gr. iv.  Gelseminin. hydrochlor $gr. \frac{1}{200}$
Zinci sulph gr. iij. Ext. gent gr. xviij. Ft. pil. vj. Varnish.  Ung. chrysarobini 3ij. Ol. terebinth 3iv. P. g. acaciæ q.s.	Ft. pil. Mitte xij.         Ext. hyos.       gr. ij.         Camphor.       gr. j.         Morph. hydroch.       gr. ½         Ol. theobrom.       q.s.         Ft. suppos. Mitte vj.         Hyd. perchlor.
Aq ad ʒiv.  M.  Sig.: The emulsion.  Pot. bicarb 3j.	Aq
Ammon. carb	Inf. digitalis ad 3ss.  Sig.: To be taken thrice daily.  Mitte 3vj.  Menthol gr. ½
M. zj. ter die c. p. acidi citrici q.s. Mitte pulveres vj.	Sodii bicarb gr. x. Bismuth. carb gr. v. M. Ft. pulv. Mitte tales vj.
Glyc. plumbi subacet.  † th B. P. quantity.  Suppos. morph. B. P. vj.	Make 2 fl. oz. syr. aromat., B.P.  Make about 4 fl. oz. syr. calci lactophosph.

Quin. sulph gr. iv.	Make a small quantity of soda citro-tart efferv.
Ft. pil. j. Mitte viij.  Ferri quin. cit gr. ij.  Inf. calumbæ 3ss.  M.	Acid. boric 10.0% Pulv. amyli 10.0% Pulv. cret. gall 80.0%
To be taken thrice daily after food. Mitte ziv.  Pot. chlor zj. Acid. hydrochlor mxvj. Aq ad zvj.	Mitte zj.  Sodii biborat zj. Sodii bicarb zj. Glycerini zj. Aq ad zvj. Sig.: The gargle.
M. et gargarisma chlorinatum fiat.  XVII.  Make 6 belladonna suppositories B.P.	Ext. euonymin. sic gr. iss. Pil. rhei co gr. iiss. Ft. pil. Mitte xij. Sig. : j. h.s.

The following are examination prescriptions which were given under the old system, and are retained here from the old edition for practising-purposes. Each set should be dispensed in an hour.

Α.	Bals. copaibæ
Tr. ferri perchlorid 3ij.	Pul. gum. acac zij.
Potass. tart	Liq. potassæ 3j.
Aquæ ad ʒvj.	Tinct. opii
	Sp. æther. nit ʒiij.
M. Ft. mist. 3ss. bis die.	Aq ad 3iv.
Atropiæ sulph gr. $\frac{1}{24}$	Capt. 3ss. q.q. quart. horâ.
Ol. theobrom q.s.	
Ft. suppos. Mitte vj.	c.
В.	Tr. cannab. ind 3ij.
Ext. belladon gr. iij.	Tr. card. co
Ol theobrom	Aq ad 3iv.
Ol. theobrom q.s.	M. Ft. mist. sec. art. Coch.
Ft. suppos. Mitte vj.	mag. j. t.d.s.
Hyd. perchlor gr. ij.	Pulv. opii gr. iij.
Ext. coloc. co gr. iij.	Potass. nit gr. xv.
Ft. pil. Mitte xij., quarum cap.	M Et auto too : 1: 1:
unam om. noct. si opus sit.	M. Ft. pulv. tres. j. bis die
om noon or opus sit.	sum.

Potassii iodid gr. xxx.	Plumbi acet gr. xiv.
Potassii carb gr. x.	Pulv. opii gr. xx.
Adipis ad 3j.	Adipis 3ss.
M. Ft. ung. m.d. utend.	Ft. ung. m.d.s.
	- transferments
D.	G.
Ammon. carb	
Tr. tolu 3ij.	Acet. plumbi gr. iij.
Tr. camph. co 3ij.	Pulv. opii gr. j.
Pulv. tragac. co gr. viij.	Ol. theobrom q.s.
Aquæ ad 3iv.	Ft. suppos. Mitte vj.
M. Ft. mist. Coch. mag. ter	Ferri sulph gr j.
quaterve die sum.	Ext. hæmatoxyli gr. ij.
	Ext. hyoscyami gr. j.
Ferri sulph gr. iss.	M. Ft. pil. Mitte xij. j. t.d.
Pil. aloes et myrrh gr. iv.	m. r. pn. mitte xij. j. t.d.
M. Ft. pil. Mitte xij. Una	
t.d. sumend.	н.
Е.	'Send a piece of white leather
Phosphori gr. $\frac{1}{36}$	spread with emp. plumbi 8 by
Ferri redact gr. iij.	2 inches.'
	Aq ad 3vj.
M. Ft. pil. Mitte xxiv.	Ol. amygd 3vj.
Emp. canthar. pone sinistram	Liq. potass 3vj.
aurem ponendam.	Liq. morph., P.B 3iss.
Mag. sulph 3j.	
Mag. carb 3ss.	M. 3ss. ter quaterve die.
Tr. lavand. co 3ij.	('Send ½ quantity of mixture.')
Pot. iodid 3ss.	
Tr. aurantii 3ss.	I.
Aq. menth ad 3viij.	Pulv. rhei gr. ij.
M. Ft. mist. Cujus æger cap.	Creosoti mj.
coch. unum ter in die in	Sapo gr. j.
cyatho vinario aq. frig. post	M. Ft. pil. Mitte octo. Cap.
jentac., prand. et coen.	j. ter die dum opus sit (post
,	cibos).
F.	
Ol. ricini 3iij.	P. cret. aromat 3j.
Ol. terebinth 3ij.	Rhei gr. xl.
Gum. acaciæ 3ij.	Mucil. tragac
Aq ad 3iv.	Aquæ ad Ziv.
M. Ft. mist. Cap. 3ss. q.q.	M. Ft. mist. Capiat 4tam part
quartâ sextâve horâ.	pro dosi s.o.s.

Potass, chlor gr. xl.	Plumbi acet gr. xxx.
Tinct. tolutan 3ij.	Opii gr. ij.
Glycerin 3ij.	M. Ft. pil. [xij.] One every
Syrup. simp 3ij.	night.
Aquæ ad 3iv.	mgnt.
Mis. Ft. garg. subinde utend.	K.
Hyd. chlor gr. xij.	A Augustus
	Hyd. č. cretâ gr. iij.
M. Ft. pil. x. Cap. j. c. sing.	Pulv. rhei gr. viij.
dos. m. seq.	Mine tors in authorem Conist
J.	Misce, tere in pulverem. Capiat
	quamprimum mane.
Pulv. rhei 3ss.	Liq. ammon. fort 3ij.
Sodii bicarb 3j.	
Bismuthi carb 3ij.	Ol. amygd 3iv.
Mucil. trag ʒiij.	Camphoræ 3j.
Sp. amm. co	Chlorof 3ij.
Aq ad 3vj.	Tinct. opii 3iss.
M. Fiat mist. C. coch. j. mag.	Aquæ ad ʒij.
quâque horâ et coch. ij. h.s.s.	Misce. Part. dolent. applicand.

## APPENDIX

# TERMS LIKELY TO OCCUR IN FRENCH AND GERMAN PRESCRIPTIONS.

A, Fr., to, or; Trois à quatre paquets (three or four powders).

Abendessen, Abend -brod, -mahlzeit, -tisch, Ger., supper. Drei von diesen Pillen vor dem Abendessen. (Three of these pills before supper.)

Acide azotique, Fr., nitric acid.

Aetz, Ger., caustic.

Aetzstein, Ger., caustic potash.

Alcohol sulphuris, Ger. Lat., carbon bisulphide.

Alcohol de soufre, Fr., carbon bisulphide.

Altschädenwasser, Ger., lotio flava, yellow wash.

Aqua calcaria, G.L., lime-water.

Aqua chlorata, G.L., chlorine-water.

Arsenige Säure, Ger., arsenious acid.

Arsensäure, Ger., arsenic acid. Augenstein, Ger., lapis divinus. Azotate, Fr., nitrate.

Barbotine, Fr., santonica.

Baudruche, Fr., goldbeater's skin.

Bisse, Ger., bolus. Sechs Bissen im Tage zu nehmen auf drei Gaben vertheilt. (Six boluses to be taken daily, divided into three doses.)

Blauholz, Ger., logwood.

Bleiessig, Ger., liq. plumbi subacet.

Bol, Fr., bolus. A prendre six bols par jour en les partageant en trois doses. (Six boluses to be taken every day, dividing them into three doses.)

Bourdaine, Fr., rhamnus frangula.

Calcaria, G.L., calx or calcium.

Carboneum, G.L., carbon.

Carbonicum, G.L., carbonas, or carbonate.

Cautère potentiel, Fr., caustic potash.

Chamomilla vulgaris, G.L., Matricaria chamomilla.

Chaux, Fr., lime.

Chinin, Ger., quinine.

Chininum, G.L., quinine.

Chloratum, G.L., chloride.

Chlorsaures, Ger., chlorate.

Cinchonium, G.L., cinchonine.

Citricum, G.L., citrate.

Coccionella, G.L., cochineal.

Colla piscium, G.L., icthyocolla.

Coton cardé, Fr., wadding, cotton wool.

Coucher, Fr., bedtime, going to bed. A prendre deux pilules avant le coucher. (Two pills to be taken at bedtime.)

Cyanatum, G.L., cyanidum, cyanide. Cuillerée à café, Fr., teaspoonful. Une cuillerée à café au cas d'une attaque de toux. (A teaspoonful to be taken if the cough comes on.)

Cuillerée à soupe, Fr., tablespoonful. Prenez une cuillerée à soupe toutes les deux heures. (One tablespoonful every two hours.)

Dower'sches Pulver, Ger., Dover's powder.

Eau de Rabel, Fr., mistura sulphurica acida.

Effet voulu, Fr., the desired effect. Une cuillerée à café toutes les demi-heures jusqu'à l'effet voulu. (A teaspoonful every half-hour till it acts.)

Einspritzung, Ger., injection.

Eisessig, Ger., glacial acetic acid.

Emplastrum adhæsivum anglicum, G.L., court plaster.

Emplastrum picatum, G.L., pitch plaster.

Esson, Ger., meals.

Essig, Ger., vinegar.

Esslöffel, Ger., tablespoon. Alle zwei Stunden einen Esslöffelvoll. (A tablespoonful every two hours.)

Ferrocyanatum, G.L., ferrocyanide. Flasche, Ger., bottle. Schütteln Sie die Flasche. (Shake the bottle well.)

Fois, Fr., time. Prenez en quatre fois à une demi-heure d'intervalle. (To be taken in four portions at intervals of half an hour.)

Gouttes, Fr., drops. A prendre dix gouttes trois fois par jour. (Ten drops to be taken thrice daily.)

Glas, Ger., glass, tumbler.

Hirschtalg, Ger., mutton suet.

Höllenstein, Ger., silver nitrate, lunar caustic.

Iodure de formyle, Fr., iodoform. Kohlensäure, Ger., carbonic acid. Kümmel, Ger., caraway.

(A) Jeun, Fr., fasting. Prenez deux ou trois de ces pilules à jeun. (Take two or three of these pills fasting.)

Latwerge, Ger., electuary

Lavement, Fr., enema.

Limonade sèche, Fr., effervescent saline.

Liqueur de belloste, Fr., liquor hydrargyri nitratis acidus.

Liquiritia, G.L., glycyrrhiza.

Mal, Ger., time, portion. Auf vier Mal in halbstündigen Zwischenräumen zu nehmen. (To be taken in four portions at intervals of half an hour.)

Malva arborea, G.L., Althæa rosea, hollyhock.

Mittagsessen, Ger., dinner (properly

'mid-day meal'). Dieses Pulver unmittelbar vor dem Mittagsessen zu nehmen. (This powder to be taken immediately before dinner.)

Natrium, G.L., sodium; Natrum, G.L., soda, sodium oxide.

Nüchtern, Ger., sober, fasting. Vier oder sechs von diesen Pillen nüchtern zu nehmen. (Four or six of these pills to be taken fasting, or before breakfast.)

Oblate, Ger., wafer. Ein Pulver vor der Mahlzeit in einer Oblate zu nehmen. (A powder to be taken in a wafer before meals.)

Ordonnance, Fr., prescription.

Ouate, Fr., wadding, cotton wool.

Pain azyme, Fr., wafer. Un de ces paquets à prendre dans du pain azyme avant le repas. (One of these powders to be taken in a wafer before meals.)

Paquet, Fr., a packet, powder. A prendre un paquet toutes es deux heures. (One powder to be taken every two hours.) On prend un de ces paquets peu de temps avant l'attaque de fièvre. (One of these powders to be taken shortly before the fever fit.)

Pasta gummosa, G.L., pâte de guimauve.

Pastilles, Fr., lozenges. A prendre de quatre à six pastilles par jour. (Four to six lozenges to be taken daily.)

Pastillen, Ger., lozenges. Man nimmt von diesen Pastillen auf einmal nur eine alle zwei Stunden. (One only of these lozenges to be taken every two hours.) Paullinia, Ger., guarana.

Pierre à cautère, Fr., caustic potash. Pillen, Ger., pills. Zwei Pillen jeden Abend vor dem Zubettegehen. (Two pills every evening at bedtime.)

Pilules, Fr., pills. Deux pilules chaque soir avant le coucher. (Two pills every evening at bedtime.)

Pincée, Fr., a pinch. Infusez une pincée de ces herbes avec un demi-litre d'eau bouillante pour faire une tisane. (Infuse a pinch of these herbs in half a pint of boiling water to make a draught.)

Potasse à la chaux, Fr., caustic potash.

Potion, Fr., mixture, potion.

Poudre, Fr., powder. Matin et soir une poudre dix minutes avant le repas. (One powder every morning and evening ten minutes before meals.)

Poudre alexitère, Fr., pulv. ipecac. co.

Poudre anodine, Fr., pulv. ipecac. co.

Poudre diaphorétique, Fr., pulv. ipecac. co.

Poudre gazeuse ou gazifère purgative, Fr., seidlitz powder.

Poudre gazogène, Fr., effervescent or gazogene powder.

Poudre gazogène neutre, Fr., soda powder.

Poudre gazogène laxative, Fr., seidlitz powder.

Poudre Savory, Fr., seidlitz powder.

Poudre sudorifique, Fr., pulv. ipe-cac. co.

Priser par le nez, Fr., to snuff.

Pour priser par le nez cinq ou six fois par jour. (To be snuffed five or six times daily.)

Pulver, Ger., powder. Ein Pulver jeden Morgen und Abend zehn Minuten vor dem Essen. (One powder every morning and evening ten minutes before meals.) Man nimmt ein Pulver kurz vor dem Fieberanfall. (A powder to be taken shortly before the fever fit.)

Pulvis aërophorus, G.L., effervescent powder, gazogene powder, soda powder.

Pulvis aërophorus laxans, G.L., seidlitz powder.

Pulvis gummosa, G.L., pulvis tragacanthæ co.

Räucherkerzchen, Ger., fumigating pastilles.

Räucheressig, toilet or disinfecting vinegar.

Remède du capucin, Fr., liquor hydrargyri nitratis acidus.

Remède du duc d'Antin, Fr., liquor hydrargyri nitratis acidus.

Repas, Fr., meals.

Rezept, Ger., prescription.

Rhodomel, Fr., mel rosæ.

Riechessig, Ger., aromatic vinegar. Saindoux, Fr., lard.

Säure, Ger., acid.

Schlafengehen, Ger., bedtime. Vor dem Schlafengehen zwei Pillen zu nehmen. (Two pills to be taken at bedtime.)

Schnupfen, Ger., to snuff. Fünf bis sechs Mal im Tage zu schnupfen. (To be snuffed five or six times daily.)

Schwarzeswasser, Ger., black wash, lotio nigra.

Schwefel, Ger., sulphur.

Schwefligesäure, Ger., sulphurous acid.

Schwefelsäure, Ger., sulphuric acid.

Sebum, G.L., sevum, suet.

Sel de lait, Fr., milk sugar.

Semencine, Fr., santonica.

Soufre végétal, Fr., lycopodium.

Stibium, G.L., antimonium.

Sucre de Saturne, Fr., lead acetate.

Sulfuratum, G.L., sulphidum, sulphuretum, sulphide.

Sulfuricum, G.L., sulphas, sulphate.

Table, Fr., table. Se mettre à table. (To dine.) A prendre deux de ces pilules en se mettant à table. (Two pills to be taken before dining.)

Taffetas d'Angleterre, Fr., court plaster.

Tartarus boraxatus, G.L., soluble tartar, potassium boro-tartrate.

Tartarus depuratus, G.L., potassium acid tartrate, cream of tartar.

Tartarus natronatus, G.L., Rochelle salt, sodium potassium tartrate.

Tartarus stibiatus, G.L., emetic tartar, antimonium tartaratum.

Theelöffel, Ger., teaspoon. Ein Theelöffelvoll, a teaspoonful.

Tisane, Fr., draught, medicated drink.

Tisch, Ger., table. Zu Tische gehen. (To dine.) Man nehme zwei von diesen Pillen wenn man zu Tische geht. (Take two pills before dining.)

Trifolium fibrinum, G.L., Menyanthes trifoliata, buckbean.

Tropfen, Ger., drop. Drei Mal

des Tages zehn Tropfen zu nehmen. (Ten drops to be taken thrice daily.)

Verordnung, Ger., prescription. Verre, Fr., glass, tumbler. Un verre d'eau sucrée. (A tumbler of sugar and water.)

Wasserstoff, Ger., hydrogen.
Weinsteinsäure, Ger., tartaric acid.
Wirkung, Ger., action, effects.

Ein Theelöffelvoll alle halbe Stunden bis zur Wirkung zu nehmen. (Take a teaspoonful every half-hour till it acts.)

Zahnwurzel, Ger., pellitory root. Zeste, Fr., the peel of oranges, lemons, &c.

Zittwersamen, Ger., santonica. Zubettegehen, Ger., bedtime. Zuckersäure, Ger., oxalic acid.

### ORDO RERUM.

The following are the regulations in force in the Drug Department of the Army and Navy Stores, London.

Hours.—From 8.30 a.m. to 7 p.m.; Saturdays, to 2.15 p.m.; after which times extra pay commences.

Assistants are requested to be at their posts by 8.50 a.m. punctually, unless otherwise instructed. Each assistant is to dust and arrange his own bottles, and to be ready to commence dispensing at 9 o'clock.

#### POISONS.

Potent are to be kept in a cupboard quite apart from other drugs; Less Potent on vermilion-coloured shelves.

### COPIERS.

When entering a prescription, to consider the doses of the drugs, also their effects, and each evening, or morning before 9.10, to enter the memos. from the 'Prescription Note Book.'

### DISPENSERS.

- (A) The prescription, or a correct copy, to be in front of the dispenser, who should first consider the doses of the drugs and their effects. Each ingredient to be weighed or measured separately, and the bottle from which it was taken put back to its place at once. Read the label as the bottle or package is taken for use, and never fail, on returning it to its place, to again see that you have taken the right bottle or package.
- (B) Re-read prescription immediately it is finished, to make doubly sure that it has been correctly dispensed.
- (C) The weighing or measuring of all poisons should be checked; if for a number of powders, the bulk to be checked, and then weighed

separately; the formulæ requiring them should be shown to the assistant who may be called upon to check. This applies to making preparations as well as dispensing.

- (D) Put notes of excipients and other memos., if needed, in a book kept for that purpose.
- (E) For all medicines for external use, or not to be taken, excepting non-poisonous gargles, mouth-washes, and sprays, special poison-bottles are to be used.
- (F) When a preparation of bark is ordered, the 1867 is to be used for all prescriptions written prior to September, 1885. Also ext. cinch. flav. liq. and inf. cinch. flav. for mixtures containing alkalies and their carbonates.
- (G) To Obviate Delay.—In every case where an order taken down by a dispenser cannot be executed forthwith, the cause of delay is to be noted in a book kept for the purpose; but as much of the order as can be done is to be proceeded with, and passed on to the finisher.

### FINISHERS.

The formula dispensed from must be before the assistant, who must thoroughly check it in all its details. The name of the patient should be copied from the prescription, but should this bear no name, it must be obtained from the prescription-book. Be careful to insert distinctly the correct index of book and number of prescription on label, also ticket number outside the medicine and envelope.

#### POISON-LABELS.

All preparations for external use containing poisons are to be labelled such, and potent medicines for internal use to have a 'with care' slip put on the bottle.

#### WAITING-ORDERS.

In every case where part of an order can be finished off, do so, but inquire if such shall wait, or be despatched with memo. that remainder shall follow.

#### STOCKKEEPER.

Carefully examine all goods before taking into stock, and when the slightest deterioration is noticed, or any doubt arises, at once refer to the manager.

In all cases of difficulty and doubt, employés are requested to apply to the head of room, who, if necessary, will consult the manager. Talking, excepting on business connected with the department, is strictly prohibited.

The observance of these rules must not be perfunctory, but real, any breach of same being visited with a heavy fine, which will be handed to the Provident Fund.

November, 1887.

#### ADDITIONS.

Finishers.—The direction on labels of all *potent* medicines must be checked by a second person, who must initial the order.

Dispensers. - The person checking a poison must initial the order.

September, 1889.

From this date, January 13, 1890, when salicylates are ordered for internal use, the natural salt is to be understood as meant; but for prescriptions copied prior to above date, the ordinary kind is to be used.

Each dispenser is to check his scales every morning, and the weights for same to be verified on the first Monday in every month, and any discrepancy to be reported to the head of the room.

All prescriptions are to be taken from the rack, according to the order in which they are arranged, and no fresh order must be taken until the one in hand has been executed, unless such order cannot be forthwith completed.

#### FOR SMALL PHARMACIES.

The following are the rules actually in use in several pharmacies employing one to three assistants, and they may be found more applicable than the foregoing, which are specially intended for such places as the Stores.

PREPARING PRESCRIPTIONS.—Prescriptions must be prepared as soon as possible after they are received, and when a prescription is left to be compounded, and the customer says he will call for it at a certain time, every possible effort must be made to have it ready before the time specified.

Prescriptions must be dispensed with the greatest neatness and elegance. Corks should be sealed, the bottle or box neatly wrapped in white paper and sealed, and use flint bottles, porcelain jars, and the best quality of boxes. If the prescription has the name of the patient on it, write the name on the label.

DOUBTFUL PRESCRIPTIONS.—When a prescription is received about which there is doubt as to whether the physician intended it as written, or when there is reasonable doubt as to what is prescribed, do not dispense the medicine.

If the customer is not in haste, and time can be gained for the purpose, send to the doctor privately a note of inquiry, otherwise hand the prescription back to the customer and request him to see the doctor about it.

If the formula for a preparation used in a prescription is not uniform, or is liable to be compounded in various ways, the dispenser must write in the margin of the prescription the exact-formula he has used.

UNSIGHTLY MIXTURES.—No unsightly or incompatible mixture is allowed to be sent out of this pharmacy until the principal's attention has been drawn to the same and every legitimate means tried to make a sightly and elegant compound.

PILLS.—In preparing a prescription of pills, mention in the prescription-book the kind and quantity of excipient used in compounding them; the same with suppositories.

BLISTERING-PLASTERS.—In preparing or spreading emp. canthar. always paint the plaster over afterwards with the ethereal solution of cantharidis. [This is for elegance, but is not permissible in our opinion.—ED.]

RENEWALS.—In renewals the soiled labels must be renewed, and, if necessary, the bottle washed. This applies also to pills and powders. [Always give fresh containers if customer does not object.—Ed.]

RESPONSIBILITIES.—Whoever dispenses a prescription in this pharmacy will be held personally responsible for any mistake in compounding. The fact of the wrong drug having been put in the shop-bottle by another assistant will not relieve the dispenser from responsibility, his duty being to critically examine every article he dispenses.

To avoid mistakes permit no talking while you are preparing prescriptions.

No substitution is permitted in prescriptions under any circumstances. Any article in a prescription which is not in stock must be procured, and the customer informed of delay.

Poisons.—Poisons to be taken internally may be labelled 'Drop with care' or 'Use with caution.' But, unless so directed by the physician, the word 'Poison' must not be written on the label.

PRICING.—When a high-price prescription has been put up, or one that seems dear according to its bulk, always explain to the customer that

it is an expensive preparation, and that it is put at as low a price as possible.

The bottle or jar used in a prescription is always charged extra, and in entering the price on a prescription it must be for the medicine only, the bottle or jar being charged for according to the price-list.

PRESCRIPTION-COUNTER.—The prescription-assistant will see that his counters are kept perfectly clean and neat. As soon as a prescription is checked off return the hand-bottles to their places on the shelves and clean up all the utensils used.

ADDRESS OF PATIENT.—Inquire the name and address of every person who leaves a prescription to be prepared, and write it on the back of prescription in pencil.

Messenger.—When a child or a servant is sent for a prescription, always write the price on the package in plain figures in ink.

PRICES OF GOODS SOLD TO PHYSICIANS.—If drugs or prescriptions for their own family use, charge them from two-thirds to one-half the regular price according to the medicine.

# DISPENSING CHARGES.

THE following are the retail prices agreed upon by the Liverpool Chemists' Association, which we reproduce from the price-list compiled by the Association and published by Mr. H. Silverlock, Blackfriars, S.E., at 1s., or post free 1s. 2d.:—

ize	Mi	Lotions,			
126	Dose, 5j.	Dose, 3ij.	Dose, \$ss.	Dose, 3j.	Injections, and Gargles
3ss. 3j.	6d. to 8d. 8d. ,, 10d.	6d. to 8d. 8d.,, 10d.	6d. 6d. to 8d.	= .	} 8d.
3iss. 3ij.	10d. ,, 1/- 10d. ,, 1/-	9d. ,, 10d. 10d. ,, 1/-	8d.,, 9d. 9d.,, 10d.	_	} 8d. to 10d.
žiij. živ.	1/2 ,, 1/6	1/- ,, 1/3 1/4 ,, 1/8	10d.,, 1/2	10d. to 1/- 1/-, 1/3	} 10d. ,, 1/-
žvj. žviij.	1/9 ,, 2/6 2/- ,, 3/-	1/6 ,, 1/10 1/8 ,, 2/-	1/4 ,, 1/6 1/6 ,, 1/8	1/2 ,, 1/4	} 1/- ,, 1/6
₹x. ₹xij.	=	=	1/9 ,, 2/- 2/- ,, 2/3	1/6 ,, 1/9 1/9 ,, 2/-	} 1/4 ,, 1/9
žxvj. žxx.	=	=	2/9 ,, 3/- 3/- ,, 3/6	2/6 ,, 2/9 2/9 ,, 3/-	} 1/9 ,, 2/6

No. Dose	Pills	Powders	Cachets	Suppositories	Bougies and Pessaries
I 2 to 4 6 12 18 to 24	3d. to 6d. 3d. ,, 6d. 6d. ,, 8d. 8d. ,, 1/- 1/- ,, 1/6	3d. to 6d. 6d.,, 8d. 9d.,, 1/- 1/-,, 1/6 1/6,, 2/6	3d. to 6d. 6d.,, 8d. 9d.,, 1/- 1/-,, 1/6 1/6,, 2/6	9d. 1/- 1/9 to 2/-	] 1/- to 1/3 1/9 ,, 2/- 2/9 ,, 3/6

Ointments, \( \) \

Blisters and Belladonna or Opium Plasters, 3 by 4 inches, 8d.; 4 by 4 inches, 10d.; 4 by 6 inches, 1s.; 5 by 8 inches, 1s. 6d.; 6 by 9 inches, 2s.; 6 by 12 inches, 2s. 6d.; minimum, 6d.

Dispensing-fee for stock liniments, tinctures, &c., 3d. to 6d., in addition to retail prices.

CHARGES FOR DOCTORS' DISPENSING.—The usual charges are 1d. per ounce for mixtures, with a minimum of 4d.; lotions are generally charged at lower rates than mixtures, but with the same minimum; liniments are charged according to composition, a profit of 10 or 15 per cent. being added to the cost; pills, 3d. a dozen; and powders, 4d. a dozen. In all cases costly alkaloids as ingredients of the prescriptions justify extra charges.

# METRIC WEIGHTS AND MEASURES.

THE subjoined tables show the approximate equivalents which may be required at the dispensing-counter :-

## AVOIRDUPOIS WEIGHT.

Oz.		Grammes.	- 1	Gramm	les.	Oz.		Gr.
1/2	=	7.09		10	=	1/4	and	45
$\frac{1}{2}$	=	14.17		20	=	1/2	,,	90
I	=	28.35		50	=	$1\frac{3}{4}$	,,	6
$I_{\frac{1}{2}}$	=	42.22		75	=	$2\frac{1}{2}$	,,	64
2	=	56.40		100	=	3 3 4	,,	103
3	=	85.05		250	=	834	,,	30
4	=	113.40		500	=	$17\frac{1}{2}$	,,	60
5	=	141.75		1,000	=	354	,,	10
12	=	340.19						
15	=	425.24						
20	=	566.99						
32	=	907.18						

		APOTHECARI	ES'	WEIGHT		
		Grammes.		Grammes.		
Gr. j.	=	0.064	1	0.10	=	gr. iss.
Gr. iss.	=	0.1		0.152	=	gr. ij.
Gr. ij.	=	0.159		0.12	=	gr. iiss.
Gr. iiss.	=	0.165		0.50	=	gr. iij.
Gr. iij.	=	0.194		0.22	=	gr. iv.
Gr. iv.	=	0.259		0.3	=	gr. ivss.
Gr. v.	=	0.324		0.4	=	gr. vj.
Gr. vj.	=	0.389		0.2	=	gr. viiss.
Gr. vij.	=	0.454		0.6	=	gr. ix.
Gr. ix.	=	0.283		0.8	=	gr. xiiss.
Gr. xv.	=	0.972		.9	=	gr. xiv.
Ðj.	=	1.296		I.0	=	gr. xvss.
3ss.	=	1.944		2.0	=	3ss. gr. j.
Gr. xlv.	=	2.916		2.2	=	3ss. gr. viiiss.
3j·	=	3.888		3.0	=	Эij. gr. vj.
3iss.	=	5.832		5.0	=	3j. gr. xvij.
3ij.	=	7.775		6.0	=	3iss. gr. iiss.
3iiss.	=	9.719		8.0	=	діј. gr. iiiss.
ziij.	=	11.663		10.0	=	ziiss. gr. iv.
3iv.	=	15.551		12.0	=	дііј. gr. v.
3v.	=	19.439		15.0	=	3iiiss. gr. xxiss.
3vj.	=	23.327		25.0	=	3vj. gr. xxvj.
zvij.	=	27.215		50.0	=	ziss. Diiss. gr. ij
						5 5 5

# APOTHECARIES' WEIGHT-continued.

	Grammes	Grammes	
<b>3</b> j.	= 31.103	75.0 = §ij. ʒiij. gr. xviiss	5.
ξij.	= 62.207	100.0 = \(\frac{1}{2}\)iij. \(\frac{1}{2}\)iss. gr. xiij.	
ξiij.	= 93.310	150.0 = \(\frac{1}{2}\)iv. \(\frac{1}{2}\)viss. \(\text{gr. v.}\)	
žviij.	= 248.828	175.0 = 3v. 3v. gr. ss.	

## LIQUID MEASURES.

			12010 11	LUITOURING		
		Cubic Centimetres		C.c.		
mj.	=	0.059		0.10	=	miss.
mij.	=	0.118		0.152	=	mij.
miiss.	=	0.12		0.12	=	miiss.
miij.	=	0.148		0.50	=	miiiss.
miv.	=	0.237		0.25	=	miv.
mv.	=	0.296		0.3	=	mv.
mvj.	=	0.355		0.4	=	mviss.
mviij.	=	0.474		0.2	=	mviiiss.
mx.	=	0.292		0.6	=	mx.
mxij.	=	0.410	1	0.8	=	mxiiiss.
mxv.	=	0.888		0.9	=	mxv.
mxx.	=	1.184		1.0	=	mxvij.
mxxv.	=	1.479		2.0	=	zss. miv.
3ss.	=	1.776		2.5	=	Đij. mij.
mxl.	=	2.368		3.0	=	zss. mxxj.
mxlv.	=	2.664		5.0	=	zj. mxxivss.
3j.	=	3.22		6.0	=	3j. mxliss.
3iss.	=	5.328		8.0	=	zij. mxv.
3ij.	=	7.103		10.0	=	ziiss. mxviij.
ziiss.	=	8.879		12.0	=	0 0
ziij.	=	10.655		15.0	=	ziv. mxiiiss.
3iv.	=	14.206		20.0	=	zvss. mviij.
3v.	=	17.758		25.0	=	zvij. miiss.
3vj.	=	21.309		30.0	=	0,
3vij.	=	24.861		50.0	=	3j. 3vj. mv.
ъj.	=	28.412		75.0	=	zij. zv. mvij.
ziss.	=	42.618		100.0	=	ziiiss. mix.
зij.	=	56.825		150.0	=	zv. zij. mxiv.
зііј.	=	85.237		175.0	=	zvj. zj. mxviss.
živ.	=	113.649		200.0	=	zvij. mxviij.
3v.	=	142.0		250.0	=	zviij. zvj. mxxiiiss.
ъvj.	=	170.474		500.0	=	zxviiss. mxlvij.
zviij.	=	227.298		1,000.0	=	zxxxv. ziss. miv.
žxx.	=	568.245				
9		100				

# ABBREVIATIONS USED IN PRESCRIPTIONS.

A., (1) aa, ana, of each ingredient;
(2) ab, absque, of or from; (3)
adde, add thou; (4) ante, before;
(5) alternus, alternate; (6) aqua,
water; (7) artem, secundum
artem, according to art; (8)
asinæ, lac asinæ, ass's milk.

A. H., alternis horis, every other hour.

A.J., ante jentaculum, fasting, or before breakfast.

A. P., ante prandium, before dinner. Abdom., abdomen, the abdomen, the belly.

Abs. febr., absente febre, fever being absent.

Acid. hydroc., (1) acidum hydrochloricum; (2) acidum hydrocyanicum.

Aconit., (I) aconitum, the plant; (2) aconitina, aconitine.

Ad 2 vic., ad secundam vicem, vel ad duas vices, for two times.

Ad 3tiam vicem, ad tertiam vicem, for three times.

Ad def. animi, ad defectionem animi, to fainting.

Ad del. animi, ad deliquium animi, to fainting.

Ad gr. acid., ad gratam aciditatem, to an agreeable acidity.

Ad libit., ad libitum, at pleasure.

Ad recid. præc., ad recidivum præcavendum, to prevent a relapse.

Add., (1) adde, add thou; (2) addantur, let them be added; (3) addendus, to be added;

(4) addendo, by adding.
Adeps S., adeps suillus, hog's lard.

Adjac., adjacens, adjacent.

Admov., (1) admove, apply; (2) admoveatur, let it be applied; (3) admoveantur, let them be applied.

Ads. febre, adstante febre, while the fever is present.

Adv., adversum, against.

Aggred. febre, aggrediente febre, while the fever is coming on.

Alter. (altern.) horis, alternis horis, every other hour.

Alvo adst., alvo adstrictâ, when the bowels are confined.

Ammon., (1) ammonia; (2) ammoniacum.

Aq. astr., aqua astricta, frozen water.

Aq. bull., aqua bulliens, boiling water.

Aq. com., aqua communis, common water.

Aq. dest., aqua destillata, distilled water.

Aq. ferv., aqua fervens, warm, or hot, water.

Aq. fluv., aqua fluviatilis, river water.

Aq. font., aqua fontana, vel fontis, vel fontalis, spring water. (Has been misread, aqua fortis.)

Aq. gel., aqua gelida, cold water.

Aq. mar., aqua marina, sea water.

Aq. niv., aqua nivalis, snow water.

Aq. pluv., aqua pluviatilis, seu pluvialis, rain water.

Auris, the ear.

B., (1) balsamum, a balsam; (2) balneum, a bath; (3) bene, well; (4) bis, twice; (5) bolus, bolus, a large pill; (6) bovis (lac b., lac bovis, cow's milk); (7) brachium, the arm (mitt. sang. b., mittatur sanguis brachio, let blood be taken from the arm); (8) bulliens, boiling.

Bb., bbds., barbadensis, Barbadoes.

B.M., balneum marinum, seu maris, a sea or salt water bath.

B.P., B.Ph., British Pharmacopœia.

B.T., balneum tepidum, a warm bath.

B.V., balneum vaporis, vaporosum, a vapour bath.

Bib., bibe, drink thou.

Bis ind., bis indies, twice a day.

Brach., brachium, the arm.

Bull., (1) bulliens, boiling; (2) bulliat or bulliant, let boil.

But., butyrum, butter.

C. (1) lac c., lac capellæ, lac capræ, goat's milk; (2) c. radat., caput radatur, let the head be shaved; (3) p.c. post cænam, after supper,

pondus civile, avoirdupois weight;
(4) colatus, strained; (5) coletur,
let it be strained; (6) compositus, compound; (7) concisus,
cut; (8) confectio, a confection; (9) congius, a gallon; (10)
conserva, a conserve; (11) continue, continue thou; (12) continue, bruised, broken small;
(13) contusus, bruised, pounded;
(14) cortex, bark; (15) cras, crastinus, of to-morrow; (16) crystallis, in crystals; (17) cujus, of which; (18) cum, with; (19) cyathus, a glass pot or cup.

C.C., (1) cucurbitula cruenta, a cupping-glass with a scarificator; (2) cornu cervi, hartshorn.

C.C.U., cornu cervi ustum, burnt hartshorn.

C.M.S., cras mane sumendus, to be taken to-morrow morning.

C.N., cras nocte, to-morrow night.

C. V., cras vespere, to-morrow evening.

Cærul., cæruleus, blue.

Cal., calidus, warm.

Cal., calom., calomelas, calomel.

Cal. chlor., (1) calcii chloridum, calcium chloride; (2) calx chlorata, chloride of lime.

Cap., capiat, let (the patient) take.

Caput r., caput radatur, let the head be shaved.

Chart., charta vel chartula, a paper (a powder in paper).

Co., compositus, compound.

Coch., cochleare, cochlearium, spoonful.

Coch. ampl., cochleare amplum, a large (table) spoonful; about 4 fl. drachms.

Coch. inf., cochleare infantis, a child's spoonful.

Coch. mag., cochleare magnum, a large or table spoonful, about 4 fluid drachms.

Coch. med. vel mod., cochleare medium vel modicum, a middling (dessert) spoonful, about 2 fl. drachms.

Coch. parv., cochleare parvum, a small (tea) spoonful; about I fl. drachm.

Cochleat., cochleatim, by spoonfuls. Col., (1) cola, strain; (2) colatus, strained.

Colat., (1) colatus, strained; (2) colatura, to the strained liquor.

Colet., coletur, let it be strained.

Colent., colentur, let them be strained.

Color., coloretur, let it be coloured. Comp., compositus, compound.

Con., concisus, cut, sliced.

Cong., congius, a gallon.

Cons., conserva, (1) a conserve; (2) keep thou.

Cont. rem. seu med., continuentur remedia seu medicamenta, let the medicines be continued.

Coq., (1) coque, boil; (2) coquantur, let them be boiled.

Coq. ad med. consumpt., coque seu coquatur ad medietatis consumptionem, boil, or let it be boiled, till half is consumed.

Coq. s. a., coque secundum artem, boil according to art.

Coque in s. a., coque in sufficiente quantitate aquæ, boil in a sufficient quantity of water.

Cort., cortex, bark.

Crast., crastinus, for to-morrow. Cuj., cujus, of which.

Cujusl., cujuslibet, of any.

Cy. vel cyath. theæ, cyatho theæ, in a cup of tea.

Cy. vinar., cyathus vinarius, a wineglass.

Cyath., cyathus, vel c. vinar., c. vinarius, a wineglass; about 2 fluid ounces, or in France about 5 fluid ounces.

D., (1) d. sp., debita spissitudo, a proper consistence; (2) detur, let it be given; (3) dexter, the right side; (4) dies, a day; (5) dilutus, diluted; (6) dimidius, the half; (7) directio, a direction; (8) divide, dividatur, divide thou, let it be divided; (9) donec, until; (10) dosis, a dose; (11) dum, until; (12) duplex, double; (13) durans, during; (14) duratus, dried.

D. in 2plo, detur in duplo, let twice as much be given.

D. in p. æq., dividatur in partes æquales, let it be divided into equal parts.

D. P., directione propriâ, with a proper direction.

D. spiss., debita spissitudo, a proper consistence.

Deaur. pil., deaurentur pilulæ, let the pills be gilded.

De d. in d., de die in diem, from day to day.

Deb. spiss., see D. spiss.

Dec., decanta, pour off.

Decub., decubitûs, of lying down.

Decub. hor., decubitûs horû, at th hour of going to bed, at bedtime.

Deglut., deglutiatur, let it be swallowed.

Dej. alvi, dejectiones alvi, stools.

Det., detur, let it be given.

Dext. lat., dextrum latus, the right side.

Dieb. alt., diebus alternis, every other day.

Dieb. tert., diebus tertiis, every third day.

Dil., (1) dilue, dilute thou; (2) dilutus, diluted.

Diluc., diluculo, at break of day. Dim., dimidius, one-half.

Donec alv. bis dej., donec alvus bis dejiciatur, until the bowels have been twice evacuated.

Donec alv. sol. fuer., donec alvus soluta fuerit, until the bowels be opened.

Donec dol. neph. exulav., donec dolor nephriticus exulaverit, until the nephritic pain is removed.

E., (1) electus, picked or selected;

(2) electuarium, an electuary;

(3) emeticum, an emetic; (4) emplastrum, a plaster; (5) eos, the morning; (6) extractum, an extract; (also as a preposition—of, out of).

Eburn., eburneus, made of ivory. Ed., edulcorata, edulcorated, clarified.

Ejusd., ejusdem, of the same.

Elect., electuarium, an electuary.

Emp. lyth., emplastrum lythargyri. (Has been misread, emplastrum lyttæ.)

Enem., enema, an enema, a clyster.

Ex gel. vit., ex gelatina vituli, in call's-foot jelly.

Exhib., exhibeatur, let it be exhibited.

Ext. col., (1) extractum colchici; (2) extractum colocynthidis.

Ext. sup. alut. moll., extende super alutam mollem, spread it upon soft leather.

F., (1) fac, make thou; (2) fiat, fiant, let it (them) be made; (3) fervens, boiling; (4) folium, a leaf; (5) forma, form, shape; (6) fortis, strong; (7) fotus, a fomentation; (8) fuscus, brown.

F.H., fiat haustus, let a draught be made.

F.L.A., fiat lege artis, let it be made by the rules of art.

F.M., fiat mistura, let a mixture be made.

F.S.A., fiat secundum artem, let it be made according to art.

F. pil., (1) fac pilulas, make pills; (2) fiant pilula, let pills be made.

F. venæs., fiat venæsectio, bleed.

Fasc., fasciculus, a bundle which can be carried under the arm; about 4 oz. Linnæus, 1 oz. Geiger.

Feb. dur., febre durante, during the fever.

Fem. intern., femoribus internis, to the inner part of the thighs.

Fict., fictilis, earthen.

Fil., filtrum, a filter.

Fist. arm., fistula armata, a clyster pipe and bladder fitted for use.

Fl., (1) flatus, flatulence; (2) flavus, yellow; (3) flos, a flower; (4) fluidus, fluid, or by measure; (5) fluviatilis, aq. fl., river water.

Fol., folium, leaf.

Frust., frustillatim, in little pieces. Ft., fiat, fiant, let it (them) be made. G., (1) gallicus, French; (2) gelatina, jelly; (3) gelida, aq.,

cold water; (4) gummi, a gum; (5) granum, a grain; (6) gutta, a drop.

G.G.G., gummi guttæ gambæ, gamboge.

Garg., gargarisma, a gargle.

Gel. quav., gelatina quavis, in any kind of jelly.

Gr., granum, a grain.

Gr. vj. pond., grana sex pondere, six grains by weight.

Gtt., gutta, a drop; gutta, drops. Gutt. quibusd., guttis quibusdam, with a few drops.

Guttat., guttatim, by drops.

H., (I) habeat, he may have, let him have; (2) horum, vel harum, of these; (3) haustus, a draught;
(4) herba, a herb; (5) hic, this; (6) hora, an hour; (7) hujus, of this.

H.D., horâ decubitûs, at bedtime, at the hour of going to bed.

H.p.n., haustus purgans noster, our purging draught (made by a private formula).

H.S., horâ somni, at the hour of sleep.

Har. pil. sum. iij., harum pilularum sumantur tres, let three of these pills be taken.

Hb., herba, a herb.

Hor. IIma mat., horâ undecimâ matutinâ, at II A.M., at the eleventh hour in the morning.

Hor. interm., horis intermediis, in the intermediate hours.

Hor. un. spat., horæ unius spatio, at the expiration of an hour.

Hydr., (1) hydrargyrum, mercury; (2) hydras, hydrate; (3) hydriodas, iodide; (4) hydrochloricum, hydrochloric; (5) hydrocyanicum, hydrocyanic.

Hydr. bic., (1) hydrargyri bichloridum, corrosive sublimate; (2) hydrargyri bicyanidum, bicyanide of mercury.

Hydr. bin., (1) hydrargyri biniodidum, biniodide of mercury; (2) hydrargyri binoxidum, red oxide of mercury.

Hydr. chlor., (1) hydrargyri chloridum, calomel; (2) hydras chloral, chloral hydrate.

Hydr. ox. n., (1) hydrargyri oxidum nigrum, black oxide of mercury; (2) hydrargyri oxidum nitricum, red oxide of mercury.

In pulm., in pulmento, in gruel.

Inc., (1) incide, cut thou; (2) incisus, cut, sliced.

Ind., indies, from day to day, daily.

Inf., (1) infunde, pour in; (2) infricare, to rub in; (3) infusum, an infusion.

Inj. enem., injiciatur enema, let an enema or clyster be (thrown up) administered.

J., jentaculum, breakfast.

Jul., julepus, julepum, julapium, a julep.

Kal. ppt., kali præparatum, prepared kali, potassium carbonate.

L., (1) lac, milk; (2) lapis, a stone; (3) lătus, a side; (4) lege, (1) read thou, (2) by law; (5) libra, a pound, also a pair of scales; (6) lignum, wood; (7) linimentum, a liniment; (8) liquor, a liquor or liquid; (9) lotio, a lotion.

Lac A., lac asinarum, ass's milk.

Lac B., lac bovis, cow's milk.

Lac C., lac capræ seu capellæ, goat's milk.

Lac O., lac ovillum seu ovinum, ewe's milk.

Lac V., lac vacca, cow's milk.

Lat. dol., *lateri dolenti*, to the painful or affected side.

Len., lenis, gentle.

M., (I) mane, the morning; (2) manipulus, a handful; (3) marina, marine, belonging to the sea; (4) b.m., balneum maris, a sea-water bath; (5) massa, a mass; (6) mensurâ, by measure; (7) m. pan., mica panis, crumb of bread; (8) minimum, a minim; (9) misce, mix thou; (10) mitte, send; (11) mistura, a mixture.

M.B., misce bene, mix well.

M.D.U., more dicto utend., to be used as directed.

M.P., massa pilularum, a pill mass. M. dict., more dicto, in the way directed.

Menth. p., (1) mentha piperita, peppermint; (2) mentha pule-gium, pennyroyal.

M. pan., mica panis, crumb of bread. Man., manipulus, a handful.

Mane pr., mane primo, very early in the morning.

Min., (1) minimum, a minim; (2) minutum, a minute.

Mic. pan., mica panis, crumb of bread.

Mitt., (1) mitte, send; (2) mittatur, mittantur, let it, let them, be sent.

Mitt. sang. ad 3xij. saltem, mitte sanguinem ad uncias duodecim saltem, take blood to 12 ounces at least.

Mod. præsc., modo præscripto, in the manner prescribed.

Mor. dict., more dicto, in the manner directed.

Mor. sol., more solito, in the usual manner.

Mist., mistura, a mixture.

N., (1) natura, nature; (2) niger, black; (3) nocte, at night; (4) nomen, name; (5) non, not; (6) novus, new; (7) nucha, nucha capitis, the nape of the neck; (8) numero, in number; (9) nux, a nut.

N.M. nux moschata, nutmeg.

N. capit., nucha capitis, the nape of the neck.

Ne tr. s. num., ne tradas sine nummo, do not deliver unless paid.

Ng., niger, black.

No., numero, in number.

O., (1) octarius, a pint; (2) oleum, cil; (3) omnis, all; (4) optimus, the best; (5) ovillum and ovium, sheep's, belonging to sheep; (6) ovum, an egg.

Ocul., oculus, the eye.

O.M., omni mane, every morning.

O.N., omni nocte, every night.

O.O.O., oleum olivæ optimum, best olive oil.

O. alt. hor., omnibus alternis horis, every alternate hour.

Ol. lini s. i., oleum lini sine igne, cold-drawn linseed oil.

Omn. bid., omni biduo, every two days.

Omn. bih., omni bihorio, every two hours.

Omn. hor., omni horâ, every hour. Omn. man., omni mane, every morn-

ing.

Omn. noct., omni nocte, every night.

Omn. quadr. hor., omni quadrante horæ, every quarter of an hour.

Ov., ovum, an egg.

Oz., the ounce avoirdupois, as distinguished from the troy or apothecaries' ounce (written 3).

P., (1) pars, a part; (2) parvus, small; (3) per, by; (4) pilula, a pill; (5) pilus, hair; (6) pondere, by weight; (7) pondus, weight; (8) præparatus, prepared; (9) prandium, dinner; (10) pro, for; (11) proprius, proper; (12) pulvis, a powder.

P. æ., partes æquales, equal parts.

P.c., pondus civile, civil weight, avoirdupois weight.

P.d., per deliquium, by deliquescence.

P.m., (I) pondus medicinale, medicinal weight, apothecaries' weight; (2) post meridiem, the afternoon.

P.r.n., pro re natâ, occasionally.

P. derad., pilus deradatur, let the hair be shaved off.

P. rat. æt., pro ratione ætatis, according to the age of the patient.

Part. aff., partem affectam, the part affected.

Part. dolen., partem dolentem, the part in pain.

Part. vic., partitis vicibus, in divided doses.

Past., pastillus, a lozenge, pastille. Pect., pectus, the breast, chest.

Per. op. emet., peractâ operatione emetici, when the operation of the emetic is finished.

Per salt., per saltum, by leaps (speaking of blood from an artery).

Ph. B., Pharmacopæia Britannica, British Pharmacopæia. Ph. D., Pharmacopaia Dublinensis, Dublin Pharmacopaia.

Ph. E., Pharmacopæia Edinensis, Edinburgh Pharmacopæia.

Ph. L., Pharmacopæia Londinensis, London Pharmacopæia.

Ph. U.S., United States Pharmacopœia.

Plen. riv., pleno rivo, in a full stream. Pocil., pocillum, a little cup.

Pocul., poculum, a cup; a teacup holds 4 to 6 fluid ounces.

Post sing. sed. liq., post singulas sedes liquidas, after every liquid stool.

Pot. hydr., *potassæ hydriodas*, hydriodate of potash.

Ppt., praparata, prepared.

Pr., mane pr., mane primo, very early in the morning.

Prand., prandium, dinner.

Pro pot. com., pro potu communi, for a common drink.

Prox. luc., proximâ luce, on the next day.

Pug., pugillus, a pinch.

Pulv., (1) pulvis, a powder; (2) pulverisatus, powdered.

Pv., parvus, small.

Q., (1) quantum, as much; (2) quisque, quaque, &c., everyone; (3) quorum, vel quarum, of which; (4) quaterve, or four times; (5) quatuor, four; (6) qui, who, which.

Q.l., quantum lubet, as much as you please.

Q.p., quantum placet, as much as you please.

Q.q.h., quâque quartâ hora, every four hours.

Q.s., quantum satis seu sufficiat, as much as is sufficient.

Q.v., quantum vis, vel volueris, as much as you will.

Quor., quorum, of which.

R., (1) caput r., caput radatur, let the head be shaved; (2) radix, a root; (3) p.r.n., pro re natâ, occasionally; (4) recipe, take thou; (5) rectificatus, rectified; (6) redactus, reduced or powdered; (7) regio, region, part.

R. in pulv., red. in pulv., redactus in pulverem, powdered.

Redig. in pulv., redigatur in pulverem, let it be reduced to powder.

Reg. hep., regio hepatis, the region of the liver.

Reg. umbil., regio umbilici, the umbilical region.

Repet., repetatur, repetantur, let it (them) be repeated.

S., (1) sal, a salt; (2) semina, seeds; (3) semi, semissis, half; (4) si, if; (5) simul, together; (6) sine, without; (7) sit, si opus sit, if there be occasion; (8) spiritus, spirit; (9) stratum, a layer; (10) succus, juice; (11) adeps s., adeps suilius, hog's lard; (12) sufficiens, sufficient; (13) sumo, sumere, to take; (14) super, upon; (15) syrupus, syrup.

S.a., secundum artem, according to art.

S.G., specific gravity.

S.N., secundum naturam, according to nature.

S.o.s., si opus sit, if there be occasion.

S.S., stratum super stratum, layer upon layer.

Ss., semi, seu semissis, half.

S.V., (1) spiritus vini, spirit of

wine; (2) spiritus vinosus, ardent spirits of any sort.

S.V.M., spiritus vini methylatus, methylated spirit.

S.V.R., spiritus vini rectificatus, rectified spirit.

S.V.T., spiritus vini tenuior, proof spirit.

Scat., scatula, a box.

Scrob. cord., scrobiculus cordis, the pit of the stomach.

Semidr., semidrachma, half a drachm.

Semih., semihora, half an hour.

Seq. luce, sequenti luce, the following day.

Sesunc., sesuncia, an ounce and a half.

Sesquih., sesquihora, an hour and a half.

Si n. val., si non valeat, if it does not answer.

Si op. sit, si opus sit, if there be occasion.

Si vir. perm., si vires permittant, if the strength permit.

Sig., signa, mark.

Signat., signatura, a label.

Sig. n. pr., signetur nomine proprio, let it be written upon or signed with the proper, and not the trade, name.

Sing., singulorum, of each.

Sod. chlor., (1) sodii chloridum; (2) soda chlorata or chlorinata, chlorinated soda.

St., (1) stet, stent, let it (them) stand; (2) statim, immediately.

Stern., sternum, the breast-bone, chest.

Sub fin. coct., sub finem coctionis, when the boiling is nearly finished.

Sulph., (1) sulphur; (2) sulphas, a sulphate; (3) sulphidum, sulphuretum, a sulphide.

Sum., (1) summitates, the summits or tops; (2) sume, take thou; (3) sumat, let him take; (4) sumatur, let it be taken; (5) sumantur, let them be taken; (6) sumendus, to be taken.

Sum. tal., sumat talem, let the patient take one like this.

T., (1) talis, such as, like this; (2) tenuis, thin, weak; (3) tere, rub thou; (4) tinctura, a tincture.

T.O., tinctura opii, tincture of opium.

T.O.C., tinctura opii camphorata, camphorated tincture of opium, paregoric elixir.

T. s., tere simul, rub together.

Tabel., tabella, a lozenge.

Temp. dext., tempori dextro, to the right temple.

in (1) seet, stead, let it them)

term, forward, the breast-bons,

Sale full election and forest actions .

Tr., Tra., tinctura, a tincture.

Trit., tritura, triturate.

Troch., trochisci, lozenges.

Ult. præscrip., ultimo præscriptus, the last ordered.

Usq. ut liq. anim., usque ut liquerit animus, until fainting is produced.

U.S.Ph., United States Pharmacopœia.

V., (1) venæ, the veins; (2) vesper, the evening; (3) vinum, wine; (4) vis, quantum vis, as much as you will; (5) vitellus, yolk (of egg); (6) vitulus, a calf; (7) volueris, quantum volueris, as much as you wish.

V.O.S., vitello ovi solutus, dissolved in yolk of egg.

Vom. urg., vomitione urgente, the vomiting being troublesome.

V.s., venæsectio, bleeding, venesection.

Do in the design view, some of

Vic., vices, times.

Zz., zingiber, ginger.

# TABLE SHOWING THE ADULT DOSES IN ORDINARY CASES OF THE PRINCIPAL MEDICINAL AGENTS.

These are taken from the British Pharmacopæia of 1898 when they are contained there. Those marked with an asterisk (\*) are taken from other sources.

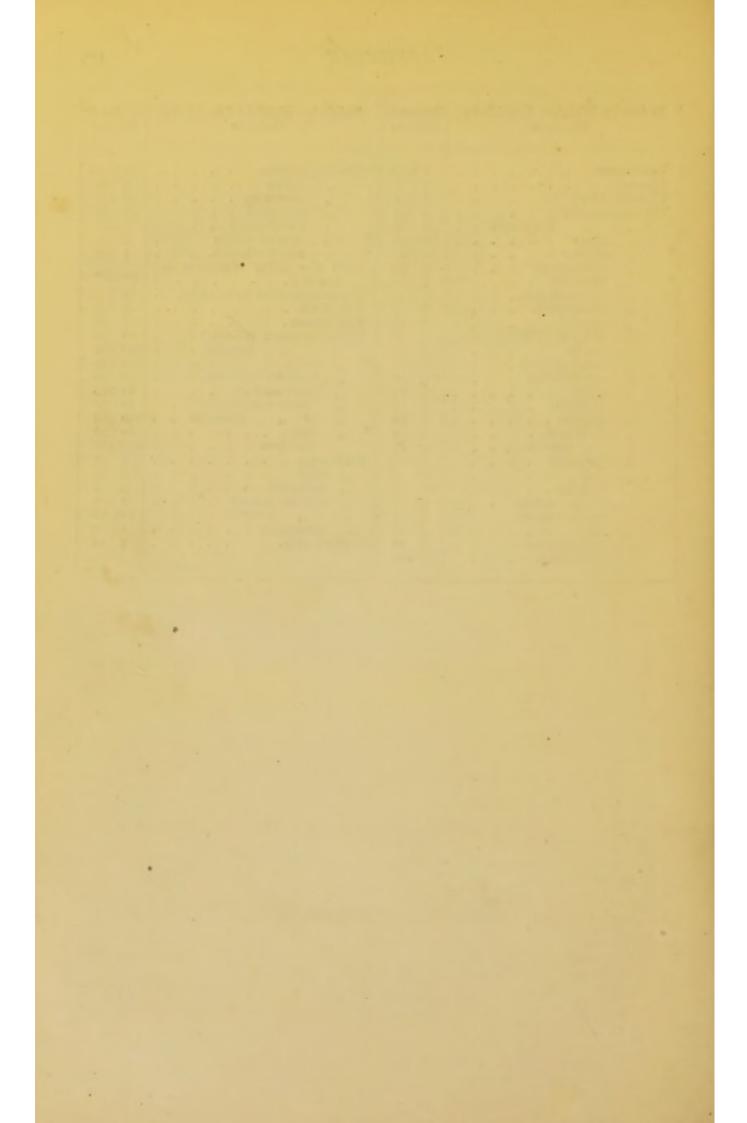
Solids by Weight; Liquids by Measure	Grains or Minims	Solids by Weight; Liquids by Measure	Grains or Minims
Acetanilidum	r to 3	Amyl. nitris	1 to I
Acetum ipecacuanhæ	10 30	*Amyli iodid	2 5
, scillæ	10 30	*Amyli iodid	30 240
Acid. acetic. dil	30 120	Antimonii oxid	I 2
,, benzoic	5 15	,, sulphurat. ,, tartarat. (emetic)	I 2
carbolic	5 15	,, tartarat. (emetic) ,	1 1
oitrio	5 20	Antipyrinum "	5 20
,, gallic	5 15	*Apiol	3 6
" hydrobrom. dil		*Apiol	3 6
" hydrochlor. dil		, (by mouth).	33 4
" hydrocyanic, dil	2 6	Aqua laurocerasi	30 120
", lactic."	I 4	Argenti nitras	1 1
,, lactic	5 20	,, oxid	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
,, ,, dil		Arsenii anhydrid	80 15
" nitric. dil		,, iodid	$\frac{1}{20}$ $\frac{1}{5}$
" nit. hydrochlor. dil	-	Asafetida	5 15
,, phosphoric dil	5 20	Atropina	200 100
" picric		Balsam. peruvian.	200 100
culphuric arom	5 20	,, tolutan	5 15
dil	5 20	*Beberinæ sulph	1 10
culphurec		Belladon. fol. and rad. pulv	1 5
,, tannic	2 5	Beta naphthol	3 10
,, tartaric	5 20	Bismuth, carbon	5 20
Aconitina	240 50	,, oxid	5 20
Æther	10 60	,, oxid	5 20
,, acetic	20 90	subnitras	5 20
*Agaricin	1 I	Bromidia	
Aloes barbad	2 5	Brucina	12 2
,, socot	2 5	Butyl-chloral hydras	
Aloïnum	1 2	Caffeina	1
Alumen	5 10	" citras	7 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
,, ferri	3 10	Calcii carbon	100000000000000000000000000000000000000
Ammoniac. gum	5 15	, chlorid	
hannana			5 15
hramid		,, hypophosph	-
oarbonee		Calx sulphurat	1 1
" chlorid		Cambogia	5 15
, phosphas		Camphora	2 5

Solids by Weight; Liquids by Measure	Grains or Minims	Solids by Weight; Liquids by Measure	Grains or Minims
Camphora monobrom	2 to10	Ext. cascaræ sagrad. liq	30 to 60
Cannabini tannas	2 10	,, cimicifugæ liq	
Cantharidis	1 1 2	,, cinchon. liq	5 15
Capsicin		,, cocæ liq	30 60
Capsici fruct. pulv	B 4 1	,, colchici	1 1 2
Carb. ligni	60 120	* ,, ,, acetic	1 2
Catechu	5 15	,, colocynth. co	2 8
Cerii oxalas	2 10	,, conii	2 6
Chloral hydras	5 20	,, digitalis U.S	1 1 2 2 8
Chloralamidum	15 45	,, ergotæ	
Chlorodyn	5 20	,, liquid	
Chloroform	1 5	,, filicis liq	45 90
Chrysarobin	6 2	,, geisemii alconol ,	1 2
Cinchonæ cort. pulv	5 60	", gentianæ	2 8
Cocæ fol. pulv		", glycyrrhiz. liq	30 60
Cocain, hydrochlor	1 1	,, hamamelid. liq	5 15
Codeïna	15 2 2	,, hydrast, liq	
Colchici corm. pulv	1 2	", hyoscyami	2 8
Colchici corm. pulv	2 5	", ipecac. liq. (expect.)	2 2
*Colchicinum	33 10	,, jaborandi liq	15 20
Colocynth pulp. pulv	2 8	,, jaborandi liq	5 15
Confect. opii	5 20	,, jalapæ	2 8
,, piperis		" krameriæ	5 15
,, scammon		,, nucis vomicæ	‡ I
,, sennæ		,, ,, liq	1 3
Carll Cal sulphuris	60 120	,, opii	
Conii fol. pulv	2 8	,, ,, liq	5 30
*Convallamarina	1 -	,, papaveris	
Copaiba	2 2	", pareiræ liq	30 120
*Coto cort	30 60	,, physostigmatis	
*Cotoin.	1 8	onem lie	
Creosotum	1 5	" sarsæ liq	120 240
Cubeb. fruct. pulv.	30 60	,, stramonii	1 1
Cupri sulph. (astring.)	1 2	topowooi	
", ", (emetic)	5 10	lia	5 15
Curara "	20 1	100 miles and manual Col	2 10
Cusso	120 240	,, viburni prunifol	10 30
Decoct. aloes comp	1 to 20z.	Fel bovis purificat	5 15
" granat. cort	1 20Z.	Ferri arsenas	16 4
,, hæmatoxyl	1 20Z.	", carb. sacch	5 15
Digitalis fol. pulv		,, et ammon. cit	5 10
Digitalin	60 30	,, et quin. cit	
Elaterinum	7 7	,, et strychninæ cit	3 6
Elaterium	10 1	,, phosph	5 10
*Emetina (emetic)	10 1 1	,, pyrophosph	2 8
Ergota	. 20 60	", sulphas	1 5
Ergotinum (ext. ergotæ)	2 8	,, exsiccat	
*Ergotinina (alkaloid)	200 40	Ferrum redactum	1 5
Eserin. (alkaloid)	100 50	tartaratum	
,, salts	· 2 30	*Fuchsinum	1 1 4
Eucalypti gum	. 2 5	Galbanum gum	5 15
Euonymin (ext. siccat.)	T 2	Gelsemina (alkaloid)	7000
Exalgin	. 1 2	Glycerinum	60 120
Ext. aconit. (green)	1 1	pepsini	60 120
* ,, ,, rad. alcohol	10 1	Guaiacol	I 5
,, aloes barb. and socot	2 4	*Hamamelin	1 2
,, anthemidis	2 8	Homatropine salts	780 80
", belladon, alcoholic	. 1 1	Hydrarg. iod. rub	7 7
,, ,, virid ,	2 8	,, virid	
	4 I	,, oxid. rub	1 I
" cascaræ sagrad	2 8	, perchlorid	32 16

Solids by Weight; Liquids by Measure	Grains or Minims		Grains or Minims
Hydrarg. subchlorid	½ to 5	Liquor senegæ conc	30 to 60
Hyoscinæ hydrobrom	200 100	,, sennæ ,,	30 60
Hyoscyaminæ sulph	200 100	,, sodæ	15 60
*Ichthyol. ammon	10 30	,, ,, chloratæ	10 20
*Ingluvin.	5 10	,, ,, arsenat	2 8
Infus. digitalis	120 240 10Z. 20Z.	,, strychnin, hydrochlor. , thyroidei	2 8 5 15
,, lupuli	10Z. 20Z.	,, trinitri	5 15 ½ 2
All the other infusions of the	10Z. 20Z.	Lithii carb	2 5
All the other infusions of the	20z. 10z.	" citras	5 10
B.P	or 2 oz.	Tupulin ,, effervesc	60 120
,, cocain. hydro. dermic	2 5	Lupulin	2 5
" ergotæ injec-	3 10	carb	5 60
morphin ) tion	2 5	,, sulphas	30 240
Iodoform	3-21-21	,, ,, effervesc	60 480
*Iodum	4 1	Manganes. ox. nig	3 10
Ipecac. rad. pulv. (expect.) (emetic)	15 30	Menthol	240 480
FIridin	I 5	,, amygdalæ	240 480
Jaborandi	5 60	", creosoti	240 480
Jalapæ rad. pulv	5 20	,, cretæ	240 480
*Kamala	30 120	,, ferri comp	240 480
Kino	5 20	" guaiaci	240 480 10z. 2 oz.
*Leptandrin	3 8	,, sennæ co	10Z. 2 0Z.
*Liquor ammoniæ	10 20	,, spt. vini gallic	10Z. 2 OZ.
,, ,, acet	120 360	Morphinæ acet	8 2
,, ,, citrat	120 360	bimeconas	
,, arsenicalis hydrochlor	2 8	,, hydrochlor sulphas	8 2
et hyd, iodid		tautune	1 1
,, et hyd. iodid	1 1	Moschus	5 10
,, bismuth. et am. cit	30 60	Muscarin. nit. (hypoderm.)	7 3
* ,, calcii chlorid	15 50	Myrrha pulv	10 20
,, calcis	10z.40z.	Naphthol	3 10
calumba conc	30 60	Narcotina	I 3
,, chirate ,,	30 60	*Nicotina	1 I
,, chlori	10 20	*Nitroglycerin	200 50
,, cuspariæ conc	30 60	Nux vomica pulv	I 4
,, ethyl. nitrit	20 60	Oleum copaibæ	5 20
@ dialyeat	5 15	" cubebæ	5 20
,, ,, perchlorid	5 15	,, morrhuæ	60 240
,, ,, pernitrat	5 15	" phosphorat	1 5
,, hamamelid. liq	30 180	,, ricini	60 480
,, hydrarg. perchlor	30 60	, sabinæ	1 4
" hydrogen. peroxid krameriæ conc	30 120 30 60	,, santan	5 30 2 240
magnecii carh	10Z. 20Z.	All the other essential oils in	-
,, morphin. acet	10 60	the B.P	1 3
9 ,, ,, bimecon	5 40	Opium	2 2
,, ,, hydrochlor	10 60	Oxymel	60 120
y, tartrat	10 60	,, scillæ	30 60
notacce	5 20	Pancreatin	2 4 1 8
nermangan	120 240	Paraldehydum	30 120
,, quassiæ conc	30 60	Pelletierina	3 6
", rhei conc	30 60	,, salts	5 8
" sarsæ conc	120 480	Pepsinum	5 10

Solids by Weight; Liquids by Measure	Grains or Minims	Solids by Weight; Liquids by Measure	Grains or Minims
*Periodates	1 to 5	Salol	5 to 15
Phenacetin	5 10	Santonin.	2 5
Phosphorus	5 20	Scammonium	5 10
*Physostigm, sem	100 20		1 3
,, alkaloid	1 4 1 1 1	Scopolamin, hydrobrom	120 240
,, salts	100 50 1 1 60 20	Sodii arsenas	120 240 10 10
Picrotoxin	100 25	" benzoas	5 30
Pilocarpin. nit	1 1	,, bicarbon	5 30
Pil. conii comp	5 10	,, bromid	5 30
,, ferri	5 15	,, carbon	5 30
" phosphori	1 2	,, ,, exsic	3 10
" plumbi et opii	2 4 2 8	" cit. tart. efferv	60 120
,, quinin, sulph	2 4	,, hypophosph	3 10
All the other pills in the B.P.	4 8	indid	10 60
Piperazin	4 10	,, nitris	5 20 I 2
Piperina	1 10	" phosphas	30 240
Plumbi acet	1 5	,, ,, effervesc	60 240
Podophyllin	1 I	,, salicylas	10 30
Potassa sulphurat	2 8	,, sulphas	30 240
Potassii acetas	10 60	", effervesc	60 240
hisauh	19 8	,, sulphis	5 20
highramas	5 30		5 15
,, bromid	5 30	OCnartain culph	1 5
,, carbonas	5 20	Spiritus ætheris and comp.	20 90
,, chloras	- 5 15	,, ,, nitrosi	20 90
,, citras	10 40	,, ammon. arom	20 90
,, hypophosph	1 6	,, ,, fetid	20 90
,, iodid	5 20	,, anisi	5 20
,, nitras	M	,, armoraciæ comp	60 120
,, permanganas	10 40	,, cajuputi	5 20
,, tartras	30 240	ahlanafanmi	5 20
,, acid	20 60	,, cinnamomi	5 40
Puly, antimonial	3 6	,, juniperi	5 20 20 60
,, catechu co	10 40	,, lavandulæ	5 20
,, cinnam. co	10 40	,, menth. pip	5 20
,, cretæ aromat	10 60	,, myristicæ	5 20
,, elaterini co	10 40	octoria rosmarini	5 20
alvourth co	1 4 60 120	Strychnin	300 100
,, ipecac. co	5 15	, salts	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
,, jalap. co	20 60	Succus belladonnæ	80 IS
,, kino co	5 20	,, conii	5 15
,, opii co	2 10	,, hyoscyami	30 60
,, rhei co	20 60	" scoparii	60 120
,, scammon. co	10 20	c ,, taraxaci	60 120
*Quininæ arsenas	20 60	Sulphonal.	10 30
budusablan	1 10	Sulphur præcipit	20 60
,, sulphas	1 10	Syrupus cascaræ arom.	20 60
Resin. guaiaci	5 15	, chloral.	30 120
, jalapæ	2 5	,, codeinæ	30 120
,, podophylli	1 I	papaveris	30 120
scammon	3 8	,, rhei	30 120
Rhei rad. pulv	3 30	,, sennæ	20 700
*Sabing cacum puly	4 6	All the other syrups in the	
*Sabinæ cacum. pulv	4 10	B.P	30 60
*Salipyrin.	5 20	*Thallinæ sulph. *Tetronal	3 5
	, -5 30	Tetronal	5 20

Solids by Weight; Liquids by	Grains or	Solids by Weight; Liquids by	Grains or
Measure	Minims	Measure	Minims
Terebenum. Thymol. Thyroid. (dry) Tinctura aconiti  """, Fleming's "" "", aloes """, arnicæ """ "", belladonnæ """, belladonnæ """, cannabis ind "", cannabis ind "", capsici "", chlorof. et morph. co." "", cocci "", colchici sem "", coroci "", digitalis "", ergotæ "", ferri acet "", perchlorid "", perchlorid "", gelsemii "", iodi "", perchlorid "", gelsemii "", æther "", nucis vomicæ "", podophyllin.", rhei comp.	1 3	Tinctura sabinæ  ,, scillæ ,, sennæ co. ,, stramonii ,, strophanthi  , veratri viridis , zingiberis fort.  All the other tinctures in the B.P.  Trimethylaminæ hydrochlor.  Uranii nit.  Urethanum  Vinum antimon. (diaph.)  ,, (emetic) ,, cocæ ,, colchici and sem. ,, ferri and cit. ,, ipecacuan. (expect.) ,, opii ,, quininæ  Zinci acet. ,, oxid. ,, phosphid. ,, sulphas (tonic) ,, valerianas  Zingiber pulv.	20 to 60 5 15 30 240 5 15 5 15 5 20 5 20 30 60 2 3 ½ 5 16 60 10 30 120 240 10 30 60 240 10 30 240 360 10 40 240 480 1 2 2 10 1 10 1 1 1 1 0 30 1 30 1 30 1 31 1 3 10 30 1 30 1



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\*\*\* Arranged as far as possible according to British Pharmacopæia of Latin names. Abbreviations which are familiar to dispensers are freely employed. It will be noticed that the alphabetical arrangement is employed in preceding chapters so far as medicines are concerned.

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